Academic Tracking: Long-term Effects on College and Career Outcomes

by

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ABSTRACT

Academic tracking has long been a subject of debate due to its potential impact on educational equity, with students who are tracked highly receiving a higher quality education in comparison to students tracked lowly. These disparities in education quality may be affecting students' outcomes, as it has been demonstrated that the short-term academic outcomes of students, such as their grades, tend to be affected by their academic track positioning. This dissertation builds upon these previous findings by utilizing a subsample of 20,584 students from the High School Longitudinal Study (2009) to examine the relation between academic track positioning and post-secondary education attendance, program length, college major, and expected future job. Additionally, the relation between academic tracking and each of these outcomes was also assessed using mediation, with potential mediators including education aspiration, expectations, and academic self-efficacy. Findings suggest that academic track positioning in math and science are influential in students' post-secondary and career outcomes, with students who are positioned highly in either subject having greater post-secondary attendance, program length, higher representation in STEM college majors, and expectations for future jobs in STEM fields in comparison to students tracked lowly. Additionally, education aspirations and expectations mediated the relations between math academic track positioning and each of the outcomes, although the effects were small in size. Educators should consider exploring avenues for improving education quality in low academic tracks.

DEDICATION

This dissertation is dedicated to educators that have strived to make a difference in the lives of their students: Bobbi Woods, Lillian Woods, and Laura Hanish. Your commitment to furthering the education of students is inspirational. Providing such leadership to students sets the foundation for a life of meaningful work both inside and outside the classroom.

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CHAPTER 1

INTRODUCTION

Academic tracking is a system implemented in education to sort students into homogeneous instruction groups according to their perceived academic ability. The use of academic tracking systems has become increasingly common in school districts across the United States as they have transitioned into the 21st century (Akos et al., 2007; Kelly, 2007; Kelly & Price, 2011). For instance, studies at the turn of the 20th century indicated that about 66% of United States schools tracked students in math, separating by perceived math ability across classrooms (Catsambis et al., 1999, 2001). More recently, reports have indicated that the number of schools using tracking to differentiate math classrooms has grown, with over 75% of United States schools tracking across math classrooms. Moreover, about 50% of schools track within math classrooms, sorting students into groups by perceived math ability within the classroom for learning activities (Organisation for Economic Co-operation and Development (OECD), 2013), implying that tracking in math is prevalent both across and within classrooms. Academic tracking systems are also prevalent in other academic subjects, such as science, English, and social sciences, indicating that academic tracking systems often exist in all core academic subjects (Kelly, 2007; Kelly & Price, 2011).

In addition to being popular domestically, tracking students according to their perceived academic abilities is a common practice internationally, with countries such as the United Kingdom, Australia, and Singapore reporting upwards of 87% of their students being tracked across math classrooms, and over 80% of students experiencing within-classroom math tracking (Organisation for Economic Co-operation and

Development (OECD), 2013). Other research has also indicated that academic tracking is prevalent in countries such as Germany, Greece, Italy, France, Slovakia, Russia, Hungary, and the Czech Republic (Hanushek & Wößmann, 2006). Thus, academic tracking across and within classrooms is a common experience for students across the world.

School districts that implement academic tracking systems do so because they want to improve student academic achievement, otherwise known as grades and standardized test scores, so that students can be better prepared for college and future careers (George, 1988; Oakes, 2005; Schafer & Olexa, 1971). Tracking students by their perceived academic ability is intended to help meet this goal by targeting instruction difficulty to students according to perceived ability and improving efficiency. More specifically, by grouping students into homogeneous academic ability groups, academic tracking systems are intended to reduce teachers' burden of developing and executing curricula that meets the needs of both high and low ability groups (George, 1988). In essence, teachers report that homogenizing classrooms according to academic ability reduces the difficulty of instruction, allowing them to more efficiently instruct similar-ability students (George, 1988). By lessening the burden of teaching, as well as making teaching more efficient, school districts use academic tracking systems to support the learning growth of students who are positioned in high and low ability groups, and ultimately prepare them for college and other alternative career pathways.

Although the implementation of academic tracking to support college preparation, alternative career pathways, and learning growth appears to be well-intentioned, the results of studies examining the short-term academic outcomes of tracked students raise concern. Research suggests that academic tracking creates diverging short-term academic outcomes for students by their track positioning. Specifically, low track positioning has demonstrated negative effects on student academic achievement, learning growth, and college admission and attendance compared to high track positioning (Alexander et al., 1998; Domina et al., 2019; Eccles et al., 2004; Hallinan & Kubitschek, 1999; Hoffer, 1992; Oakes, 2005; Werblow et al., 2013). This issue of academic tracking supporting inequalities between students should concern researchers and educators, raising the question of whether students in low academic tracks receive a high-quality education despite their positioning.

If there are indeed differences in short-term outcomes across academic tracks, how does academic track positioning in math and science impact post-secondary education attendance, program length (e.g., attending a 2-year versus a 4-year post-secondary institution) and college major? Furthermore, are the expected future jobs of math- and science-tracked students impacted by educational inequality? If academic tracking indeed impacts post-secondary education attendance, program length, college major choice, as well as expected future jobs, do the education aspirations, expectations, and academic self-efficacy of math- and science-tracked students possibly mediate these relations? These are the questions that I will address in the proposed study.

The Contributions of the Present Study to the Extant Academic Tracking Literature

Much of the academic tracking literature has focused on the short-term effects of track positioning on academic outcomes such as grades, with the academic track positioning of students being positively associated with academic performance (Alexander et al., 1998; Carbonaro, 2005). In essence, students who are tracked highly also tend to have higher academic performance compared to students who are in lower tracks. While the effects of academic tracking on short-term academic outcomes are important issues to consider, there appears to be a key problem that needs to be addressed in the academic tracking literature: how does the academic track positioning of students affect their post-secondary education and careers? While several studies have examined the effects of academic tracking on college attendance, few have done a deeper examination of the effects of academic tracking on other post-secondary and career experiences, including whether students attend 2-year versus 4 years colleges, what college majors students are selecting, and their expected future careers. This is problematic, because the post-secondary education experiences of students have a large impact on their occupations and peer relationships, which in turn affect earning potential (i.e., who students build relationships and spend time with; (Chetty et al., 2022b, 2022a; Kamens, 1971; Pascarella & Terenzini, 1991). This study looks to build upon the extant academic tracking literature by examining this question, bringing light to how academic tracking might impact the long-term post-secondary education and career experiences of students.

Additionally, the existing studies that have examined post-secondary and career experiences were largely conducted decades ago (e.g., Ainsworth & Roscigno, 2005; Arum & Shavit, 1995; Bagasao, 1984; Falsey & Heyns, 1984; Rosenbaum, 1980). Even for the more recent studies that have examined the relation between academic track positioning and post-secondary education and career experiences, the age of the cohorts has been an issue (e.g., Rojewski & Kim, 2003; Tyler, 2010). Specifically, the data collected in these more recent studies are from the 1980’s, which is about four decades old. These issues of study and cohort age within the academic tracking literature are especially problematic because researchers have noted that academic tracking systems have often changed their structure over time, with a shift from systems that utilize vocational and academic tracks to systems that sort students into on grade and honors tracks occurring in the late 20th century (Lucas, 1999). This makes the older academic tracking studies, and more recent studies utilizing data collected from the 1980's, especially problematic for understanding the effects of 21st century academic tracking systems on the post-secondary and career experiences of students. The present study plans to address these issues by conducting a modern examination of the relation between academic track position and post-secondary and career experiences, using a more recent sample collected as part of the High School Longitudinal Study from 2009 to 2017.

An additional issue with the academic tracking literature is the lack of studies examining the effects of academic tracking on students across STEM (Science, Technology, Engineering, and Math) subjects. Specifically, the majority of the academic tracking literature focuses on non-domain specific tracking as students were historically placed into academic and vocational tracks. More recently, studies have shifted towards tracking students by subject, but there is still a dearth of research examining the effects of STEM-specific academic tracking. This is an issue because the effects of being highly or lowly positioned may potentially vary across subjects, with students who are positioned highly in English benefitting in different ways in comparison to students who are tracked highly in math or other science. Understanding how math and science tracking, specifically, impacts students is important to fill this gap in the literature This study looks to build upon prior research by examining the effects of academic tracking systems in the

STEM fields of math and science on the post-secondary and career outcomes of students. Given the lack of STEM-specific literature currently available, I draw on prior research coming from non-domain specific findings (academic vs. vocational) or findings that are targeted specifically to non-STEM subjects (e.g., English) to guide my research on academic tracking in math and science.

Another shortcoming of the academic tracking literature is the lack of theory integration for explaining the effects of academic tracking on students. In essence, few studies have used theory to explain why academic tracking might lead, in part, to the reported differences in academic performance across academic tracking levels. This issue has been explicitly discussed in previous tracking research (Mulkey et al., 2009). This is problematic because previous research has indicated that theory should drive the questions researchers ask and help to explain the relation between predictors and outcomes. The present study looks to address this issue by using Bronfenbrenner's bioecological model, including proximal processes, to explain how variation in education quality across academic tracks might lead to diverging post-secondary and career outcomes among students. Including theory for explaining hypotheses and results is an integral part of research and has been neglected in the academic tracking literature.

Literature Review

In this literature review, I will examine differences in education quality across academic tracks. This section is intended to help explain education quality from within the framework of a resource-input model, as well as how academic tracking systems work to create learning environments that vary in quality by position. The next section is then used to review previous research on the long-term effects of academic tracking. In this section, I will consider what is currently known about the effects of academic tracking on students' future college and career experiences, including post-secondary education attendance and level, college major choice, and future expected jobs. Then, in the following section, the role of education aspirations, expectations, and academic self-efficacy as potential mediators will be discussed. More specifically, I plan to discuss why it is necessary to examine mediation and why education aspirations, expectations, and academic self-efficacy may be mediators between academic track positioning and college major choice, post-secondary attainment, and expected future jobs. Finally, academic tracking in the context of Bronfenbrenner's bioecological model will be examined. Specifically, this will include an examination of how proximal processes, a key feature of Bronfenbrenner's bioecological model, may explain how education quality differences lead to diverging academic and career outcomes for tracked students.

Education Quality and Academic Tracking

It is important to consider the relation between education quality and academic track positioning, as the education quality that students experience may impact their long-term post-secondary and career outcomes. In this context, the quality of the education that students receive is defined by a resource-input model, which suggests that whether students receive a high- or low-quality education is determined by the qualifications of school faculty and staff, whether students are challenged academically by the school, available facilities and equipment, the faculty-student ratio, and financial support from the school community (Cheong Cheng & Ming Tam, 1997). In other words, the students who experience a quality education have highly qualified teachers, are challenged academically, have access to supportive facilities and equipment (e.g., lab for science experiments, calculators), a low teacher-student ratio in their classes, and strong financial support from the school. This definition of education quality, according to the resource-input model, is supported by other studies that have worked to define high quality schools and classrooms (Johnson et al., 2000; Taylor, 1990; Van Der Burg, 1987). Many of these factors have been studied in relation to academic tracking. Thus, in the following sections, I detail how instructor and instruction quality, academic rigor, and student access to resources – each vital to education quality according to the resource-input model - vary by academic track position. Variation in education quality across academic tracks is important to consider, as long-term exposure to a lower-quality education may lead to diverging student post-secondary and career outcomes.

Instructor and Instruction Quality

Instructors who have higher educational attainment and experience are more qualified. Instructors who have masters, relative to bachelors, degrees, are often more effective teachers, providing students with greater academic achievement gains (Goldhaber & Brewer, 1996, 1998, 2000; Rowan et al., 1997). Additionally, experienced instructors tend to be more effective than inexperienced instructors in improving the academic growth of students, with instructors that have at least 2 to 5 years of teaching experience more effectively improving students' academic growth than instructors with less than 2 years of experience (Croninger et al., 2007). While having well-trained and experienced teachers is an indicator of a high-quality education, previous studies indicate a stark difference in the qualifications of instructors across academic tracks. That is, instructors in higher academic tracks are more likely to have higher educational attainment and more experience teaching than instructors in lower academic tracks

(Darling-Hammond, 1997; Kelly, 2009; Lortie, 1975; Oakes, 1990, 2005; Siskin, 2014). For instance, in a large high school tracking study, the researchers found that the least qualified instructors teach the low academic tracks while the most qualified instruct the high tracks (Oakes, 1990). In essence, these studies suggest that students in higher tracks are more likely to have highly qualified teachers, in both education attainment and experience, than students in the lower tracks, which indicates that education quality in the low academic tracks may be worse than in the higher tracks.

In addition to considering instructor qualifications when determining how education quality varies across academic tracks, the quality of instruction students receive is also important to examine. The quality of instruction, or the assignment of critical thinking exercises and activities that requires synthesis and analysis, that students receive is dependent upon their positioning in the academic tracking system, with the instruction quality in lower tracks being poorer than the instruction quality in the higher tracks (Evertson, 1982; Gamoran, 1989; Gamoran et al., 1995; Hacker et al., 1991a; Ireson & Hallam, 2001a; Kelly, 2009; Oakes, 1990, 2005). For instance, in a middle and high school tracking study investigating the instruction quality of 92 English classrooms, researchers found that instruction quality was positively associated with academic track position, with students that were positioned in higher tracks receiving better quality instruction than students that were positioned in lower tracks (Gamoran et al., 1995). Specifically, the researchers found that the teacher-student discussions in low track classrooms, in comparison to the high track classrooms, were more likely to be off-topic from what was being taught and included little to no analysis of the assigned readings. Furthermore, previous studies have demonstrated that the types of tasks assigned by the instructors vary by track. That is, a within-high school tracking study examining the influences of science tracking systems found that teachers were more likely to assign critical thinking and analytical tasks to students in higher tracks than they were to students in lower tracks (Hacker et al., 1991b). Due to the relation between education and instruction quality, such that instruction in high tracks is more likely to be on-topic and include critical thinking and analytical tasks, it is apparent that the instruction of low academic tracks negatively impacts education quality.

