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"Is Math for Me?": Effects of Math Course Sequence and Ethnic Context on Math Motivation

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"Is Math for Me?": Effects of Math Course Sequence and Ethnic Context on Math Motivation

A dissertation submitted in partial satisfaction of

the requirements for the degree Doctor of Philosophy

in Education

by

Jessica Morales-Chicas

ABSTRACT OF THE DISSERTATION

“Is Math for Me?”:

Effects of Math Course Sequence and Ethnic Context on Math Motivation

by

Jessica Morales-Chicas

Doctor of Philosophy in Education

University of California, Los Angeles, 2016

Professor Sandra H. Graham, Chair

This dissertation investigated whether math course sequence from 8^{th} to 9^{th} grade influenced 9^{th} grade math motivation, defined as perceived competence in math, sense of belonging in math, importance of math, and math anxiety. Two competing hypotheses were proposed suggesting that a more accelerated math curriculum (Algebra 1 in 8^{th} grade versus 9^{th} grade), would either protect student motivation or lessen it. The second overarching goal of this dissertation was to examine the independent and interacting role of two distinct measures of ethnic context on math motivation: (1) the perceived number of same ethnic peers in math; and (2) the incongruence between the perceived number of same ethnic peers in math class versus school. It was anticipated that students would report higher sense of belonging when they perceived more same ethnic peers in math class and when they perceived more same ethnic peers in math compared to the school. Data from this dissertation came from a larger longitudinal study of ethnically diverse youth (n = 4,385) who were recruited from 26 middle schools starting in the 6th grade and then followed into the 152 high schools to which they transitioned.

Results showed that students who took Algebra for the first time in the 9th grade showed lower math motivation compared to students who took Algebra in 8th grade and transitioned to a higher level math course. Additionally, perceiving more same ethnic peers in math class (and in math class relative to the school) was related to greater sense of belonging in math. The role that perceived number of same ethnic peers played on math motivation also depended on students' ethnic background and the type of math course sequence they were in. For most ethnic groups (e.g., White, Black, and Latino students), perceiving more same ethnic peers in math class buffered math motivation in a more advanced math course sequence; alternatively, for other ethnic groups (e.g., Asian students), more perceived same ethnic peers was more important in a lower level math sequence. Policy implications regarding both the consequences of math course intensification and ethnic segregation in schools were discussed.

The dissertation of Jessica Morales-Chicas is approved.

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DEDICATION

This dissertation is dedicated to my husband Joseph Chicas who has inspired me every step of the way. I also dedicate this dissertation to my Mother (Ninfa Morales), Father (Rafael Morales), and immediate family for your endless support, love, and encouragement throughout this journey. Lastly, I dedicate this dissertation to the many educators who believed and inspired this young girl from Pacoima, California. Thank you for bestowing in me the power of education. Through the many tools I have learned over the years, I hope to continue inspiring, transforming, and leading the new generation of students.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

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To my parents, thank you for instilling in me the value of hard work and perseverance. As a daughter of two immigrant parents who did not have the opportunity to even complete high school, I owe this to them for they have scarified so much to get me to this point. Thank you for your constant understanding and your unweaving commitment to my educational journey. To my Sister, thank you for opening many doors for me and inspiring me to become an educator, your selflessness and passion for children are truly inspiring. To my brother, nieces, nephews, extended family, and friends from home, I am forever grateful for your kind words and the motivation you have given me. You all hold a special place in my heart, thank you. Last but not least, thank you to my dog Josie for being my source of joy and smiles. This little dog has sat next to my computer each day as I wrote my dissertation. This process would not have been the same without her.

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Achievement motivation, course-taking patterns (especially in math), school transitions, perceptions of school climate, school ethnic diversity

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Morales-Chicas, J. & Graham, S. (2015). Pubertal timing of Latinas and school connectedness during the transition to middle school. *Journal of Youth and Adolescence, 44(6)*, 1-13. Retrieved from doi: 10.1007/s10964-014-0192-x

<u>SELECTED CONFERENCE PRESENTATIONS</u>

Morales-Chicas, J., Graham, S. (April, 2016). *Attributions for Failure in Math: An Examination of Ethnicity and Classroom Ethnic Context*. Poster presented at Society for Research on Adolescence. Biennial Conference, Baltimore, MD.