Academic Rigor

Another factor to consider in the quality of education that students receive is the academic rigor of their coursework (Cheong Cheng & Ming Tam, 1997). The higher academic tracks are typically more rigorous in their coursework than the lower academic tracks (Boaler, 1997a; Domina et al., 2016; Ireson & Hallam, 2001a; Oakes, 1990). For instance, in a qualitative within-school tracking study implementing interviews and observations of United Kingdom students ages 13 to 16, researchers found that the pace of coursework was faster, there was a greater sense of urgency in meeting course deadlines, and there was more competition in the higher academic tracks in comparison to the lower academic tracks (Boaler, 1997b). A similar pattern has also been found in other studies, in which researchers examining teacher classroom practices found that higher academic tracks covered more reading and writing materials than lower academic tracks (Ireson & Hallam, 2001b). This included teachers describing the amount of work that students positioned in high academic tracks cover as “intensive” when compared to the students positioned in lower academic tracks. Thus, due to variation in academic rigor by academic track position, students placed in lower track classes are disproportionately exposed to a lower quality education than those students who are highly tracked.

Access to School Resources

Another factor in whether students experience a quality education is whether they have access to school resources (Cheong Cheng & Ming Tam, 1997), which include adequate funding, access to guidance counselors, and the lab spaces necessary for academic growth. Specifically, if students are not provided the appropriate resources for them to grow as academics, then the quality of their education likely suffers. This is concerning, as previous research has suggested that access to school resources is often tied to student academic track position. That is, students that are positioned more highly tend to have greater access to resources than students who are placed into low track classes (Donelan et al., 1994; Lindner, 2002; Oakes, 1992). For instance, a tracking study using a high school sample found that vocational tracks, in comparison to academic tracks, have had their funding reduced in recent decades (Oakes, 1992). This has led to a reduction in resources for classes previously deemed important for students in vocational tracks, including electronics, metal working, and graphic arts. Further, the study demonstrated that school administrators were more likely to seek funds for resources in support of students in academic tracks in comparison to the students in vocational tracks. Thus, school administrators were not financially supportive of students in low tracks (vocational), while ensuring that students in high tracks (academic) were receiving the financial backing they need. In addition to finding funding differences by academic track position, this study concluded that there were inequalities in student access to guidance counselors. That is, students in the academic track typically had more guidance counselors available to them in comparison to the students in the vocational track. Differential access to guidance counselors by academic track position is an issue because these faculty members provide valuable mentoring to students that help guide them along their academic careers (Mulhern, 2019). When examining how academic track position is tied to student learning areas, such as labs, it is apparent that students in the low tracks are again disadvantaged in comparison to students in the high tracks. For example, in a within-school high school tracking study comparing students in college-preparatory versus average tracks, researchers found that students in college-preparatory tracks had greater access to science laboratories than students in the average tracks (National Center for Educational Statistics, 1985). Such lab spaces provide learning opportunities for students to grow academically, and the lack of available labs for students in low tracks indicate an advantage to those that are tracked highly. Altogether, these studies suggest that students in the higher academic tracks tend to have greater access to a variety of resources, including additional funding, guidance counselors, and workspaces for learning growth such as science laboratories. This is problematic for low track students, as it indicates that they may be disproportionately exposed to a lower education quality due to a lack of available resources.

Education Quality Differences May Lead to Variation in Post-Secondary Education Attainment, College Major, and Expected Future Jobs

Previous research has suggested that academic track position is associated with education quality, with students who are tracked highly receiving a higher quality education than students who are tracked lower. This should be cause for concern, as researchers have suggested that education quality variation can lead to disparities in post-secondary education attainment, college major, and the career choice of students (Altonji & Mansfield, 2011; Evans, 2013; Nores, 2010). Specifically, prior research has suggested that students who experience poorer education quality may be less like to attend 4-year universities, less likely to choose STEM college majors, and have lower representation in STEM careers in comparison to students who experience an education that is of high quality. Expanding upon these findings to better understand how variation in academic track position in science and math courses, due to its relation with education quality, may lead to differences in post-high school outcomes is paramount.

Several academic and occupational outcomes, including post-secondary education level, college major, and career choice, are understudied in the academic tracking literature. Examining the relation between academic track position and each of these outcomes is important due to their short- and long-term effects on students' lives. For instance, it is important to consider the association between academic track positioning and post-secondary education attainment, as prior research has indicated that post-secondary education attainment is an indicator of the long-term life satisfaction, income, and health of students. In essence, students who have higher post-secondary education levels tend to have greater life satisfaction, income, and improved health in comparison to students with lower post-secondary education levels (Hartog & Oosterbeek, 1998; Helliwell, 2003; Salinas-Jiménez et al., 2011). Additionally, it is necessary to consider the relation between academic track positioning and college major, as college major has been demonstrated to be a predictor of future income and job satisfaction. Specifically, students in math, engineering, business, and science fields tend to have greater income and job satisfaction than students in other majors, including humanities, education, and social sciences (Thomas & Zhang, 2005; Wolniak & Pascarella, 2005). The association between academic track positioning and career choice is also important to examine because research has demonstrated that an individual's career is indicative of overall health, disability status, as well as mortality, with individuals who choose careers in higher earning fields such as STEM having better health, fewer reported disabilities, as well as improved mortality rates in comparison to individuals who choose lower earning non-STEM fields (Ravesteijn et al., 2018). Each of these studies hint that post-secondary education level, college major, and career choice impact the short- and long- outcomes of students, and it may be beneficial to better understand the role of academic track position as a predictor due to its positive association with education quality.

Post-Secondary Education Attainment

Research has suggested that academic track position and post-secondary education attainment are significantly related. Specifically, research has found that students tracked more highly are also more likely to attend college in comparison to students who are tracked lower (Ainsworth & Roscigno, 2005; Falsey & Heyns, 1984; Rojewski & Kim, 2003; Rosenbaum, 1980). For instance, a study using the National Longitudinal Study (NLS) of the high school class of 1972 found that, among a sample of about 17,000 high school seniors, students tracked more highly were also more likely to attend college (Rosenbaum, 1980). In addition, using descriptive statistics, a study utilizing a sample of over 3,000 high school seniors suggested that students tracked more highly were more likely to attend college than students who were tracked lower (Falsey & Heyns, 1984). Furthermore, a study using a sample of about 25,000 students found that students who had foregone attending college were three times as likely to be in a vocational versus an academic track during high school (Rojewski & Kim, 2003). However, each of these studies used samples several decades old to demonstrate that higher track positioning is indeed associated with attending college. This is problematic, as research has demonstrated that academic tracking systems have shifted towards separating students by individual subjects over the last 30 years and away from the academic/vocational tracking systems often displayed in the aforementioned studies (Lucas, 1999). Thus, changes in the structure of academic tracking systems warrants a reevaluation of the relation between academic track positioning and post-secondary education attainment.

College Major

The number of studies examining the relation between college major and academic track positioning is limited. The few studies that have been conducted have suggested that being tracked more highly in high school was significantly associated with studying a STEM major in college (Paik & Shim, 2013; Tyler, 2010). Although there have been a limited number of studies examining the impact of academic tracking on college major in the United States, researchers have found a significant relation between academic track positioning and college major choice (Tyler, 2010). More specifically, using a sample of about a thousand high school students from the National Education Longitudinal Study (NELS) conducted in 1988, researchers demonstrated that students positioned in academic tracks were more likely to be represented in STEM college majors in comparison to students positioned in vocational tracks. This relation between academic track positioning and college major has also been examined outside of the United States, although the number of international studies is limited as well. For instance, a South Korean study found that high school students placed in low tracks were more likely to enroll in college majors that were vocationally oriented, while students placed in high tracks were more likely to enroll in college majors that were math or science oriented (Paik & Shim, 2013). Thus, a limited number of studies have suggested that students in academic tracks are more highly represented in STEM college majors while students in vocational tracks are more likely to be in non-STEM majors. These few studies demonstrating a significant relation between academic track position and college major have also been limited due to the age of their sample and/or being located outside of the United States.

Although there have not been many studies examining the effects of academic tracking on college major choice, a study has suggested that disparities in STEM college major choice may originate from earlier STEM track positioning in high school. Specifically, a qualitative study interviewed Black students in regard to their motivations in education, with many of the study participants suggesting that their opportunities, or lack thereof, to participate in STEM college majors originated from their STEM track positioning in high school (Cornelius, 2021). In essence, the interviewees suggested that activities beneficial for STEM development have greater availability in higher academic tracks compared to lower academic tracks. While this qualitative research study helps to illuminate issues regarding the relation between academic tracking and college major, more research on the relation is needed. Specifically, further examination of the relation between academic tracking and college major is necessary, as college major helps to guide students into their future occupations (Bottia et al., 2022; Ceglie & Settlage, 2016; Chiang, 1994; Cornelius, 2021; Filer, 2009; Martinez, 2021; Sucoff, 2020; Syed et al., 2011). For instance, in a study focused on how socioeconomic differences lead to diverging pathways for college students, researchers hypothesized that academic tracking may be the root cause of STEM major disparities and they argued that the greater quality of education and resources available to students tracked more highly may afford them greater opportunities to choose STEM college majors compared to students who are tracked lower (Bottia et al., 2022). In summation, there has been limited research examining the relation between academic track position and college major, and recent studies have demonstrated a need for further examination of the relation between academic track position and college major due to a lack of recent research with United States samples. Specifically, the few studies that have been conducted use archaic tracking structures (academic versus vocational tracks) that make older samples less relevant to the experiences of students in modern academic tracking systems, while foreign samples may not be as accurately representative of students in the United States due to cultural variation.

Career Choice

There are a limited number of studies examining the effects of academic tracking on the career choice of students, but the few studies that have been conducted have suggested a significant association. In essence, researchers have suggested that students tracked more highly are also more likely to have STEM careers in comparison to students tracked lowly (Arum & Shavit, 1995; Bagasao, 1984). For instance, a study examining the effects of high school vocational track positioning on career choice used a subsample of about 13,000 students from the High School and Beyond data, finding that participation in a vocational track negatively impacted students' chances of participating in a STEM or managerial occupation (Arum & Shavit, 1995). Additionally, a study of over 200 college bound Asian American high school seniors found that students were more drawn to math and science careers due to their high academic track positioning in STEM subjects (Bagasao, 1984). In other words, studies over 25 years old have found that students tracked more highly are also more likely to be tracked into STEM careers in comparison to students who are in lower tracks. Due to the limited number and age of the aforementioned studies, it is important to re-examine the relation between academic track position and expected future jobs with a more recent sample that uses up-to-date academic tracking systems.

Education Aspirations, Expectations, and Academic Self-Efficacy: The Potential Mediating Relations Between Academic Tracking and Long-Term Outcomes

Before delving into the potential mediators between academic track positioning and post-secondary education and career experiences, it is important to clarify what mediators are. A mediator is a variable that accounts for, or explains, the relation between an independent and dependent variable (Baron & Kenny, 1986; Fairchild & MacKinnon, 2009; Wu, 2011). In other words, mediation examines why the relation occurs (Fairchild & MacKinnon, 2009). The first two variables I will consider for mediation are educational aspirations and expectations, which are expected to operate similarly as research has demonstrated that they both represent the optimism or pessimism that students have for their futures (Beal & Crockett, 2010). I am considering education aspirations and expectations because of research that has individually examined the relation between educational aspirations and expectations with academic tracking, post-secondary education, and career experiences. More specifically, a few studies have suggested that educational aspirations and expectations are related to academic track position, with students who are tracked more highly tending to have higher educational aspirations and expectations than students who are tracked lowly (Pyryt, 1993; Smith-Maddox & Wheelock, 1995). Furthermore, prior research has suggested that educational aspirations and expectations are related to post-secondary education attainment as well as career choices, with students who have higher aspirations and expectations being more likely to attend college and be in a STEM career than students who have low aspirations and expectations (Bui, 2005; Cardoza, 1991; Lichtenberger & George-Jackson, 2013). Despite studies examining the relation between education aspirations and expectations with academic track position, post-secondary education, and career experiences, there have not been studies, to my knowledge, that have examined education aspirations and expectations as potential mediators. It is important to consider the role of education aspirations and expectations as potential mediators because students in higher academic tracks may have higher education aspirations and expectations than students in lower academic tracks, explaining why there is a significant relation between academic track position and post-secondary and career experiences.

The third variable to consider for mediation between academic track position and post-secondary and career experiences is academic self-efficacy. Previous research has indicated that academic track position is associated with academic self-efficacy, with students who are of higher academic track position also having higher academic self-efficacy compared to students that are tracked lower (Ballard, 1998; Kemp & Watkins, 1996). Furthermore, research has indicated that academic self-efficacy is associated with post-secondary education and career experiences, with students who have higher academic self-efficacy being more likely to attend college and participate in STEM careers than students who have lower academic self-efficacy (Chambers et al., 2016; Kwon et al., 2019). Despite each of these studies examining the relation between academic self-efficacy and academic tracking, post-secondary, and career experiences, no studies, to my knowledge, have examined academic self-efficacy as a potential mediator. It is important to consider academic self-efficacy as a potential mediator, as students in the higher academic tracks also have higher academic self-efficacy in comparison to students in lower academic tracks. Specifically, if there is a positive association between academic track position and academic self-efficacy, then it is possible that academic self-efficacy mediates the relation between academic track position and post-secondary and career experiences.

The Influence of Academic Tracking Through Proximal Processes

The hypothesis that academic track positioning may be impactful on the post-secondary education and career experiences of students is rooted in the theoretical concepts presented in Bronfenbrenner's bioecological model. The bioecological model suggests that an individual's development is influenced by four environmental subsystems: the microsystem, mesosystem, exosystem, and macrosystem (Bronfenbrenner & Morris, 2007). The microsystem refers to the immediate environment of the individual (Perron, 2017). For instance, an example of a student's microsystem, or their immediate environment, is the academic track they are positioned in. The second level of the bioecological model is known as the mesosystem, or the relationship between a student's immediate environments. For example, the mesosystem may be the relation between a student's academic track and their home, in which academic tracks and homes are both microsystems for students, and events in one may influence the other. The third level of the bioecological model is the exosystem, which is comprised of the relations between environments similar to the mesosystem, although one of these environments must not be an immediate to the individual and has to influence the development of an individual in an immediate environment. For example, an exosystem may be comprised of the relation between an academic track, or an immediate environment of the student, and the College Board, which is not an immediate environment of the students. Specifically, the College Board develops tests such as the Scholastic Aptitude Test (SAT) and Advanced Placement (AP) exams that influence how high schools, the immediate environments of the students that include academic tracks, prepare students for post-secondary education. The next system in the bioecological model is the macrosystem, which is often defined as the values, laws, customs, and resources of a culture that impact an individual's development (Perron, 2017). An example of the macrosystem is the value that modern society has placed on academic tracking systems to prepare students for post-secondary education or careers. Thus, Bronfenbrenner argues that there are multiple environmental subsystems that affect individual development, but what processes are used to explain the developmental influence of these subsystems on students?