Morales-Chicas, J., Graham, S. (April, 2015). *I'm Just Not Smart Enough:" Perceived Barriers to High School Success and School Ethnic Context*. Paper presented at the American Educational Research Association. Annual Conference, Chicago, IL.

Morales-Chicas, J., Graham, S. (April, 2014). *Not All Change is Bad: Positive Ethnic Incongruence for Latinos during the Middle School Transition.* Paper presented at the American Educational Research Association. Annual Conference, Philadelphia, PA.

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“Is Math for Me?”:

Effects of Math Course Sequence and Ethnic Context on Math Motivation

The high school transition presents a challenging time for adolescents due to the new context, more rigorous academic demands, and more complex social landscape (Benner, 2011). In turn, it is no surprise that during the transition to high school students often experience achievement loss, increased absenteeism, diminished motivation, and higher risks of mental health problems (Seidman, Aber, Allen, & French, 1996; Benner & Graham, 2009; Barone, Aguirre-Deandreis, Trickett, 1991; Barber & Olsen 2004). Though many students navigate through the new school just fine, for some, the high school transition can be the beginning or continuation of a poor academic trajectory. For example, failing courses in the first year of high school may mean not having enough credits to enter the next grade. Even worse, doing poorly in the 9^{th} grade transitional year heightens the risk of dropping out of school (Langenkamp, 2010; Rumberger & Larson 1998). Consequently, for students already struggling academically, the critical high school transition could be particularly burdensome.

Math Course-Taking

Although success or failure in any academic subject matters in high school, failure in 9^{th} grade math could have more serious consequences. This is because math typically reflects an organized sequence of courses (e.g., Algebra 1, Geometry, etc.), in which students must master some concepts before advancing to the next course. For students who demonstrate mastery in prerequisite courses, this temporal curriculum creates a positional advantage to take higher level math over time, alternatively producing a curricular disadvantage for students who struggle in math (Schneider, Swanson, & Riegle-Crumb, 1997). Few studies, however, have examined how math course taking during the important high school transition influences students’ motivation in math. With STEM fields expected to grow faster than any other occupation (Long, Conger, & Iatarola, 2012), the current study seeks to investigate how math course sequence during the transition from 8^{th} to 9^{th} grade affects students' math motivation.

Robust research suggests that students who take higher level math tend to have a more successful matriculation into STEM related fields. For example, students enrolled in more advanced math classes in high school were more likely to follow a STEM career trajectory in college, than students who did not (Tyson, Lee, Borman, & Hanson, 2007). Taking more advanced level math was also associated with higher scores on college entrance exams such as the ACT and SAT (Riegle-Crumb, 2006; McClure, 1998; Brody & Benbow, 1990). To further illustrate, one study using the High School and Beyond (HS&B) national dataset found that students who had average grades in more advanced math courses (in this case, Pre-Calculus) were more likely to graduate with a bachelor's degree in STEM fields than high achieving students who took lower level math courses (Adelman, 1998). Students' math course sequence in the 9^{th} grade, therefore, serves as a critical gatekeeper for access to more advanced math courses necessary for admission to college and access to high status STEM careers.

Background and Opportunity Gaps in Math Courses

Despite the importance of taking higher level math, differences exist in the course taking patterns between African American and Latino students compared to their White or Asian peers. To illustrate, African Americans and Latinos are less likely to enroll in advanced STEM courses and less likely to pass critical math gatekeeping courses in the 9^{th} grade (Mickelson, Bottia, Lambert, 2013; Tyson et al., 2007; Riegle-Crumb & Grodky, 2010). Although there has been an increase in ethnic minorities taking more advanced math courses, the math achievement gap continues (Tyson et al., 2007; NCES, 2013). As students reach the highest levels of math such as

Pre-Calculus or Calculus, the math achievement gap between ethnic minorities and White students becomes even more pronounced, although this gap narrows as parents' income level rises (Riegle-Crumb & Grodsky, 2010). Even though many individual factors like income contribute to racial gaps, school structural barriers also help explain why certain ethnic minorities seem to fall behind in higher level math course achievement and enrollment when compared to more successful White and Asian peers.