The four environmental subsystems of Bronfenbrenner's bioecological model may influence the development of individuals through proximal processes, or the interactions between individual's genes, their personal attributes, and their immediate environment (Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2006). In essence, Bronfenbrenner and Morris (2006) argued that individuals' success in meeting their genetic potential is proximal process driven, with the attributes of the individual being either developmentally generative or disruptive in this pursuit. Using this framework, it is believed that genes are actualized by interacting with the individual's attributes and their environment to determine developmental outcomes, rather than genes providing predetermined abilities (Cairns, 1979; Gottlieb, 1991, 1992; Turkheimer & Gottesman, 1991). In essence, consider an individual with a high genetic predisposition towards academic abilities and possessing attributes that are developmentally generative, such as a keen engagement with course materials. The proximal processes, defined as the interactions between their genetic predisposition, personal attributes, and environment, will ultimately dictate whether they actualize the upper or lower thresholds of their academic potential. Furthermore, there are several important factors to consider when determining whether proximal processes are effective in actualizing an individual's potential. Specifically, the authors argue that systematic variation in whether students meet their genetic potential may be due in part to the environmental quality and stability over extended periods of time. In essence, an effective environment that is stable over time allows for repeated opportunity for proximal processes to shape students' development.

Drawing on Bronfenbrenner's bioecological model, academic tracking systems are thought to provide students in high tracks the necessary environment and stability to reach their full genetic potential, and conversely, inhibit the potential of students in lower tracks via a lower quality environment. In essence, the high academic tracks may solidify or strengthen the likelihood that, with repeated exposure to high tracks, students will grow to achieve at a higher level or at a faster rate than students who are repeatedly exposed to lower academic tracks due to the superior education quality that is characteristic of high academic tracks. These differences in education quality are because the higher academic tracks provide instructors that are more qualified, instruction that is more effective, more rigorous coursework, and better access to school resources in comparison to the lower academic tracks. Thus, students in the low academic tracks may not reach their fullest academic potential due to inequality in the education environment.

The interactions students have within their environments may be related to their personal attributes, including educational aspirations, expectations, and academic self-efficacy. These individual qualities may play a role in the interactions students experience with their teachers, ultimately impacting a student's academic growth and thereby shaping the operation of their proximal processes, or the interaction between their genes, their personal attributes, and their environment. These interactions with teachers can be either elicited by the personal attributes of the student, or the personal attributes of the student can be shaped by the teacher and their beliefs. For example, if a student's personal attributes elicit an interaction with the teacher, the teacher may be more likely to offer increased support and encouragement when the student has higher educational aspirations and expectations, in comparison to students with lower education aspirations and expectations, due to their genuine interest in education. This targeted assistance, in turn, may facilitate the creation of an effective learning environment and improve the developmental outcomes of the students with high educational aspirations and expectations experience.

Conversely, teachers can also shape the personal attributes of students. If a teacher believes that a student has high academic potential they may be more likely to foster academic growth for that individual student via encouragement and academic support. Furthermore, students perceived to have lower academic potential may suffer from the beliefs of their teachers, as there may be negative biases against students in lower academic tracks. Considering the interrelation between academic track position and education aspirations, expectations, and academic self-efficacy, such that students in higher academic tracks also tend to be higher in each of these measures in comparison to students in lower tracks, academic tracking likely exacerbates any pre-existing differences in education aspirations, expectations, and academic self-efficacy across tracks. Academic tracking may then lead to further divergence in the education aspirations, expectations and academic self-efficacy of students, potentially widening the educational disparities between students in higher and lower tracks. The differences in educational quality between academic tracks contribute to this disparity, as higher academic tracks provide more qualified instructors, more effective instruction, rigorous coursework, and better access to school resources in comparison to lower academic tracks. Therefore, students in lower academic tracks may experience less effective proximal processes, hindering their ability to reach their fullest academic potential due to inequalities in the educational environment.

These differences in effective proximal processes across academic tracks may lead, in part, to the variation found in academic and career outcomes by track position. That is, the experiences of students in lower academic tracks may lead to lower post-secondary education levels, a reduced likelihood of pursuing STEM college majors, and have lower representation in STEM careers in comparison to students tracked highly.

These disparities highlight the challenges associated with less effective proximal processes within the lower academic tracks.

Present Study

The purpose of this dissertation is to consider whether academic tracking in high school math and science courses is associated with differences in post-secondary education level, college major, and students' expected future jobs. An additional aim is to consider whether students' educational aspirations, expectations, and academic self-efficacy mediate the relation between academic track position and post-secondary education attendance and program length, college major, and students expected future jobs. After carefully reviewing the literature, I present the following hypotheses.

In this study, I hypothesize direct and mediated effects of math and science academic track position on several outcomes: post-secondary education attendance and program length, college major, and expected future jobs. Firstly, I posit that students in higher math and science tracks will have greater overall post-secondary education attendance and representation in four-year programs than students in lower tracks, when controlling for high school grades. This hypothesis is supported by previous research that suggests students tracked highly benefit from a more effective learning environment in their subject of study in comparison to students tracked lowly (Boaler, 2005; Chiu et al., 2017; Giersch, 2018; Mulkey et al., 2009). Secondly, I propose that high track students will be more likely to take STEM college majors (e.g., engineering, biology, chemistry), while low track students will be more represented in non-STEM majors (e.g., psychology, sociology, creative writing). This is due to the increased performance and opportunities in STEM fields for students tracked highly in math and science (Alexander et al., 1998; Carbonaro, 2005). Lastly, I anticipate that students tracked highly in math and science will be more likely to expect STEM jobs (e.g., Computer and Mathematics, Life and Physical Sciences, Healthcare), while those in lower tracks will anticipate non-STEM jobs (e.g., Arts and Design, Sales, Military, Production). This expectation is based on the professional skills and behaviors taught to students in high tracks, preparing them for a STEM work environment (Crul & Schneider, 2009; Greene, 2014; Moller & Stearns, 2012). It is also important to note that I expect all math and science tracking effects to have similar directions, and this is due to the interrelated nature of math and science as STEM fields.

In addition to these direct effects, I also hypothesize mediated effects through educational aspirations, expectations, and academic self-efficacy. Specifically, I expect these factors to mediate the relations between math and science academic track position and the outcomes (post-secondary education attendance and program length, college major, and expected future job). In each case, I expect the effects of the mediators (educational aspirations, expectations, and academic self-efficacy) to be stronger than the direct effects of math and science academic tracking on each of the outcomes. This is supported by prior research that suggests the strength of the mediator effects are stronger than math and science academic tracking, historically, on post-secondary education attendance and program length (Bui, 2005; Cardoza, 1991; Chambers et al., 2016; Hillmert & Jacob, 2010; Holm et al., 2013), college major (Lichtenberger & George-Jackson, 2013; Paik & Shim, 2013; Tyler, 2010), and expected future job (Ballard, 1998; Kwon et al., 2019; Moller & Stearns, 2012; Pyryt, 1993). In essence, I believe that the presence of these mediators and their strong relations to the outcomes will make the direct effects between academic track position and these outcomes insignificant. This reduction in direct effect significance and/or strength is an important qualifier for mediation.

CHAPTER 2

METHOD

Participants

The data for this dissertation comes from the High School Longitudinal Study (2009). The High School Longitudinal Study (HSLS) was a study conducted in the United States from 2009 to 2017, following students from their freshman year of high school to 4 years after high school graduation. The data for HSLS is nationally representative and was collected from public, charter, and private schools across all 50 United States as well as the District of Columbia. School districts were selected using a stratified probability proportional to size (PPS) design, which considered school type or sector (public, private, etc.), region of the United States (Northeast, Midwest, South, West), and locale (city, suburban, town, or rural). Selected districts were initially recruited for the study via information packages sent to each district office, which was then followed up with a phone call to the superintendent by the study recruiting team to confirm receipt of the package as well as identify the district approver for the study. Of the 1,287 contacted school districts, 1,042 (81%) provided permission to recruit high schools.

After receiving the information package and permission from the superintendent or other district approver, recruitment of eligible sampled high schools commenced. To ensure a nationally representative sample, 1,658 high schools from these school districts were identified as eligible to participate in the study due to the demographic composition (e.g., race/ethnicity, socioeconomic status) of their student populations. Of the 1,658 eligible high schools, there were 1,400 (84%) that provided permission to conduct the study. These high schools were recruited in four waves that followed the nationally representative stratified sample plan. After receiving permission to recruit high schools, information packages were sent to each of the eligible high school principals and the principals received follow-up phone calls to answer any questions before providing consent to participate.

After receiving consent to conduct the study in the high school, a school coordinator was identified. These school coordinators determined whether explicit or implicit parental consent were necessary for 9th grade students at their high school to participate in the study. Approximately 20% of high schools opted to use explicit consent versus 80% who used implicit. In essence, for explicit consent a written agreement had to be signed by parents for a student to be surveyed, and for implicit consent an 'opt-out' form was sent home with students that allowed for parents to sign and return to the school if they did not want their student to participate in the study. The parental explicit and implicit consent rate for the study was 87% for all study eligible high school students, with 71% of parents providing explicit and 91% providing implicit consent to participate in the study.

The full sample for the present study consisted of 23,503 high school students who had parental consent. The subsample for the present study consisted of 20,584 9th grade students from US high schools who were tracked in math or science. The students in this subsample were chosen because they had participated in tracking systems in math or science. Approximately half of the students in the sample were males (50.5%). For race and ethnicity, the sample consisted of students who were White (54.6%), Hispanic (16.4%), Black/African American (10.4%), Asian (8.8%), Multiethnic (8.6%), American

Indian (0.7%), and Native Hawaiian/Pacific Islander (0.5%). Furthermore, the first language was only English for most students (83.6%). The rest of the sample was comprised of students whose first language is a non-English language only (10.1%) and students whose first language is English and non-English equally (6.3%). As for family income, a measure of socioeconomic status, 8.8% of families made less than $15,000, 17.9% made between $15,000 and $35,000, 16.3% between $35,000 and $55,000, 15.2% between $55,000 and $75,000, 11.3% between $75,000 and $95,000, 9.0% between $95,000 and $115,000, and families with incomes above $115,000 made up 21.6% of the sample.

Procedures

A longitudinal study design was used for the HSLS. The initial data used in this dissertation were collected during the fall semester of students' freshman year of high school (9th grade; T1). Follow-up data used in this dissertation were collected at two time points: during the spring semester of students' junior year of high school (11th grade; T2) and three years post high school graduation (data were collected during spring to fall; T3).

Data collection at T1 focused on gathering transcripts, which included student academic tracking information in the 9th grade for both math and science and questionnaires that were self-administered over the web using school computers. At T2, data collection entailed self-administering questionnaires over the web using school computers and included measurements of student education aspirations/expectations and academic self-efficacy. For T3, data were obtained via transcripts, which were used to collect post-secondary education attendance and program length, and questionnaires were sent to participants via the internet and completed on their own personal devices, measuring college major and expected future job at age 30. If students were unable to complete the questionnaire online at any of the time points, they were given the opportunity to complete it via telephone. The percent of students that participated in the questionnaires via telephone ranged from 1.9% at Time 1 to 18.4% at Time 3, increasing with each subsequent data collection.

Measures

Academic Tracking

Academic tracking in 9th grade math and science courses was assessed using data drawn from transcripts that were collected at T1 (fall semester of freshman year). Math and science tracking were measured differently. Math academic track positioning in the 9th grade was reported on an ordinal scale (*1 = Basic Math*; *2 = Other math*, 3 = *Pre-algebra*, *4 = Algebra I*, *5 = Geometry*, *6 = Algebra II*, *7 = Trigonometry*, *8 = Other advanced math*, *9 = Probability and statistics*, *10 = Other AP/IB math*, *11 = Precalculus*, *12 = Calculus*, *13 = AP/IB Calculus*). Math academic track positioning was then recoded into a simpler ordinal scale consistent with prior math academic tracking research (*1 = Below grade level*, *2 = On-grade level*, *3 = Above grade level*; Irizarry, 2021; Updegraff et al., 1996). Students in the below grade-level track took Basic Math or Pre-algebra in 9th grade, while students in the on-grade level track were in Algebra 1. Additionally, students who were in the above grade level track took one of the following math courses in the 9th grade: Geometry, Algebra II, Trigonometry, Other advanced math, Probability and statistics, Other AP/IB math, Precalculus, Calculus, or AP/IB Calculus. Science academic track positioning was also an ordinally coded variable (*1 = General Science or*

Specialty Science, 2 = Advanced or AP Science). General or Specialty Science included subjects such as Biology, Earth Science, Physical Science, Physics, or Chemistry, while Advanced or AP Science included subjects such as AP Biology, AP Chemistry, and AP Physics.

Educational Aspirations and Expectations

Students self-reported their educational aspirations and expectations using single items administered at T2 (11^{th} grade). To measure educational aspirations, students were asked, "How far in school would you want to go?" Responses to this question were rated on a scale ranging from 1 (*Less than high school completion*) to 7 (*Complete PhD/MD/law degree/other high level professional degree*), with higher scores indicating greater educational aspirations.

To measure educational expectations, students were asked, "As things stand now, how far in school do you think you will actually get?" The responses to this question were rated on a scale ranging from 1 (*Less than high school completion*) to 12 (*Complete PhD/MD/law degree/other high level professional degree*), with higher scores indicating greater education expectations. The measure of education expectations is a larger scale due to the measurement of partial completion of education milestones, which was not measured in educational aspirations.

Academic Self-Efficacy

Students self-reported their academic self-efficacy in math and science using 4-item scales at T2 (11^{th} grade). Sample items included "You are confident that you can do an excellent job on math assignments" and "You are/were certain that you can/could understand the most difficult material presented in this course?" Items were rated on a 4-

point scale, with higher scores indicating higher academic self-efficacy. Specifically, the scale ranged from 1 (strongly disagree) to 4 (strongly agree). Scale scores were computed by adding response scores together and dividing by the total number of items. Cronbach's alpha was 0.89 for students' math academic self-efficacy and 0.92 for science academic self-efficacy.

Post-Secondary Education Attendance and Program length

The post-secondary education attendance and program length of students was provided via school transcripts at T3 (3 years post-high school graduation). Post-secondary education attendance was coded as a binary variable indicating those that did not attend and those that did (*0 = Did not attend a post-secondary institution, 1 = Attended a post-secondary education institution*). The length of the post-secondary program students attended was rated on a 3-point scale (*0 = Less than 2-year, 1 = 2-year, 2 = 4-year*).

College Major

Students who were identified as taking part in a post-secondary program were asked about their college major at Time 3. Specifically, students were asked, "What major they most seriously considered when first entering their postsecondary education?" Students were allowed to choose from possible college majors, including but not limited to agriculture, education, engineering, biological sciences, psychology, mathematics, mechanic and repair technologies, and history. The college major for each student was coded into non-STEM versus STEM *(non-STEM = 0, STEM = 1*), with non-STEM majors being comprised of Economics, Business, Humanities, Arts, Social Sciences, and

Interdisciplinary, while STEM majors included Engineering, Computer Science, and Natural Sciences.

Expected Future Job

Students self-reported their expected future jobs at Time 3. Specifically, students were asked, "What is your expected job at age 30?" Students were allowed to choose from 21 possible categories, including but not limited to management occupation, computer and mathematical operations, healthcare support, sales, construction and extraction, personal care and service, production occupations, and legal occupations. The careers were coded into non-STEM versus STEM fields of work (*non-STEM = 0, STEM = 1)*, with non-STEM fields including occupations such as Arts and Design, Sales, Military, and Production, and STEM occupations including Computer and Mathematics, Life and Physical Sciences, and Healthcare.

CHAPTER 3

RESULTS

In this dissertation, I examined 9th grade academic tracking in math and science using the subsample of High School Longitudinal Study (2009) participants who had data on math and science tracking at 9th grade. I then evaluated academic tracking in math and science as predictors of post-secondary outcomes (namely educational attendance, post-secondary program length, college major, and expected future jobs), and I tested for whether these relations were mediated by education aspirations, expectations, and academic self-efficacy.

Preliminary Analyses

Preliminary analyses for this study involved examining variables using descriptive statistics in SPSS. This included an examination of categorical variables such as race, sex, language, family income, math and science academic track positioning, post-secondary education attendance and program length, college major, and expected future career using frequencies, percentages, and mode (see Tables 1 and 2). In this subsample of HSLS students tracked in math and science, the majority were White, with the largest representation from minoritized racial or ethnic groups being Hispanic, African American, Asian, and Multi-Ethnic. There was also a small representation of Native American and Pacific Islander students. In regard to sex, there were slightly more males than females in the subsample. For language, an overwhelming majority of students spoke only English at home, with fewer speaking a non-English language at home or bilingual in English and another language in their homes. Over half of the students came from families earning less than $75,000, with modal family income between $15,000 and $35,000.

For math academic track positioning, students were overly represented in the on-grade track, followed by the above-grade track. There were relatively few students in the below-grade track. For science academic tracking, almost all students were in the general or specialty science classes, with a small minority being in the advanced or AP science classes. The majority of students also attended a post-secondary institution, with the majority going to a 4-year program followed by institutions that feature programs that are 2-years and less than 2 years in length. A minority of students chose STEM college majors or expected to have a STEM career in the future.

For the continuous variables, which included covariates such as math GPA and science GPA, as well as the mediating variables representing education aspirations, education expectations, and academic self-efficacy in math and science, I examined the mean, standard deviation, and minimum and maximum scores. Furthermore, normality was examined by evaluating skewness and kurtosis (see Table 3). The average high school GPA for students was about a *C* in both math and science. Additionally, in junior year of high school the average education aspirations indicated that students aspired to complete more than a bachelor's degree, and the average education expectations indicated that many students expected to complete a bachelor's degree in their future. The sample also indicated that student academic self-efficacy in math and science was leaning positively, with the mean for the sample being closer to 'Agree' than 'Disagree,' indicating that students were confident in their abilities relative to the academic subject. West, Finch, and Curran (1995) suggest normally distributed variables have skewness values below |2| and kurtosis less than |7|. All the previously stated continuous variables did not violate normality for their distribution, with skewness and kurtosis levels falling within appropriate ranges.

Next, the relation between demographic characteristics (e.g., race and ethnicity, sex, language spoken, and family income) and academic and career outcome variables (e.g., post-secondary education attendance and program length, college major, and expected future job) were examined to determine whether it was necessary to control for the demographic variables in the primary analyses. Chi-square analyses revealed that race/ethnicity was significantly related to post-secondary education attendance, program length of post-secondary institution attended, college major, and expected future job (see Tables 4 through 7). Specifically, students who were White or Asian were more likely to attend college and be represented in 4-year institutions in comparison to their peers who were their peers who were African American, Native American, Hispanic, Multi-Ethnic, or Pacific Islander. Additionally, Asian students were more likely to choose STEM college majors and expect future careers in STEM than their peers who were White, African American, Native American, Hispanic, Multi-Ethnic, or Pacific Islander.

Sex was significantly related to post-secondary education attendance, college major and expected future job (see Tables 8 through 11). Specifically, female students were more likely to attend college, be represented in 4-year institutions, and expect future careers in STEM than their male peers. However, male students were more likely to choose STEM college majors.

Language spoken was significantly related to post-secondary education attendance, program length of post-secondary institution attended, college major, and expected future job (see Tables 12 through 15). Students whose who spoke a language other than English exclusively at home were less likely to attend college than those who spoke English only or split their home language between English and another language. Students who spoke non-English exclusively were also more highly represented in 2-year post-secondary programs compared to those students that spoke English-only or split their home language between English and another language. Additionally, students who spoke non-English exclusively or split their home language between English and non-English were more likely to choose STEM college majors and expect future careers in STEM than their peers who spoke only English. In summary, these chi-square results suggested that it was necessary to control for race, sex, and language spoken in each of the primary analyses.

Logistic regression analyses were conducted to examine the effects of family income, math GPA, and science GPA on post-secondary and career outcomes (see Table 16). The results revealed significant positive relationships between these predictors and post-secondary education attendance, program length, college major, and expected future job. Family income was found to be a significant predictor, with students from higher-income families more likely to attend college, enroll in 4-year institutions, choose STEM majors, and anticipate STEM careers compared to their counterparts from lower-income families. Similarly, math and science GPAs were significant predictors of post-secondary and career outcomes. Students with higher GPAs in these subjects were more likely to attend post-secondary institutions, enroll in lengthier programs, choose STEM majors, and anticipate STEM careers than those with lower GPAs. These findings highlighted the need to control for family income, math GPA, and science GPA in the primary analyses.

Primary Analyses

Primary analyses were then conducted to test each hypothesis. Analyses were conducted using regressions (binomial and ordinal logistic) in SPSS.

Examining the Relation Between Academic Tracking and Post-Secondary and Career Outcomes and Assessing for Potential Mediation

The data analytic plan involves examining math and science tracking as predictors of post-secondary outcomes using binomial and ordinal logistic regressions. I rotated the outcome variables in separate analyses, using binomial regressions to assess effects of the predictors and mediators on post-secondary attendance, college major, and expected job and using logistic regressions to assess effects on post-secondary program length. Further, for each outcome variable, I tested the effects of math and science tracking separately and jointly, resulting in three sets of analyses for each outcome variable. The rationale for examining academic tracking effects separately for math and science was to assess each discipline's unique impact on the post-secondary and career outcome variables of interest. Additionally, incorporating both math and science tracking into a single model enables an assessment of whether the individual effects are robust when considered in conjunction. This approach helps to build a comprehensive understanding of the tracking effects in each academic discipline and their combined influence on the outcomes. Math tracking was recoded using dummy coding so that the on-grade track was the reference group. To assess education aspirations, expectations, and academic self-efficacy as mediators, I used the Hayes' Process Macro in SPSS.

In all primary analyses, weights created by the HSLS researchers were used for effects (but not standard errors). These weights serve multiple functions: they adjust for attrition within the sample and account for variations in transcript (e.g., academic tracking, post-secondary education attendance, etc.) and student response data (e.g., education expectations, aspirations, and academic self-efficacy). In essence, the weights account for differential response patterns within and across data collections to ensure the sample remains nationally representative even when participants do not respond. Importantly, these weights were created to align with the study's complex, stratified random sampling design. By using these weights, the primary analyses of this dissertation become more robust and the resulting estimates become nationally representative of the target population, thereby enhancing the validity and generalizability of the results.

Effects were determined to be significant at the $p < .05$ level. For logistic regressions significant at the $p < .05$ level, regression coefficients were examined to see the change in log odds of the outcomes for a 1-unit change in the students' academic track positions in math or science. In addition, odds ratios (OR) were examined to determine the likelihood of each outcome. An OR of 1.25 means that the odds of the outcome are 25% higher given a 1-unit increase in the predictor variable. This is because an OR gives the percentage increase (if positive) or decrease (if negative) in the odds of the outcome for each 1-unit increase in the predictor variable. In this case, $1.25 - 1 = 0.25$, which is a 25% increase in the odds. Conversely, if there was an OR of 0.75 it would indicate a 25% decrease in the odds. For example, if a student's academic track position in math or science increased by one unit, the odds of the outcome (such as attending a post-secondary institution or choosing a STEM major) would decrease by 25%.

For the mediation analyses, the degree to which a full or partial mediation model could be supported was determined using a four-step process. First, the independent variable (math or science tracking) must be a significant predictor ($p < .05$) of the dependent variable. Second, the independent variable must significantly predict the mediator (education aspirations, expectations, and academic self-efficacy). Third, the mediator must significantly predict the dependent variable while controlling for the relation between the independent and dependent variables. Finally, the relation between the independent and dependent variable must be either no longer statistically significant (indicating full mediation) or diminished (indicating partial mediation). If all of these requirements are met, the relation between the independent and dependent variable is considered mediated. The significance of the indirect effect indicates whether the relation between the independent and dependent variable was mediated. The direct effects are considered statistically significant if $p < .05$, and the indirect effects are considered statistically significant if 1 does not fall between the lower and upper confidence limits. The indirect effect calculation is based on a bootstrap of 5000 samples.

Do Math and Science Academic Track Positioning in the 9^th^ Grade Predict Post-Secondary Education Attendance?

A binomial logistic regression revealed that math track position in Grade 9 was significantly associated with post-secondary education attendance (see Table 17). Students in the below grade track for math had 39% lower odds of attending a post-secondary institution compared to their on-grade tracked peers, whereas students in the above grade track had 57% greater odds of attending a post-secondary institution than those in the on-grade track. Similarly, there was a significant relation between science track in Grade 9 and post-secondary education attendance, with students who were tracked into advanced or AP science classes having 92% greater odds of attending a post-secondary institution than those who were tracked into general or specialty science classes (see Table 18). When both math and science tracks were simultaneously entered into the same binomial regression predicting post-secondary education attendance, the results were consistent with the results of the first two binomial logistic regressions (see Table 19).

What Mediational Mechanisms Explain the Relation Between Math and Science Track Positioning in the 9th Grade and Post-Secondary Education Attendance?

A logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between math tracking and attendance in a post-secondary institution. The first step for assessing mediation was met in the prior analysis: math tracking significantly predicted education aspirations and expectations. The second step for assessing mediation was partially met: significant indirect effects indicated that students in the below grade level track had lower educational aspirations and expectations compared to students in the on-grade level track, and that educational aspirations and expectations predicted post-secondary education attendance while controlling for math tracking (see Table 20). There were no significant mediational effects for below grade students with self efficacy, nor were any significant mediational effects obtained for students tracked above grade level in math. The third step for assessing mediation was met: the relation between below grade level math tracking and post-secondary education attendance was diminished from an OR of 0.61 in the prior analysis to an OR of 0.78 in the current model, indicating partial mediation of the relation between below grade math tracking and post secondary attendance via education expectations and aspirations.

Another logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between science tracking and attendance in a post-secondary institution. The first step for assessing mediation was met: science tracking significantly predicted education expectations. The second step for assessing mediation was also met: a significant indirect effect indicated that students in the advanced or AP science track had higher education expectations compared to students in the general or specialty science track, and education expectations significantly predicted post-secondary education attendance while controlling for advanced or AP science tracking (see Table 21). The third step for assessing mediation was not met: the relation between science tracking and post-secondary education attendance was not diminished, with the relation in the prior analysis having an OR of 1.92 in comparison to an OR of 2.08 in the current mediation model.

Do Math and Science Academic Track Positioning in the 9th Grade Predict Post-Secondary Program Length?

An ordinal logistic regression revealed that math track position in Grade 9 was significantly associated with the program length of post-secondary education attended (see Table 22). Specifically, students in the below-grade math track had 24% lower odds of attending a lengthier post-secondary program, while students in the above-grade track had 70% higher odds of attending a lengthier post-secondary program compared to students in the on-grade track. Similarly, there was a significant relation between science track in Grade 9 and the program length of post-secondary education attended, with students who were tracked into advanced or AP science classes having 95% greater odds of attending a lengthier post-secondary program compared to those who were tracked into general or specialty science classes (see Table 23). When both math and science tracks were simultaneously entered into the same ordinal regression predicting the program length of post-secondary education attended, the results were mostly consistent with the results of the first two ordinal logistic regressions (see Table 24). The only difference was that there was no longer a significant relation between the log odds of being in a below versus an on-grade level math track in the joint model.

What Mediational Mechanisms Explain the Relation Between Math and Science Track Positioning in the 9th Grade and Post-secondary Program Length?

A logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between math tracking and post-secondary program length. The first step for assessing mediation was met: math tracking significantly predicted education aspirations and expectations. The second step for assessing mediation was partially met: significant indirect effects indicated that students in the below grade level track had lower and students in the higher grade level track had higher education expectations, and students in the above grade level track had higher education aspirations in comparison to students in the on-grade level track (see Table 25). The significant indirect effects also indicate education aspirations and expectations significantly predicted post-secondary program length while controlling for math tracking. The third step for assessing mediation was met: the relation between below grade level math tracking and post-secondary program length was insignificant, indicating full mediation via education expectations. However, for above grade level tracking, the relation was diminished with above grade level tracking have an OR of 1.70 in the prior analysis and an OR of 1.21 in the current mediation model, indicating partial mediation via education aspirations and expectations.