One possible explanation for why underrepresented groups tend to fall short in math is because of the differential opportunities they receive in courses. Using large national datasets, Oakes and others (1990) found that low-income African-American and Latino youth were provided with a strikingly different experience in math and science courses than White peers. This occurred because African Americans and Latinos tended to be overrepresented in lower level math courses, which produced less curricular goals and maintained less qualified teachers (Oakes et al., 1990). These courses also provided less access to resources such as laboratory equipment, textbooks, computers, and programs to supplement learning (Oakes et al., 1990; Strutchens & Silver, 2000). Over time, race based segregation patterns within and between schools could have real effects on math achievement and math potential. To illustrate, a recent review using a metaregression analysis of studies on racial segregation and math outcomes from the past 20 years, suggested that the negative effects of racial segregation on mathematics performance compounds over time as students reach higher grade levels (Mickelson, Bottia, Lambert, 2013). With African Americans and Latinos significantly less likely to be placed in advanced math classes, these opportunity gaps further limit their chances to pursue more challenging STEM courses (Kelly, 2008; Oakes et al., 1990).

The Move toward 8th Grade Algebra

The current gaps in advanced math course enrollment and achievement have triggered an increased push (especially in California) to get all 8th grade students to enroll in Algebra, in hopes that more students could reap the benefits of taking higher level math courses as they progress in high school. The idea behind this new educational policy was that enrolling more students in Algebra earlier on would lead students toward a more successful pathway into advanced math and ultimately produce higher scores on standardized assessments. As a result of this new movement, the percentage of 8th grade students taking Algebra has risen by 27% from 2003 to 2011 (California Department of Education, 2003, 2011). A more recent statistic from 2013 shows that about 58% of students in California public schools are now taking Algebra in the 8th grade (California Department of Education, 2013). However, various studies have shown that 8th graders who take Algebra in the 8th grade do not necessarily achieve at a higher rate in math than those who do not, nor do they continue to advance to higher level courses as expected (Domina, et al., 2014; Liang, Heckman, & Abedi, 2012; Loveless, 2008; Gamoran & Hannigan, 2000). These findings suggest that there is a leak in this new pipeline approach. In other words, this policy has focused so much on rushing students to enroll in Algebra yet has ignored how a lack of quality preparedness in early math or motivational patterns could negatively affect mastery in higher level math in the future. Despite the new focus on 8th grade Algebra, very few studies have empirically examined how this new policy shift affects students' motivation in math when they transition to high school.

As students transition to high school, requirements for math often change depending on the state, district, and school. For example, according to the California Department of Education (2016), in the State of California, high school students are required to complete two courses in math from 9th to 12th grade and one or a combination of these courses must meet or exceed

Algebra 1. This suggests that unless districts decide to create their own more rigorous requirements, students in California may opt out from any additional math courses unless they choose to take more or unless their school places them in these more advanced courses. The results from a large scale and national dataset suggest that 40% of U.S. high school students decide to stop taking at least one or more years of high school math from what is required (Martinez, 2014). Since students' motivation in math influences the decision to stay in math when it is not required (Martinez, 2014), an examination of important predictors of math motivation earlier in high school is necessary. Moreover, understanding how math motivation in the 9^{th} grade is influenced by important policy initiatives, like *Algebra for All* urging students to take Algebra earlier on, could also help elucidate whether Algebra enrollment timing actually shapes students' math motivational patterns and math trajectories.

As students adjust their high school classes, it is important to recognize that the math classroom context could also change. In other words, as peer networks become disrupted during the transition to high school, the social support students once had in math may need to be rebuilt. Perceived greater peer support in math may be especially important since it has been linked to better attitudes and higher perceptions of ability (Rice, Barth, Guadagno, Smith, & McCallum, 2013). Math classes, however, tend to foster more alienation than any other subject by stressing individualism in learning and instruction (Boaler & Greeno, 2000). Therefore, salient similarities with peers in class such as ethnic background may serve as an important identifier to begin friendships, especially in math which is often characterized by ethnic segregation, due to unintentional racialized tracking. Prior ethnographic studies suggest that similar ethnic peers in math may be especially important for students of color who tend to be underrepresented in more advanced courses (Tyson, 2011; Davidson, 1996). However, little is known about whether the ethnic context in math actually predicts math motivation and whether more same ethnic peers could also alter the effect that math course sequence from 8th to 9th grade has on math motivation. This present study aimed to better understand this phenomenon by looking not only at the perceived ethnic context of students' math class but also how the perceived mismatch between students' math class and school could influence math motivation.

The Current Study

The current study addressed the interplay between math course sequence between 8th to 9th grade and the associated perceived ethnic context (both in the classroom and school) on 9th grade math motivation. Data for this dissertation were drawn from a longitudinal study of a large sample of ethnically diverse students who were surveyed during middle school and in 9th grade following the transition to high school. The students were recruited from 26 middle schools that systematically varied in ethnic diversity. Students then transitioned to 152 high schools that also varied in diversity. Information on students' 8th grade math course (e.g., whether they took Algebra 1) and 9th grade math course was available. This information allowed me to identify different math sequences between 8th and 9th grade that captured the timing of Algebra 1. Given the rich ethnic diversity of this sample, these data were well suited for an examination of the ethnic context of students' math classes.

Math motivation as defined in this dissertation draws on Expectancy X Value theories of achievement motivation (see review in Graham & Weiner, 2011). The critical components of this theoretical approach poses questions such as *Can I do it?*, *Do I want to do it?*, and *Am I worried about whether I can do it?* Stated otherwise, I examined students' perceived math ability, the importance (value) of math, and anxiety in the domain of math. Examining cognitive/affective constructs like perceptions of ability and value within a domain are not only core components of motivation, they are also strongly related to achievement in math (Singh, Granville, and Dika, 2002; Graham & Weiner, 2014).

This study also focused on the concept of belonging in math as a motivational construct. Sense of belonging is a basic human need defined as feeling like you fit in or are able to find a niche in a group (Baumeister & Leary, 1995). In adolescent research, scholars tend to assess belonging as a school climate variable. Prior studies indicate that more sense of belonging in school buffers achievement, academic engagement, and motivation in high school (Gillen-O'Neel & Fuligni, 2013; Walton & Cohen, 2007). However, currently, there is limited research assessing belonging within an academic domain like math (e.g., feeling a sense of belonging or fitting in with the other students in math class). Examining factors that could buffer feelings of belonging in math is particularly important, since math classes tend to foster more alienation than other courses by stressing individualism in learning and instruction (Boaler & Greeno, 2000). Sense of belonging in the classroom is also central in adolescence since youth are in the midst of exploring their identities and fitting in with peers increasingly matters (Eccles & Roeser, 2011). For example, Hamm and Faircloth (2005) found that students who perceived a more supportive peer context in math or those who gained higher recognition for peer mentoring in math reported higher belonging in math class. With scant to no studies examining sense of connectedness in high school math class, the current study sheds light on how math course sequence predicted sense of belonging in math class. This study also examined relevant descriptive patterns of students' math courses and math course sequences across middle and high school.

Research Questions and Hypotheses

Five research questions were examined. The first research question asked: (1) ***Does math course sequence from the 8th to the 9th grade predict students' 9th grade math motivation (i.e., perceived belonging in math, perceived competence in math, math importance, and math anxiety)?*** Two competing hypotheses were put forth. Prior studies have found that enrollment in a more advanced math course was associated with higher interest, positive attitudes, and more inclination toward math careers (Thorndike-Christ, 1991; Oakes, 2008). In turn, the new movement toward 8th grade Algebra has increased the number of students taking Algebra in middle school (California Department of Education, 2003, 2011) in order to help level the field between students in higher level math and those who would traditionally be placed in lower quality remedial math (Domina et al., 2014). Earlier enrollment in Algebra allows students to take a full breadth of math in high school including the highest levels of math (e.g., Pre-Calculus and Calculus). Since taking a more advanced class increases opportunity, the first hypothesis predicted that students in a more accelerated or advanced math sequence (i.e., Algebra 1 in 8th grade) would report overall higher math motivation. However, more course intensification could also come with a cost. In other words, a shift toward 8th grade Algebra has led teachers to dilute the curriculum in order to accommodate more diverse students as well as shifted underprepared teachers to now teach higher level math (Clotfelter, Ladd, & Vigdor, 2012). Thus, the competing hypothesis suggested that a more accelerated math course sequence (i.e., Algebra 1 in 8th grade) could instead lower math motivation since students may now receive a watered down curriculum or be underprepared and struggle in these more advanced courses. By examining how math course sequence influences math motivation (while controlling for prior math achievement and other important covariates), we can gain new insight into the consequences of this new policy approach.