Another logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between science tracking and post-secondary program length. The first step for assessing mediation was met: science tracking significantly predicted education expectations. The second step for assessing mediation was not met for any of the mediators: each of the indirect effects were nonsignificant, indicating that education aspirations, expectations, and academic self-efficacy did not mediate the relation between academic track positioning in science and post-secondary program length (see Table 26).

Do Math and Science Academic Track Positioning in the 9th Grade Predict College Major?

A binomial regression revealed that math track position in Grade 9 was significantly associated with college major at three years post high school graduation (see Table 27). Students in the above grade track had 82% greater odds of majoring in a STEM area in college than their on-grade tracked peers.Students in the below grade track did not significantly differ in their odds of college major in comparison to students in on-grade level. Students who were tracked into advanced or AP science did not significantly differ in their odds of pursuing a STEM major than those who were tracked into general or specialty science classes (see Table 28). When both math and science tracks were simultaneously entered into the same binomial regression predicting student college major, the results were consistent with the results of the first two binomial logistic regressions (see Table 29).

What Mediational Mechanisms Explain the Relation Between Math and Science Track Positioning in the 9th Grade and College Major?

A logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between math tracking and college major. The first step for assessing mediation was met: math tracking significantly predicted education aspirations and expectations. There was also evidence supporting the second step for assessing mediation: significant indirect effects indicated that students in the below grade level track had lower education aspirations and students in the above grade level track had higher education aspirations and expectations compared to students in the on-grade level track (see Table 30). Furthermore, the significant indirect effects indicate education aspirations and expectations significantly predicted college major while controlling for math tracking. The third step for assessing mediation was met for students in the below grade track. Specifically, the relation between below grade level math tracking and college major was insignificant, indicating full mediation via education aspirations. However, for above grade level math tracking, the relation was diminished with an OR of 1.82 in the prior analysis but only 1.73 in this mediation model, indicating partial mediation via education aspirations and expectations.

Another logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between science tracking and college major. The first step for assessing mediation was met: science tracking significantly predicted education expectations (see Table 31). The second step for assessing mediation was not met for any of the mediators: each of the indirect effects were nonsignificant, indicating that education aspirations, expectations, and academic self-efficacy did not mediate the relation between academic track positioning in science and college major choice.

Do Math and Science Academic Track Positioning in the 9th Grade Predict Future Job Expectations?

A binomial logistic regression revealed that math track position in Grade 9 was significantly associated with expecting a future job in a STEM-related field at age 30 (see Table 32). Specifically, students in the above grade track had 39% greater odds of expecting a future job in STEM compared to their peers in the on-grade track. Students in the below grade level math track did not have a significantly different log odds in comparison to students in the on-grade level. There was an insignificant relation between science track in Grade 9 and expecting a future job in STEM, with students who were tracked into advanced or AP science classes not having significantly greater odds of expecting a future job in STEM compared to those who were tracked into general or specialty science classes (see Table 33). When both math and science tracks were simultaneously entered into the same binomial regression predicting expected future job in STEM, the results were consistent with the results of the first two binomial logistic regressions (see Table 34).

What Mediational Mechanisms Explain the Relation Between Math and Science Track Positioning in the 9th Grade and Expected Future Job?

A logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between math tracking and expected future job. The first step for assessing mediation was met: math tracking significantly predicted education aspirations and expectations. The second step for assessing mediation revealed significant effects for students in both the below grade and above grade tracks. Significant indirect effects indicated that students in the below grade level track had lower and students in the above grade level track had higher education aspirations and expectations compared to students in the on-grade level track (see Table 35). Furthermore, the significant indirect effects indicate education aspirations and expectations significantly predicted expected future job while controlling for math tracking. The third step for assessing mediation was met: the relation between below grade level math tracking and expected future job was insignificant, indicating full mediation via education aspirations and expectations. However, for above grade level tracking, the relation was diminished from an OR of 1.39 in the prior analysis to 1.27 in the current mediation model, indicating partial mediation via education aspirations and expectations.

Another logistic regression was conducted to test whether educational aspirations, expectations, and academic self-efficacy mediated the significant relation between science tracking and expected future job. The first step for assessing mediation was met: science tracking significantly predicted education aspirations and expectations. The second step for assessing mediation was not met for any of the mediators: each of the indirect effects were nonsignificant, indicating that education aspirations, expectations, and academic self-efficacy did not mediate the relation between academic track positioning in science and career choice (see Table 36).

CHAPTER 4

DISCUSSION

In this dissertation, I explored the association between math and science academic track positioning in the 9th grade and post-secondary education attendance, program length, college major, and expected future job at age 30. Based on prior research, I anticipated a significant relation between academic track position and these outcomes. Specifically, I hypothesized that students tracked highly in math and science would be more likely to attend post-secondary institutions, enroll in longer programs, choose STEM college majors, and expect future jobs in STEM fields compared to their lower-tracked peers. In addition to these direct effects, I also investigated whether educational aspirations, expectations, and academic self-efficacy mediated the relations between academic track position and the post-secondary and career outcomes. I expected these personal attributes to play a significant mediating role. The findings of this dissertation largely supported my expectations. The results suggested that high track positioning in math was beneficial for students' post-secondary education attendance, program length, college major choice, and expected future job. Additionally, high track positioning in science was beneficial for students' post-secondary education attendance and program length, but science track position did not have a significant relation with student college major and expected future job. Furthermore, there was evidence that educational aspirations and expectations mediated the relations between academic track position and these outcomes for math, but not science. However, academic self-efficacy appeared to be less influential in these relationships, as it was mostly nonsignificant as a mediator.

Does Academic Track Position in 9th Grade Predict Future Post-secondary and Career Outcomes?

In the present study, the findings for post-secondary education attendance, program length, college major, and expected future job were trending in the expected directions in their relations to math tracking. Additionally, post-secondary education attendance and program length were trending in their expected directions in relation to science tracking, although college major and expected future job were not significantly associated with science track. In essence, students who were tracked highly in math or science were also more likely to attend a post-secondary institution and attend a longer post-secondary program. Furthermore, students tracked highly in math were more likely to choose a STEM college major and expect to be employed in a STEM-related field at age 30. These findings were mostly consistent with models testing math and science tracking effects tested separately as well as jointly. The only exception was the joint model predicting program length, in which below grade level math tracking was no longer a significant predictor.

The underlying theme of these analyses is that, although high academic track positioning is often positively associated with student post-secondary and career outcomes, the direct effects for math tracking were more robust than the direct effects for science tracking. These differences in significance for direct effects could be due to the small group size of the advanced or AP science track. The larger group sizes of the below, on grade, and above grade level math track groups may have better allowed for the detection of group differences in each of the post-secondary and career outcomes.

In line with Bronfenbrenner's bioecological model, the present study further substantiates the important role of academic tracking, a component in a student's microsystem, in shaping their post-secondary and career outcomes. The mostly significant relations between academic tracking and post-secondary education attendance, program length, college major, and expected future job help to validate the model's emphasis on the impact of the immediate environment on students' developmental trajectories.

The direction of effects for these analyses are consistent with prior research examining the relation between academic track position and post-secondary and career outcomes, suggesting that students tracked highly benefit in comparison to students tracked lowly (Ainsworth & Roscigno, 2005; Arum & Shavit, 1995; Bagasao, 1984; Falsey & Heyns, 1984; Rojewski & Kim, 2003; Rosenbaum, 1980; Tyler, 2010). Specifically, these prior studies have suggested that students who are tracked more highly are also more likely to attend a post-secondary institution and have managerial positions in their jobs. After reexamining the effects of academic tracking on post-secondary and career outcomes with contemporary data, it appears that the advantages of high track placement versus on-grade and low track placement are still prevalent and extend beyond post-secondary attendance and occupation position to include a wider array of outcomes.

Taken together, current and prior findings suggest that academic tracks help to propel certain students, those who are tracked highly, into greater post-secondary educational and career opportunities. This impact is likely due to the fact that students in higher tracks benefit from a relatively high-quality education environment. Academic tracks are often correlated with the quality of education, where students in higher tracks tend to benefit from more qualified instructors, more challenging coursework, and superior access to school resources compared to students in lower academic tracks (Boaler, 1997; Donelan et al., 1994; Goldhaber & Brewer, 1996, 1998, 2000; Ireson & Hallam, 2001; Lindner, 2002; Oakes, 1992).

Although there are benefits of academic tracks for highly positioned students, the findings of this study also highlight the disparities that can exist for students who are assigned to lower tracks. Disparities in education quality may negatively influence post-secondary and career trajectories for those students who experience less enriching educational curricula. The adverse impact of tracking on the post-secondary and career outcomes of students in lower tracks could have enduring consequences, as existing research has established a significant relation between post-secondary and career experiences and other long-term outcomes. For example, numerous studies have shown that an individual's level of education is positively associated with life satisfaction, income, and overall health (Hartog & Oosterbeek, 1998; Helliwell, 2003; Salinas-Jiménez et al., 2011; Thomas & Zhang, 2005). Furthermore, research has indicated a significant relation between an individual's career choices, particularly in STEM fields, and enhanced earnings, better health, fewer disabilities, and improved mortality rates (Ravesteijn et al., 2018). In a broader sense, while academic tracks benefit students who are tracked highly, they may hinder the short-term success of students in lower tracks, impeding their long-term growth. These findings emphasize the need for a more equitable approach to academic tracking, one that guarantees every student the chance to realize their full potential.

The Importance of Considering Systemic Effects of Academic Tracking on Racial/Ethnic Groups

The findings of this study lead to the critical need to consider the effects of academic tracking on students by their socioeconomic and racial/ethnic groups. Specifically, students from lower socioeconomic backgrounds or racial/ethnic minority groups are often disproportionately placed in lower academic tracks (Akos et al., 2007; Conger, 2005; Hallinan, 1994; Mickelson, 2002; Oakes, 1990; Rojewski & Kim, 2003), a practice that can perpetuate systemic inequities and have profound, long-term impacts on students. Specifically, results of this dissertation suggest that students who are of lower socioeconomic status or part of a racial/ethnic minority group may face negative effects on their post-secondary and career experiences due to their lower track positioning. For instance, these students may experience lower post-secondary attendance rates, shorter program durations, and a tendency towards non-STEM fields in both college majors and future careers. Because of this disparity in how students are tracked by their demographic characteristics, it becomes essential for educators at all levels to implement a comprehensive strategy for dismantling the barriers to a high-quality education for students of all backgrounds.

Do Education Aspirations, Expectations, and Academic Self-Efficacy Mediate the Relation Between Academic Track Position in the 9th Grade and Post-secondary and Career Outcomes?

In this dissertation, a central objective was to investigate the roles of educational aspirations, expectations, and academic self-efficacy as potential mediators in the relations between students' academic track positioning in the 9th grade and subsequent post-secondary education attendance, program duration, college major, and expected future job at age 30. The analyses conducted with math tracking, but not science tracking, as the predictor revealed partial to complete mediation effects for educational aspirations and expectations in all analyses, but not for academic self-efficacy. These findings suggest that students' educational aspirations (or education dreams and ambitions) and expectations (education goals that have a high likelihood of occurring), which are shaped by their math academic track, influence their future educational and career trajectories.

While no prior studies have directly explored educational aspirations and expectations as mediators between academic tracking and post-secondary and career outcomes, the findings of this dissertation align with the broader literature on the impact of academic tracking on these outcomes. For example, prior research has indicated that students with higher educational aspirations and expectations are more likely to be placed in advanced academic tracks and, separately, to achieve better post-secondary and career outcomes, but these studies have not examined a mediated relation between these variables (Bui, 2005; Cardoza, 1991; Lichtenberger & George-Jackson, 2013; Pyryt, 1993; Smith-Maddox & Wheelock, 1995). This study uniquely contributes to the literature by integrating these separate findings, introducing educational aspirations and expectations as mediators that link 9th-grade academic tracking to subsequent post-secondary and career outcomes.

Whereas education aspirations and expectations were largely consistent in their roles as mediators, academic self-efficacy was not a significant mediator in the relation between academic track positioning and post-secondary education attendance, program length, college major, and expected future job. This lack of mediation via academic self-efficacy could be due to the intersectional nature in how student academic self-efficacy develops in adolescence. In essence, prior research has suggested that studying the prediction of academic self-efficacy in adolescence is particularly difficult due to the myriad of factors that appear to each have a role in its development, including but not limited to academic ability, race/ethnicity, gender, and socioeconomic status (Schunk & Meece, 2006). Thus, academic tracking may play a smaller role in its development in comparison to some of these aforementioned factors that have been well documented to be impactful on academic self-efficacy.

These findings raise several concerns that warrant consideration. Firstly, these findings bring attention to the risk of self-fulfilling prophecies: students placed in lower academic tracks may develop lower educational aspirations and expectations as a result, which could in turn limit their ambition and narrow their post-secondary and career opportunities. This stresses the need for supporting educational aspirations and expectations for students across all academic tracks. In order to do so, educators must encourage: sensible risk-taking via challenging tasks and projects related to future career opportunities, goal-setting for future education and career endeavors, and a positive school climate that helps to nurture education aspirations and expectations via feelings of empowerment and a sense of belonging (Quaglia & Cobb, 1996).

However, it is important to note that the effect sizes were relatively small, suggesting that although educational aspirations and expectations serve as statistically significant mediators, their practical impact may be limited. In other words, while educational aspirations and expectations may help to explain the relation between academic track positioning and post-secondary and career outcomes, there are other potential mediators that better explain this relation (e.g., peer relationships).

This dissertation also highlights potential gaps in the existing academic tracking literature. While educational aspirations and expectations do influence post-secondary and career outcomes, these relations may be better explained by variables not included in this dissertation's analyses. These could include education quality, peer relationships, and parental involvement, among other factors (Levine & Sutherland, 2013; Swenson et al., 2008). Future research should, therefore, explore questions such as: Does the disparity in education quality across academic tracks contribute to observed differences in outcomes? How might peer relationships within a particular academic track influence these outcomes?