The Ethnic Context

As students reach higher-level math, the number of ethnic minorities (excluding more Asian students) begins to decrease (Tyson et al., 2007; Oakes et al., 1990). However, the new school structure shift encouraging early enrollment in Algebra may inadvertently reduce this segregation, since now students who were traditionally funneled into lower level math (i.e., students of color) are now repositioned to take a higher level math courses. Despite this shifting school structure, hardly any studies have tried to capture the interplay between math course sequence and ethnic context on math-related affect. In adolescence when same ethnic friendships become increasingly important (Graham, Taylor, & Ho, 2009), an increase in the availability of same ethnic peers could make it easier for students to automatically connect with classmates. The well-known theory of *goodness-of-fit*, suggests that a person is influenced by how well they "fit" with their social context (e.g., Eccles & Roeser, 2009). Thus, being around more similar peers that match students' ethnic background in school tends to buffer sense of belonging, especially for ethnic minority youth (e.g., Benner & Graham, 2009). Building upon the notion that same ethnicity peers matter during the high school transition (Benner & Graham, 2009), the next set of research questions addressed how the ethnic context of math class shaped math motivation. That is, (2) ***does perceiving more same ethnic peers in math class impact math motivation?*** Moreover, (3) ***for certain ethnic groups, does the association between perceiving more same ethnic peers in math and math motivation differ as a function of students' math course sequence?*** In other words, if a student identifies as Asian as opposed to Latino, does perceiving more same ethnic peers matter more in certain math course sequences than others?

Very few studies have examined whether the ethnic context of students' math class matters and plays an important role in perceptions of math. A recent study that did examine the ethnic context of math classes found that perceiving fewer same ethnic peers in 9^{th} grade Algebra was associated with a decrease in feelings of perceived Math Competence, but that having a more positive ethnic climate in school buffered this negative effect (Graham & Morales-Chicas, 2015). Having more same ethnic friends in class could therefore be protective, potentially serving as a source of social capital. Tyson (2011) found that for Black students in higher-level math courses, having more friends in class increased feelings of confidence in math. With same ethnicity peers playing an important role in friendship formation in high school (Currarini, Jackson, & Pin, 2010), it was hypothesized in the current study that more perceived same ethnic peers in math would increase feelings of belonging in math by making it easier for students to find a support system in class. It was also expected that perceiving more same ethnic peers in math class would be especially impactful for ethnic minorities in an advanced math course sequence where they are typically underrepresented. The relation of math course sequence and ethnic context on perceived competence, math anxiety, and math importance was more exploratory.

Ethnic Incongruence

In addition to the ethnic representation of students' math class, it is important to also examine the relative ethnic context of the school. Despite law mandating integration and increased diversity in this country, schools are more segregated now than they have been over the past several decades (Orfield, 2014). Moreover, even in more integrated schools, school organizational practices like academic tracking, which assigns students to classes based on ability, ends up inadvertently segregating students by ethnicity within schools (Oakes, 2005). While policies like *Algebra for All* aim to address this concern, few to no studies have examined how a mismatch in the ethnic representation between students' math class and the school impacts math motivation. Thus, the next research questions examined the following: (4) ***does perceiving more same ethnic peers in math class than in school (ethnic incongruence) impact math motivation?*** Furthermore, (5) ***for certain ethnic groups, does the association between perceiving more same ethnic peers in math than in school and math motivation differ as a function of students' math course sequence?***

Prior research examining ethnic incongruence in school contexts has focused predominately on the ethnic representation difference between schools during a school transition. The findings from such studies typically show that more same ethnic peers in the receiving school provides a protective function for students' achievement and school-related affect (see review Benner, 2011). However, it is more unknown how a mismatch in the ethnic representation between the school and the classroom affects students' math class related affect when adjusting to a school transition. It was hypothesized that when there is a mismatch, perceiving fewer same ethnic peers in math class than in school would present a challenge to the perceived fit in the class, thereby producing lower belonging in math. Furthermore, with prior literature suggesting that transitioning to a high school with fewer same ethnic peers than in middle school was associated with a decline in belonging for African American and Latino students specifically (Benner & Graham, 2009), I anticipated that decreased representation of same ethnic peers would be especially problematic for students of color. Lastly, it was expected that taking a more advanced math sequence would relate to reduced math motivation when there was more ethnic incongruence.

Summary of Proposed Research

Five research questions were examined in this dissertation. Research Question 1 examined the independent effect of math course sequence from 8^{th} to 9^{th} grade on math motivation. Two competing hypotheses were tested: The first suggested that students taking a more advanced math sequence would report more math motivation when compared to other students. Alternatively, the competing hypothesis suggested that taking a more advanced math sequence would hinder math motivation since students may be underprepared due to course intensification policy changes. Research Questions 2 and 3 then investigated the independent influence of perceived same ethnic peers in math class on math motivation, and whether this association differed as a function of math course sequence for certain ethnic groups. It was expected that perceiving more same ethnic peers in math class would be related to more perceived belonging in math, especially for ethnic minorities and for students who are underrepresented in accelerated courses.

The next set of research questions was similar but this time focused on the perceived ethnic incongruence between students' math class and the school. In this case, Research Questions 4 and 5 investigated if for certain ethnic groups perceived ethnic incongruence (i.e., the mismatch between the perceived representation of same ethnic peers in math class and the school at large) predicted math motivation and whether this association differed as a function of students' math course sequence. It was hypothesized that fewer same ethnic peers in math class than in the school at large, would negatively affect math sense of belonging, especially for students of color. Furthermore, it was expected that the association between perceived ethnic incongruence and math motivation would vary as a function of students' ethnic background or math course sequence.

Method

Participants

Participants were from a larger longitudinal study called the UCLA Middle School Diversity Project and the High School Diversity Project. Students were initially recruited in the 6th grade from 26 ethnically diverse middle schools across 3 cohorts in 2009, 2010, and 2011. Beginning in 2012, they were re-recruited in the 9th grade from the high schools to which they transitioned. All participants required parental consent and student assent to participate. Participants in the current study included the 9th grade students who were surveyed across three cohorts in 2012, 2013, and 2014. From the total of 5,991 participants in middle school, 4,385 were granted parent consent a second time and eligible to participate in the high school study.

Of the participating high school students, 3,507 actually took the 9th grade survey, of whom 46% were male and 54% were female. Based on student self-report, the ethnic breakdown of participants was as follows: 33.1% Latino, 23.3% White/Caucasian, 14.9% Asian (East or Southeast Asian), 10% Black/African American, 7.8% Multiethnic or Biracial, 3.2% Filipino or Pacific Islander, 2.7% Middle Eastern, 1.9% South Asian, .6% Other (including Native American), and 2.5% did not report an ethnic group. Preliminary descriptive findings presented in the Results section are in reference to this full dataset, which included all these ethnic categories.

To study ethnic differences in the main analysis, only the four numerically largest ethnic groups in the sample were considered: Latino, White, Asian, and Black. The remaining ethnic groups were excluded from the main analyses because of their small numerical representation in the sample and across each school. While Multi-ethnic/Biracial participants were more largely represented than these smaller groups, they were still omitted from the main analysis in order to reduce complexity in the interpretation of results. For instance, for mono-ethnic participants (e.g., Latinos), perceptions of the number of same ethnic peers in a certain math courses could be easily connected to past literature on racialized tracking and to public California datasets disaggregating math courses by ethnicity. Moreover, if a certain mono-ethnic group is typically underrepresented objectively in a math course sequence and their math motivation is buffered when they perceive more same ethnic peers in this course sequence, it is easier to suggest why more perceived same ethnic peers was protective in this context. In contrast, for students who are Biracial or Multiethnic, the alignment of objective and perceived representation of their ethnic group across math sequence could be less clear. For example, it is unknown whether identifying with two societal ethnic minority groups (e.g., African American and Latino) as opposed to another pairing could have implications for math placement. Additionally, it is unclear whether perceptions of same ethnicity peers change for multiethnic or biracial students who identify strongly with one ethnic group as opposed to with both ethnic groups, or as a multiethnic student. Better understanding Multiethnic and Biracial adolescents' perception of their representation in math class and in their school is an important study within itself and a task for future research.

Procedure

Participants were surveyed in non-academic classes during the Spring semester of their 9th grade year. Participants answered questions that were programmed into individual *iPads*. Instructions for completing the survey were audio taped and all students worked at their own pace. Several graduate students circulated around the room to assist individual students as needed. The entire survey took about 45 minutes to one hour to complete. Students received a $20 honorarium.