In this context, it's particularly noteworthy to consider the role of active and engaged parenting as a protective factor for students in lower academic tracks (Gibbons, 2002; Khattab, 2015; Watts & Bridges, 2006). Improving parent-child relationships can elevate educational aspirations and expectations, and research shows that such relationships can be enhanced through parents' active participation in children’s playtime (Ginsburg & Health, 2007). Educators and administrators can further support these relationships by connecting families with programs that have proven effective in strengthening the parent-child bond, such as the Triple P Positive Parenting Program (Wiggins et al., 2009). These considerations add another layer to our understanding of the complex effects of academic tracking on future post-secondary and career outcomes.

The results of this dissertation also indicate that there was not significant mediation by academic self-efficacy between academic track positioning and any of the outcomes (post-secondary education attendance, program length, college major, and expected future job). This lack of significance suggests that while academic self-efficacy remains an important aspect of students' academic development, it does not seem to drive post-secondary and career outcomes. Nevertheless, schools and educators should continue to implement strategies to boost students' confidence in their academic abilities, as this can contribute to their overall academic success (Honicke & Broadbent, 2016).

Strengths and Limitations

This dissertation has several strengths that contribute to the extant academic tracking literature. The sample size, which is larger than that used in most previous academic tracking studies, is a key strength. For example, many tracking studies rely on sample sizes ranging from several hundred to several thousand students (e.g., Akos et al., 2007; Broussard & Joseph, 1998; Dockx et al., 2019), whereas this dissertation utilizes a sample of nearly 20,000. A larger sample size is a key component in capturing the complexities of academic tracking across a broader student population, thereby providing sufficient power for detecting significant effects through rigorous quantitative methods such as null hypothesis testing. In fact, the use of null hypothesis testing, underutilized in much of the extant academic tracking literature (e.g., Kershaw, 1992; Oakes & Guiton, 1995), offers a more robust analytical approach to examining the effects of academic tracking on post-secondary and career outcomes than do descriptive analyses (which predominate in the field).

Furthermore, the diversity of the sample enhances the study's generalizability. Unlike much of the existing academic tracking literature that has predominantly focused on White and Black students (e.g., Moody, 2001; Shavit, 1990; Walsemann & Bell, 2010), this study utilizes a nationally representative sample that includes students from a wide array of racial and ethnic groups, including Latinx, Asian, and Native American students. This diverse racial-ethnic composition helps to improve our understanding of the effects of academic tracking and helps to improve the generalizability of this dissertation's findings.

Another strength of this dissertation is the examination of the effects of science academic tracking, a subject area that remains largely understudied in contrast to other academic disciplines such as math and language arts. By delving into science academic tracking, this dissertation builds upon the extant academic tracking literature by broadening our understanding of STEM tracking effects, thereby complementing previous studies that have predominantly examined the impact of math tracking. Furthermore, this gap in the literature underscores the need for additional research into the effects of tracking in other understudied academic subjects (e.g., social studies, history, social sciences). In summation, this dissertation serves as an important contribution to the academic tracking literature, offering an examination into the overlooked science subject.

This dissertation, while offering a variety of contributions to the academic tracking literature, is not without its limitations. One of the more salient limitations of this dissertation is the small group size for the advanced or AP science track. The relatively small size of existing study groups, along with a lack of research on the effects of science tracking, underscores the need for more comprehensive tracking studies. These studies should focus on understanding the experiences of students who participate in science tracking and the effects of their track placement on their academic and social outcomes.

An additional limitation to this dissertation is the use of Haye's Process Macro for testing mediation. Although there has been research that has suggested the Process Macro produces similar results to latent models for mediation (Hayes, 2017), there are other analytic methods, such as Structural Equation Modeling (SEM; MacKinnon & Valente, 2014), that are more widely used and accepted means of assessing the relation between a predictor, a potential mediator, and the outcome of interest. Specifically, SEM provides more effective means of accounting for measurement error, an ability to test model fit indices, as well as greater flexibility for assessing complex models.

Furthermore, a limitation of this dissertation is that it does not delve into the potentially transactional nature of academic tracking and student educational aspirations and expectations. Specifically, the educational aspirations and expectations that students develop early in their lives may influence their subsequent placement into academic tracks. Conversely, once placed within an academic track, the experiences within the track could significantly alter or reinforce these education aspirations and expectations. If this relation is indeed bidirectional, it would suggest a transactional relation, where early education aspirations and expectations may set the trajectory for track placement, which in turn, could either amplify or diminish those initial aspirations and expectations. To unravel these potentially transactional relations, future research should employ longitudinal designs. One strategy would be to collect data in early elementary school, prior to the explicit tracking that often occurs in middle and high school. Such studies would help to clarify whether educational aspirations and expectations are a driving force in track positioning or if the track placement itself is a determinant in the development of student education aspirations and expectations.

Another limitation of this study is the inability to compare the effects of academic tracking in STEM versus non-STEM subjects. That is, comparing the effects of math and science tracks versus language arts and social sciences tracks could reveal differential impacts of tracking across academic disciplines. In essence, studying academic tracking across disciplines could provide a more comprehensive understanding of how tracking shapes student trajectories. Although ideal, this comparison was not feasible in the current study due to the lack of available tracking data for language arts and social sciences in the HSLS data. The absence of this comparative perspective constrains the study's ability to provide a holistic view of academic tracking across all core subjects, leaving potential gaps in our understanding of how tracking operates within different academic disciplines.

Implications for Practice

A common suggestion as a solution to the issues of diverging academic outcomes from tracking systems has been the idea of detracking, or the dissolution of academic tracking systems (Argys et al., 1996; Chang et al., 2006). The idea is that detracking would create more equitable learning environments, as students of all perceived ability levels would be aggregated into the same classrooms and would thus increase the academic rigor that students in lower tracks would otherwise receive (Burris & Welner, 2005). In addition to the academic benefits for students who are tracked lowly, it would also promote social well-being as exposure to diverse peer groups has a myriad of benefits including increased dialogue and debate, point of view comprehension, and overall critical thinking (Aboud et al., 2003; Chang et al., 2006; Orfield & Frankenberg, 2011; Siegel-Hawley, 2012). To build upon this idea, future research should consider conducting studies that compare students who are tracked versus students who are not, which will allow for a more comprehensive understanding of the effects of academic tracking. Moreover, focusing on demographically matched student groups within these comparative studies can offer helpful insights into specific ways academic tracks influence student outcomes.

Despite the potential benefits that students of all ability groups could receive from a detracked school system, the process of detracking has often been hindered by parents with high social status in schools. Specifically, prior research has demonstrated that powerful parents within schools will go as far as the following to avoid detracking: threaten to leave their schools, work to convince educational leadership that their job is to serve the parental elites, use their social status to influence parents that are not part of the social elite that detracking is a bad idea, and even use their social capital to bribe schools (Oakes et al., 1997). A critical question that arises is whether educational institutions should yield to such pressures, especially when doing so appears to compromise the quality of education for students in lower tracks. Given the recent decline in school enrollment due to low birth rates, administrators are unlikely to give into such pressures, as the risk of losing these elite parents – often referred to as 'flight' – is too significant of an issue to ignore (Petrilli, 2019). This parental concern highlights an important issue: any changes to the tracking system need to be carefully considered to ensure that they do not adversely affect students who are currently benefiting from higher level track positioning. Specifically, higher academic tracks often provide high-quality learning environments that allow highly tracked students to grow and prepare for future endeavors such as post-secondary education attainment and their career paths. Any changes or updates to the tracking systems need to consider the need to do no harm to students who tend to be placed in the higher tracks.

Given the issues in detracking, there is another alternative – namely, improving the quality of education that students in lower tracks receive. This is a path of less resistance, in comparison to detracking, that could prove to be fruitful. In essence, school districts could work to improve the education quality students tracked lowly receive by providing programs that improve the qualifications of existing teachers, hiring more highly qualified teachers, ensuring that teachers engage in effective teaching practices such as providing rigorous coursework, and that teachers respond to students with constructive feedback that allows them to grow academically. However, it is important to note that such an approach could inadvertently continue to perpetuate the 'separate but equal' system in which students in lower tracks may receive an inferior education quality. Specifically, prior research has demonstrated that schools have attempted to implement 'separate but equal' learning environments for students, but have been unsuccessful in creating truly equal learning opportunities for students (Kujovich, 1987).

Conclusion

In summary, the findings of this dissertation highlight diverging post-secondary and career outcomes across academic tracks. They also suggest education aspirations and expectations serve as a vehicle for the effects of academic tracking on students' post-secondary education attendance, program length, college major, and expected future job. These effects should concern education administrators, especially due to the interrelation between academic tracking, race/ethnicity, and socioeconomic status. It has been often suggested that educators consider detracking, or removing tracking systems completely from their education systems, but this has often been met with resistance from parents within school systems. Alternatively, focusing on increasing the quality of education in the lower academic tracks could prove to be beneficial as well as be met with less resistance from the community. The concern with this approach is the maintenance of 'separate but equal' learning environments, in which students in lower tracks receive a poorer education due to their positioning. Researchers should consider examining the effects of detracked school systems to better understand this issue and make thoughtful recommendations.

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APPENDIX A

TABLES

Table 1

Frequencies, Percentages, and Mode for Demographic Variables

Variable	*N*	%
Race		
Asian	1734	8.8%
African American	2056	10.4%
Native American	135	0.7%
Hispanic	3229	16.4%
Multi-Ethnic	1701	8.6%
Pacific Islander	93	0.5%
White	10761	54.6%*
Sex		
Male	10383	50.5%*
Female	10196	49.5%
Dual Language		
English Only	15750	83.6%*
Non-English	1897	10.1%
Split English and Non-English	1187	6.3%
Family Income		
Less than $15,000	1315	8.8%
> $15,000 and <= $35,000	2681	17.9%*
> $35,000 and <= $55,000	2446	16.3%
> $55,000 and <= $75,000	2279	15.2%
> $75,000 and <= $95,000	1700	11.3%
> $95,000 and <= $115,000	1349	9.0%
> $115,000 and <= $135,000	882	5.9%
> $135,000 and <= $155,000	684	4.6%
> $155,000 and <= $175,000	340	2.3%
> $175,000 and <= $195,000	220	1.5%
> $195,000 and <= $215,000	291	1.9%
> $215,000 and <= $235,000	108	0.7%
> $235,000	710	4.7%

Note. *Indicates mode for that variable

Table 2

Frequencies, Percentages, and Mode for Categorical Variables of Interest

Variable	*N*	%
Math Academic Track Position		
Below Grade Level	1471	7.5%
On-Grade Level	10506	53.9%*
Above Grade Level	7528	38.6%
Science Academic Track Position		
General or Specialty Science	19011	98.2%*
Advanced or AP Science	349	1.8%
College Attendance		
Attended College	12006	77.1%*
Did not attend College	3571	22.9%
College Type		
Enrolled in 2 Years or Less	121	1.4%
Enrolled in 2 Year	1690	19.1%
Enrolled in 4 Year	7025	79.5%*
College Major		
STEM	2965	26.5%
Non-STEM	8221	73.5%*
Expected Future Career		
STEM	3742	38.9%
Non-STEM	5885	61.1%*

Note. *Indicates mode for that variable

Table 3

Descriptive Statistics for Continuous Variables

Variable	*M (SD)*	Min	Max	Skew	Kurt
Math GPA	2.42 (0.94)	0.25	4.00	-0.15	-0.77
Science GPA	2.49 (0.94)	0.25	4.00	-0.26	-0.70
Education Asp.	5.78 (1.43)	1.00	7.00	-1.40	1.40
Education Exp.	8.15 (2.90)	1.00	12.00	-0.67	-0.23
Math SE	2.78 (0.71)	1.00	4.00	-0.30	-0.06
Science SE	2.82 (0.73)	1.00	4.00	-0.29	-0.08

Note. Asp. = Aspirations, Exp. = Expectations, SE = Self-Efficacy.

Table 4

Chi-Square Analysis: Post-Secondary Education Attendance By Race/Ethnicity

	x^2	df	V
	213.4***	6	0.12

	No College			Attended College		
Race	*N*	%	Res.	*N*	%	Res.
Asian	138	10.2%	-9.7	1215	89.8%	5.2
African American	429	28.0%	4.3	1105	72.0%	-2.3
Native American	37	39.4%	3.4	57	60.6%	-1.8
Hispanic	670	28.8%	6.1	1657	71.2%	-3.3
Multi-Ethnic	299	23.4%	0.5	978	76.6%	-0.3
Pacific Islander	17	27.0%	0.7	46	73.0%	-0.4
White	1809	21.8%	-1.8	6489	78.2%	1.0

Note. Res. = Standardized Residual.

$*p < .05$. $**p < .01$. $***p < .001$.

Table 5

Chi-Square Analysis: Post-Secondary Program Length By Race/Ethnicity

x^2	df	V
170.1***	12	0.14

	Less than 2-Year			2-Year			4-Year		
Race	*N*	%	Res.	*N*	%	Res.	*N*	%	Res.
Asian	4	0.4%	-2.7	144	13.8%	-4.0	893	85.8%	2.3
African American	14	1.9%	1.4	167	23.0%	2.3	545	75.1%	-1.3
Native American	0	0.0%	-0.6	9	29.0%	1.2	22	71.0%	-0.5
Hispanic	24	2.1%	2.3	346	30.8%	8.8	753	67.1%	-4.6
Multi-Ethnic	10	1.5%	0.4	152	22.9%	2.1	502	75.6%	-1.1
Pacific Islander	0	0.0%	-0.7	5	15.2%	-0.5	28	84.8%	0.4
White	62	1.3%	-0.4	821	16.8%	-4.0	4006	81.9%	2.0

Note. Res. = Standardized Residual.

**p* < .05, ***p* < .01, ****p* < .001.

Table 6

Chi-Square Analysis: College Major By Race/Ethnicity

x^2	df	*V*
274.2***	6	0.16

	Non-STEM			STEM		
Race	*N*	%	Res.	*N*	%	Res.
Asian	610	53.7%	-7.8	526	46.3%	12.9
African American	429	28.0%	4.3	1105	72.0%	-2.3
Native American	38	74.5%	0.1	13	25.5%	-0.1
Hispanic	1192	78.1%	2.1	334	21.9%	-3.5
Multi-Ethnic	677	74.9%	0.5	227	25.1%	-0.8
Pacific Islander	30	71.4%	-0.2	12	28.6%	0.3
White	4517	74.6%	1.0	1540	25.4%	-1.7

Note. Res. = Standardized Residual.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 7

Chi-Square Analysis: Expected Future Job By Race/Ethnicity

x^2	df	*V*
145.1***	6	0.13

	Non-STEM			STEM		
Race	*N*	%	Res.	*N*	%	Res.
Asian	338	41.7%	-7.0	473	58.3%	8.7
African American	596	64.5%	1.4	328	35.5%	-1.8
Native American	35	64.8%	0.4	19	35.2%	-0.5
Hispanic	887	65.4%	2.1	470	34.6%	-2.7
Multi-Ethnic	477	62.0%	0.4	292	38.0%	-0.5
Pacific Islander	23	57.5%	-0.3	17	42.5%	0.3
White	3269	61.8%	0.9	2018	38.2%	-1.1

Note. Res. = Standardized Residual.

**p < .05, **p < .01, ***p < .001*.

Table 8

Chi-Square Analysis: Post-Secondary Education Attendance By Sex

					x^2	df	*V*
					126.7***	1	0.09
	No College			Attended College			
Sex	*N*	%	Res.	*N*	%	Res.	
Male	2025	26.8%	7.1	5524	73.2%	-3.9	
Female	1544	19.2%	-6.9	6481	80.8%	3.8	

Note. Res. = Standardized Residual.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 9

Chi-Square Analysis: Post-Secondary Program Length By Sex

x^2	df	*V*
5.91*	2	0.03

	Less than 2-Year			2-Year			4-Year		
Sex	*N*	%	Res.	*N*	%	Res.	*N*	%	Res.
Male	54	1.4%	0	798	20.2%	1.6	3089	78.4%	-0.8
Female	67	1.4%	0	891	18.2%	-1.5	3936	80.4%	0.7

Note. Res. = Standardized Residual.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 10

Chi-Square Analysis: College Major By Sex

				x^2	df	*V*
				454.6***	1	0.20
		Non-STEM			STEM	
Sex	*N*	%	Res.	*N*	%	Res.
Male	3272	63.8%	-8.1	1855	36.2%	13.5
Female	4948	81.7%	7.4	1110	18.3%	-12.4

Note. Res. = Standardized Residual.

**p < .05, **p < .01, ***p < .001.*

Table 11

Chi-Square Analysis: Expected Future Job By Sex

				x^2	df	*V*
				243.1***	1	0.16
		Non-STEM			STEM	
Sex	*N*	%	Res.	*N*	%	Res.
Male	3086	69.5%	7.1	1354	30.5%	-8.9
Female	2798	54.0%	-6.6	2387	46.0%	8.3

Note. Res. = Standardized Residual.

$*p$ < .05, $**p$ < .01, $***p$ < .001.

Table 12

Chi-Square Analysis: Post-Secondary Education Attendance By Language Spoken

x^2	df	*V*
7.0*	2	0.03

	No College			Attended College		
Language	*N*	%	Res.	*N*	%	Res.
English Only	2800	22.4%	0.1	9332	77.6%	0.5
Non-English	339	24.1%	1.3	1069	75.9%	-0.7
Split English and Non-English	173	19.4%	-1.9	720	80.6%	1.0

Note. Res. = Standardized Residual.

**p < .05, **p < .01, ***p < .001*.

Table 13

Chi-Square Analysis: Post-Secondary Program Length By Language Spoken

							x^2	df	*V*
							18.6***	4	0.03
	Less than 2-Year			2-Year			4-Year		
Language	*N*	%	Res.	*N*	%	Res.	*N*	%	Res.
English Only	95	1.4%	0.3	1268	18.6%	-1.4	5470	80.1%	0.6
Non-English	8	1.0%	-0.9	199	24.7%	3.5	598	74.3%	-1.6
Split English and Non-English	8	1.4%	0.1	116	20.5%	0.6	443	78.1%	-0.3

Note. Res. = Standardized Residual.

**p < .05, **p < .01, ***p < .001*.

Table 14

Chi-Square Analysis: College Major Across Language Spoken

				x^2	df	*V*
				76.3***	2	0.09
		Non-STEM			STEM	
Language	*N*	%	Res.	*N*	%	Res.
English Only	6550	75.3%	1.8	2151	24.7%	-3.0
Non-English	642	64.7%	-3.3	350	35.3%	5.5
Split English and Non-English	438	65.4%	-2.5	232	34.6%	4.2

Note. Res. = Standardized Residual.

**p < .05, **p < .01, ***p < .001*.

Table 15

Chi-Square Analysis: Expected Future Job By Language Spoken

x^2	df	*V*
31.5***	2	0.06

	Non-STEM			STEM		
Language	*N*	%	Res.	*N*	%	Res.
English Only	4688	61.9%	1.4	2869	38.1%	-1.7
Non-English	429	53.4%	-2.6	374	46.6%	3.3
Split English and Non-English	298	54.5%	-1.9	249	45.5%	2.3

Note. Res. = Standardized Residual.

**p < .05, **p < .01, ***p < .001*.

Table 16

Logistic Regressions With Family Income, Math and Science GPA Predicting Post-Secondary and Career Outcomes

	B	S.E.	df	O.R.	95% C.I. for O.R. Lower	95% C.I. for O.R. Upper
Post-Secondary Attendance						
Family Income	0.32***	0.01	1	1.38	1.35	1.41
Math GPA	1.16***	0.03	1	3.19	2.96	3.43
Science GPA	1.27***	0.03	1	3.56	3.31	3.82
Post-Secondary Program Length						
Family Income	0.22***	0.01	1	1.25	1.23	1.27
Math GPA	1.12***	0.04	1	3.06	2.87	3.26
Science GPA	1.23***	0.04	1	3.42	3.21	3.64
College Major						
Family Income	0.06***	0.01	1	1.06	1.05	1.07
Math GPA	0.60***	0.03	1	1.82	1.71	1.94
Science GPA	0.66***	0.03	1	1.93	1.81	2.06
Expected Future Job						
Family Income	0.04***	0.01	1	1.04	1.03	1.05
Math GPA	0.47***	0.02	1	1.60	1.56	1.64
Science GPA	0.51***	0.03	1	1.67	1.56	1.79

Note. *$p < .05$, **$p < .01$, ***$p < .001$. Weights were not applied to the sample for preliminary analyses.

Table 17

Binomial Logistic Regression with Math Tracking Predicting Post-Secondary Attendance

	B	S.E.	df	O.R.	95% C.I. for O.R. Lower	95% C.I. for O.R. Upper
Race/Ethnicity	-0.11***	0.02	1	0.91	0.88	0.94
Sex	0.29***	0.06	1	1.39	1.31	1.48
Language	0.03	0.06	1	1.08	1.02	1.14
Family Income	0.25***	0.01	1	1.26	1.24	1.28
Math GPA	0.04***	0.04	1	2.58	2.44	2.73
Math Academic Track						
Below Grade Level	-0.57***	0.09	1	0.61	0.54	0.69
Above Grade Level	0.41***	0.06	1	1.57	1.48	1.67

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 18

Binomial Logistic Regression with Science Tracking Predicting Post-Secondary Attendance

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.14***	0.02	1	0.89	0.86	0.93
Sex	0.29***	0.06	1	1.40	1.24	1.57
Language	0.07**	0.06	1	1.20	1.07	1.35
Family Income	0.24***	0.01	1	1.27	1.25	1.30
Science GPA	1.16***	0.04	1	3.06	2.82	3.31
Science Academic Track						
Advanced or AP Science	0.76**	0.29	1	1.92	1.09	3.38

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track.
Gen. = General, Spec. = Specialty.
$*p < .05$, $**p < .01$, $***p < .001$.

Table 19

Binomial Logistic Regression With Math and Science Tracking Predicting Post-Secondary Attendance

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.14***	0.02	1	0.89	0.86	0.93
Sex	0.25***	0.06	1	1.36	1.21	1.53
Language	0.12	0.06	1	1.13	1.00	1.27
Family Income	0.23***	0.01	1	1.25	1.23	1.27
Math GPA	0.44***	0.05	1	1.55	1.41	1.71
Science GPA	0.78***	0.05	1	2.08	1.89	2.30
Math Academic Track						
Below Grade Level	-0.40***	0.10	1	0.70	0.58	0.85
Above Grade Level	0.32***	0.07	1	1.45	1.27	1.67
Science Academic Track						
Advanced or AP Science	0.42*	0.30	1	1.52	0.84	2.74

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level. Additionally, the reference group for science academic track was general or specialty science, which AP or advanced science were being compared to.

Gen. = General, Spec. = Specialty.

**p < .05, **p < .01, ***p < .001.*

Table 20

Logistic Regression between Math Tracking and Post-Secondary Attendance with Mediators

	B	S.E.	O.R.	95% C.I. for O.R. Lower	Upper
Direct Effects					
Race/Ethnicity	-0.08***	0.02	0.92	0.88	0.96
Sex	0.24	0.07	1.27	1.11	1.46
Language	0.01	0.07	1.01	0.88	1.16
Family Income	0.17***	0.02	1.00	0.96	1.04
Math GPA	0.81***	0.04	2.25	2.09	2.44
Math Academic Track					
Below Grade Level	-0.25*	0.12	0.78	0.62	0.99
Above Grade Level	0.28***	0.08	1.32	1.13	1.54
Indirect Effects					
Below Grade via Ed. Asp.	-0.06^{+}	0.02	0.94	0.90	0.98
Below Grade via Ed. Exp.	-0.22^{+}	0.04	0.80	0.74	0.87
Below Grade via Math SE	0.00	0.01	1.00	0.98	1.02
Above Grade via Ed. Asp.	0.03	0.01	1.03	1.01	1.05
Above Grade via Ed. Exp.	0.14	0.02	1.15	1.11	1.20
Above Grade via Math SE	0.00	0.00	1.00	1.00	1.00

Note. $^{+}$Indicates a significant confidence interval. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level.

Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 21

Logistic Regression between Science Tracking and Post-Secondary Attendance with Mediators

				95% C.I. for O.R.	
	B	S.E.	O.R.	Lower	Upper
Direct Effects					
Race/Ethnicity	-0.10***	0.02	0.90	0.87	0.94
Sex	0.21***	0.07	1.23	1.07	1.41
Language	0.04	0.07	1.04	0.91	1.19
Family Income	0.22***	0.02	1.25	1.20	1.30
Science GPA	0.92***	0.05	2.51	2.28	2.77
Science Academic Track					
Advanced or AP Science	0.73*	0.36	2.08	1.03	4.21
Indirect Effects					
Advanced via Ed. Asp.	0.02	0.04	1.02	0.94	1.10
Advanced via Ed. Exp.	0.09[+]	0.04	1.09	1.01	1.18
Advanced via Sci. SE	0.00	0.01	1.00	0.98	1.02

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track. Gen. = General, Spec. = Specialty, Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

*$p < .05$, **$p < .01$, ***$p < .001$.

[+]Indicates a significant confidence interval.

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Table 22

Ordinal Logistic Regression With Math Tracking Predicting Post-Secondary Program Length

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.06***	0.01	1	0.95	0.93	0.97
Sex	0.15***	0.05	1	1.22	1.11	1.35
Language	0.15**	0.05	1	1.06	0.96	1.17
Family Income	0.19***	0.01	1	1.20	1.18	1.22
Math GPA	0.94***	0.03	1	2.56	2.41	2.72
Math Academic Track						
Below Grade Level	-0.24*	0.11	1	0.76	0.61	0.94
Above Grade Level	0.52***	0.05	1	1.70	1.54	1.87

Note. The reference group for math academic tracking was the on-grade level, indicating that below- and above-grade levels were being compared to on-grade level.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 23

Ordinal Logistic Regression With Science Tracking Predicting Post-Secondary Program Length

	B	S.E.	df	O.R.	95% C.I. for O.R. Lower	Upper
Race/Ethnicity	-0.08***	0.01	1	0.95	0.93	0.97
Sex	0.13**	0.05	1	1.16	1.05	1.28
Language	0.18***	0.05	1	1.12	1.02	1.23
Family Income	0.18***	0.01	1	1.20	1.18	1.22
Science GPA	1.10***	0.03	1	3.10	2.92	3.29
Science Academic Track						
Advanced or AP Science	0.49**	0.18	1	1.95	1.37	2.77

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track.
Gen. = General, Spec. = Specialty.
$*p < .05$, $**p < .01$, $***p < .001$.

Table 24

Ordinal Logistic Regression with Math and Science Tracking Predicting Post-Secondary Program Length

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.08***	0.02	1	0.94	0.90	0.98
Sex	0.12**	0.05	1	1.16	1.05	1.28
Language	0.16***	0.05	1	1.11	1.01	1.22
Family Income	0.18***	0.01	1	1.19	1.16	1.21
Math GPA	0.49***	0.05	1	1.58	1.43	1.74
Science GPA	0.67***	0.05	1	2.01	1.82	2.22
Math Academic Track						
Below Grade Level	-0.11	0.11	1	0.88	0.71	1.09
Above Grade Level	0.45***	0.05	1	1.57	1.42	1.73
Science Academic Track						
Advanced or AP Science	0.38*	0.19	1	1.73	1.19	2.51

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level. Additionally, the reference group for science academic track was general or specialty science, which AP or advanced science were being compared to.

Gen. = General, Spec. = Specialty.

$*p < .05, **p < .01, ***p < .001$.

Table 25

Logistic Regression between Math Tracking and Post-Secondary Program length with Mediators

				95% C.I. for O.R.	
	B	S.E.	O.R.	Lower	Upper
Direct Effects					
Race/Ethnicity	-0.03***	0.01	0.97	0.95	0.99
Sex	0.08	0.03	1.08	1.02	1.15
Language	0.07**	0.03	1.07	1.01	1.13
Family Income	0.07***	0.00	1.07	1.07	1.07
Math GPA	0.47***	0.02	1.60	1.54	1.66
Math Academic Track					
Below Grade Level	-0.16	0.07	0.85	0.74	0.98
Above Grade Level	0.19***	0.03	1.21	1.14	1.28
Indirect Effects					
Below Grade via Ed. Asp.	-0.01	0.01	0.99	0.97	1.01
Below Grade via Ed. Exp.	-0.05+	0.02	0.95	0.91	0.99
Below Grade via Math SE	0.00	0.00	1.00	1.00	1.00
Above Grade via Ed. Asp.	0.01+	0.00	1.01	1.01	1.01
Above Grade via Ed. Exp.	0.04+	0.01	1.04	1.02	1.06
Above Grade via Math SE	0.00	0.00	1.00	1.00	1.00

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level. Ed. stands for education, Asp. stands for aspirations, Exp. stands for expectations, and SE stands for self-efficacy.

Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

$*p < .05$, $**p < .01$, $***p < .001$.

+Indicates a significant confidence interval.

Table 26

Logistic Regression between Science Tracking and Post-Secondary Program Length with Mediators

	B	S.E.	O.R.	95% C.I. for O.R. Lower	95% C.I. for O.R. Upper
Direct Effects					
Race/Ethnicity	-0.04***	0.01	0.96	0.94	0.98
Sex	0.07**	0.03	1.07	1.01	1.13
Language	0.08**	0.03	1.08	1.02	1.15
Family Income	0.07***	0.00	1.07	1.07	1.07
Science GPA	0.54***	0.02	1.72	1.65	1.79
Science Academic Track					
Advanced or AP Science	0.18	0.09	1.20	1.01	1.43
Indirect Effects					
Advanced via Ed. Asp.	0.00	0.01	1.00	0.98	1.02
Advanced via Ed. Exp.	0.02	0.01	1.02	1.00	1.04
Advanced via Sci. SE	0.00	0.00	1.00	1.00	1.00

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track. Gen. = General, Spec. = Specialty, Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

$*p < .05$, $**p < .01$, $***p < .001$.

[+]Indicates a significant confidence interval.

Table 27

Binomial Logistic Regression with Math Tracking Predicting College Major

	B	S.E.	df	O.R.	95% C.I. for O.R.	
					Lower	Upper
Race/Ethnicity	-0.08***	0.02	1	0.95	0.91	0.99
Sex	-1.09***	0.05	1	0.36	0.33	0.40
Language	0.23***	0.05	1	1.14	1.03	1.26
Family Income	0.02***	0.01	1	1.02	1.00	1.04
Math GPA	0.62***	0.04	1	1.77	1.63	1.91
Math Academic Track						
Below Grade Level	-0.23	0.16	1	0.80	0.59	1.09
Above Grade Level	0.60***	0.06	1	1.82	1.62	2.05

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 28

Binomial Logistic Regression with Science Tracking Predicting College Major

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.10***	0.02	1	0.92	0.88	0.96
Sex	-1.09***	0.05	1	0.36	0.33	0.40
Language	0.25***	0.05	1	1.19	1.08	1.31
Family Income	0.03***	0.01	1	1.03	1.01	1.05
Science GPA	0.82***	0.04	1	2.14	1.98	2.31
Science Academic Track						
Advanced or AP Science	0.17	0.17	1	1.09	0.78	1.52

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track. Gen. stands for general and Spec. stands for specialty.

Gen. = General and Spec. = Specialty.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 29

Binomial Logistic Regression with Math and Science Tracking Predicting College Major

	B	S.E.	df	O.R.	95% C.I. for O.R. Lower	95% C.I. for O.R. Upper
Race/Ethnicity	-0.09***	0.02	1	0.93	0.89	0.97
Sex	-1.11***	0.06	1	0.36	0.32	0.41
Language	0.24***	0.05	1	1.17	1.06	1.29
Family Income	0.02***	0.01	1	1.01	0.99	1.03
Math GPA	0.30***	0.06	1	1.23	1.09	1.38
Science GPA	0.46***	0.06	1	1.65	1.47	1.85
Math Academic Track						
Below Grade Level	-0.16	0.17	1	0.88	0.63	1.23
Above Grade Level	0.53***	0.06	1	1.72	1.53	1.93
Science Academic Track						
Advanced or AP Science	0.12	0.17	1	1.02	0.73	1.42

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level. Additionally, the reference group for science academic track was general or specialty science, which AP or advanced science were being compared to.

Gen. = General and Spec. = Specialty.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 30

Ordinal Logistic Regression between Math Tracking and College Major with Mediators

				95% C.I. for O.R.	
	B	S.E.	O.R.	Lower	Upper
Direct Effects					
Race/Ethnicity	-0.05**	0.02	0.95	0.91	0.99
Sex	-1.00***	0.06	0.37	0.33	0.42
Language	0.23***	0.06	1.26	1.12	1.42
Family Income	0.02*	0.01	1.02	1.00	1.04
Math GPA	0.42***	0.04	1.52	1.40	1.64
Math Academic Track					
Below Grade Level	0.00	0.19	1.00	0.69	1.45
Above Grade Level	0.55***	0.06	1.73	1.54	1.95
Indirect Effects					
Below Grade via Education Asp.	-0.05^{+}	0.02	0.95	0.91	0.99
Below Grade via Education Exp.	-0.08	0.02	0.92	0.88	0.96
Below Grade Level via Math SE	0.00	0.02	1.00	0.96	1.04
Above Grade via Education Asp.	0.03^{+}	0.01	1.03	1.01	1.05
Above Grade via Education Exp.	0.06^{+}	0.01	1.06	1.04	1.08
Above Grade via Math SE	0.00	0.01	1.00	0.98	1.02

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level.

Gen. = General, Spec. = Specialty, Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

**p* < .05, ***p* < .01, ****p* < .001.

$^{+}$Indicates a significant confidence interval.

Table 31

Ordinal Logistic Regression between Science Tracking and College Majors with Mediators

				95% C.I. for O.R.	
	B	S.E.	O.R.	Lower	Upper
Direct Effects					
Race/Ethnicity	-0.08***	0.02	0.92	0.88	0.96
Sex	-1.05***	0.06	0.35	0.31	0.39
Language	0.24***	0.06	1.27	1.13	1.43
Family Income	0.02*	0.01	1.02	1.00	1.04
Science GPA	0.65***	0.04	1.92	1.77	2.08
Science Academic Track					
Advanced or AP Science	0.12	0.18	1.13	0.79	1.61
Indirect Effects					
Advanced via Ed. Asp.	0.03	0.02	1.03	0.99	1.07
Advanced via Ed. Exp.	0.03	0.02	1.03	0.99	1.07
Advanced via Science SE	0.02	0.02	1.02	0.98	1.06

Note. $^{+}$Indicates a significant confidence interval. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track.

Gen. = General, Spec. = Specialty, Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 32

Binomial Logistic Regression with Math Tracking Predicting Future Job at Age 30

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.07***	0.02	1	0.97	0.93	1.01
Sex	0.67***	0.05	1	1.95	1.77	2.15
Language	0.51***	0.05	1	1.16	1.05	1.28
Family Income	-0.01***	0.01	1	0.99	0.97	1.01
Math GPA	0.43***	0.03	1	1.45	1.37	1.54
Math Academic Track						
Below Grade Level	-0.17	0.13	1	0.86	0.67	1.11
Above Grade Level	0.33***	0.05	1	1.39	1.26	1.53

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 33

Binomial Logistic Regression with Science Tracking Predicting Future Job at Age 30

					95% C.I. for O.R.	
	B	S.E.	df	O.R.	Lower	Upper
Race/Ethnicity	-0.09***	0.02	1	0.96	0.92	1.00
Sex	0.52***	0.05	1	1.97	1.79	2.17
Language	0.14***	0.05	1	1.26	1.14	1.39
Family Income	0.01	0.01	1	1.00	0.98	1.02
Science GPA	0.50***	0.03	1	1.51	1.42	1.60
Science Academic Track						
Advanced or AP Science	0.22	0.17	1	1.48	1.06	2.06

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track. Gen. = General and Spec. = Specialty.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 34

Binomial Logistic Regression with Math and Science Tracking Predicting Future Job at Age 30

	B	S.E.	df	O.R.	95% C.I. for O.R. Lower	Upper
Race/Ethnicity	-0.08***	0.02	1	0.97	0.93	1.01
Sex	0.50***	0.05	1	1.93	1.75	2.13
Language	0.12*	0.05	1	1.26	1.14	1.39
Family Income	0.00	0.01	1	0.99	0.97	1.01
Math GPA	0.25***	0.05	1	1.27	1.15	1.40
Science GPA	0.23***	0.05	1	1.15	1.04	1.27
Math Academic Track						
Below Grade Level	-0.16	0.13	1	0.90	0.70	1.16
Above Grade Level	0.30***	0.06	1	1.43	1.27	1.61
Science Academic Track						
Advanced or AP Science	0.16	0.17	1	1.34	0.96	1.87

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level. Additionally, the reference group for science academic track was general or specialty science, which AP or advanced science were being compared to. Gen. = General and Spec. = Specialty.

$*p < .05$, $**p < .01$, $***p < .001$.

Table 35

Logistic Regression between Math Tracking and Expected Future Jobs with Mediators

				95% C.I. for O.R.	
	B	S.E.	O.R.	Lower	Upper
Direct Effects					
Race/Ethnicity	-0.05*	0.02	0.95	0.91	0.99
Sex	0.43***	0.06	1.54	1.37	1.73
Language	0.12*	0.06	1.13	1.00	1.27
Family Income	0.00	0.01	1.00	0.98	1.02
Math GPA	0.25***	0.04	1.28	1.18	1.38
Math Academic Track					
Below Grade Level	-0.09	0.15	0.91	0.68	1.22
Above Grade Level	0.24***	0.06	1.27	1.13	1.43
Indirect Effects					
Below Grade via Ed. Asp.	-0.07^{+}	0.02	0.93	0.90	0.97
Below Grade via Ed. Exp.	-0.07^{+}	0.02	0.93	0.90	0.97
Below Grade via Math SE	0.00	0.01	1.00	0.98	1.02
Above Grade via Ed. Asp.	0.05^{+}	0.01	1.05	1.03	1.07
Above Grade via Ed. Exp.	0.05^{+}	0.01	1.05	1.03	1.07
Above Grade via Math SE	0.00	0.00	1.00	1.00	1.00

Note. The reference group for math academic tracking was the on-grade level, indicating that below and above grade levels were being compared to on-grade level.

Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

*p < .05, **p < .01, ***p < .001.*

$^{+}$Indicates a significant confidence interval.

Table 36

Logistic Regression between Science Tracking and Expected Future Jobs with Mediators

				95% C.I. for O.R.	
	B	S.E.	O.R.	Lower	Upper
Direct Effects					
Race/Ethnicity	-0.07***	0.02	0.93	0.90	0.97
Sex	0.43***	0.06	1.54	1.37	1.73
Language	0.14*	0.06	1.15	1.02	1.29
Family Income	0.00	0.01	1.00	0.98	1.02
Science GPA	0.30***	0.04	1.35	1.25	1.46
Science Academic Track					
Advanced or AP Science	0.07	0.19	1.07	0.74	1.55
Indirect Effects					
Advanced via Ed. Asp.	0.04	0.02	1.04	1.00	1.08
Advanced via Ed. Exp.	0.02	0.01	1.02	1.00	1.04
Advanced via Science SE	0.01	0.02	1.01	0.97	1.05

Note. The reference group for science academic tracking was the general or specialty science track, indicating that advanced or AP science was being compared to the general or specialty science track. Gen. = General, Spec. = Specialty, Ed. = Education, Asp. = Aspirations, Exp. = Expectations, and SE = Self-Efficacy.

$*p < .05$, $**p < .01$, $***p < .001$.

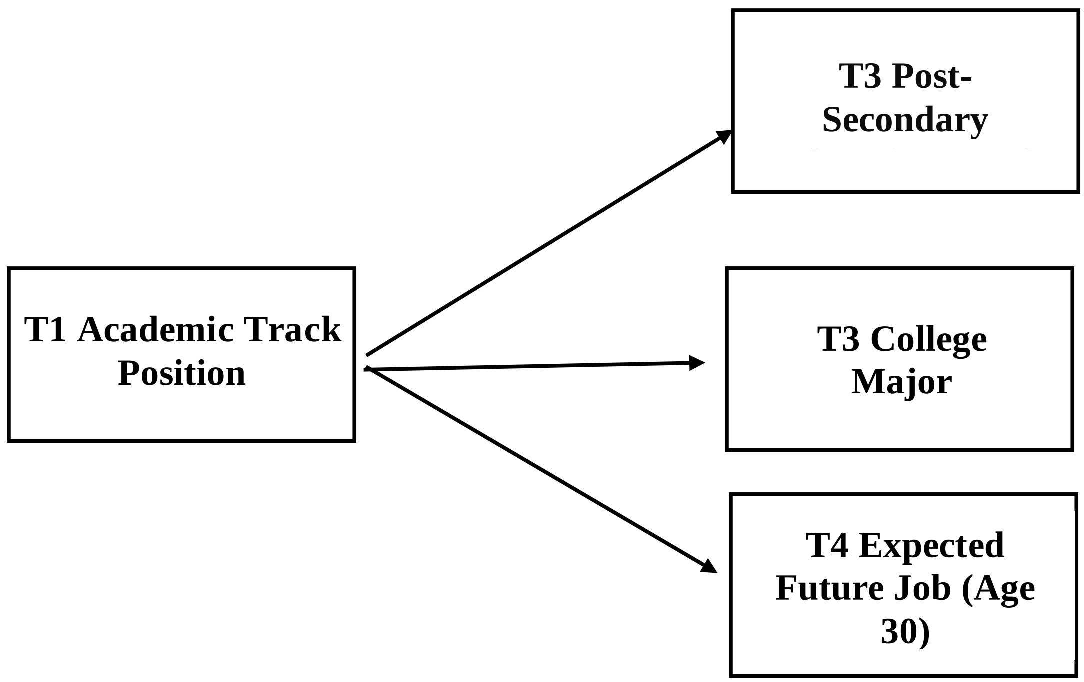
$^{+}$Indicates a significant confidence interval.

APPENDIX B

FIGURES

Heuristic Figure 1

The Prediction of Post-Secondary Education Attendance and Program length, College Major, and Expected Future Job from Academic Track Position



Heuristic Figure 2

The Potential Mediation of the Relation Between Academic Track Position and Post-Secondary Education Attendance and Program length, College Major, and Expected Future Job