Measures

Independent Variables:

Ethnicity

Students selected an ethnic group from a total of 13 categories presented to them. The following categories were shown: American Indian, Black/African American, Black/Other Country of Origin (e.g., Belizean, Guyanian, Caribbean, West Indian), East Asian (e.g., Chinese, Korean, Japanese), Latino/Other Country of Origin (e.g., Guatemalan, Argentinean, etc.), Mexican/Mexican American, Middle Eastern, Pacific Islander, South Asian, Southeast Asian (e.g., Vietnamese, Cambodian, etc.), White/Caucasian, Multiethninc/Biracial, and Other. From these categories Mexican/Mexican American and Latino/Other Country of Origin were collapsed and labeled as Latino. Black/African American and Black/Other Country of Origin were also grouped and labeled as Black.

Although multiple Asian pan ethnic categories (e.g., East Asian, South Asian, Southeast Asian, and Pacific Islander) could be grouped and labeled as Asian, only East Asian and Southeast Asian students were collapsed and included in the main analysis. Various descriptive analyses were conducted to confirm that these two ethnic categories were more similar than different. Foremost, 8th grade math grades (ranging from 0 to 4 being the highest) for East Asian students (M = 3.36) were not significantly different and most similar to Southeast Asian students (M = 3.29) than when compared to South Asian students (M = 2.99) and Pacific Islander students (M = 2.97). East Asian students' average parent level of education (see *covariates* section for measurement details) (M = 4.31) was also most similar and not significantly different from Southeast Asian students (M = 4.01) but was significantly different from South Asian students (M = 4.67) and Pacific Islander students (M = 4.53). Lastly, I tested whether identifying as Southeast Asian or East Asian played a role on the association between parent level of education and math achievement. The results suggested that the effect of parent level of education on math achievement did not significant differ based on whether a student was of Southeast Asian or East Asian descent $b = .35$, $t(225) = 1.32$, $p = .19$. Altogether, these descriptive findings showed that despite the background and historical differences between these Asian pan ethnic groups, collapsing Southeast Asian and East Asian students for this study on math made sense. Furthermore, given the small numerical representation of South Asian and Pacific Islander students in this sample, they were too small as individual groups to be included in the main analysis.

Math Course Sequence

Two indicators of math class were used to identify math course sequences during the transition to high school. First, students' middle school transcripts were collected to identify what math class they took in the 8^{th} grade. Table 1 shows each of the possible math courses students took in the 8^{th} grade. Since 9^{th} grade transcripts were not yet available, self-reported math class in the 9^{th} grade served as the second indicator. Table 2 shows each of the possible 9^{th} grade math courses reported. Using a combination of students' 8^{th} and 9^{th} grade math course, four prominent math course sequences were created, which took into account students' Algebra enrollment timing across the 8^{th} and 9^{th} grade. Algebra 1 serves as an important gatekeeper to STEM, thus, accounting for the timing in which students first took Algebra could be very telling of their math course sequence potential. First, students taking Algebra 1 in the 9^{th} grade who did not take Algebra 1 in the 8^{th} grade were labeled as *First-Time Algebra Takers* (n = 533). Second, students enrolled in Algebra 1 in the 8^{th} but who re-took Algebra 1 in the 9^{th} grade, for whatever reason, were labeled as *Algebra Repeaters* (n = 469). The third sequence was comprised of students who took Algebra 1 in the 8^{th} grade and transitioned to Geometry or Algebra 2 in the 9^{th} grade; this group was defined as *Algebra Succeeders* (n = 1,154). Lastly, the fourth and highest math sequence was labeled as *Advanced Math*, which included students who took Geometry in the 8th grade (meaning they already took Algebra 1 at some point in middle school) and were now taking Algebra 2 in the 9th grade (n = 452). Since Table 2 indicated that a very small number of students were taking Basic Math, Pre-Algebra, Calculus, and other types of math (e.g., Integrated Math Path) in 9th grade (n = 92), a math course sequence considering these courses was not created. Students who listed two math courses in the 9th grade (n = 71) were also excluded from the study.

Perceived Same Ethnicity Peers

The number of perceived same ethnicity peers was measured by 1-item that asked "how many students in your math class are from your ethnic group?" Students responded on a 7-point scale: 1 = "none or hardly any (less than 10%)," 2 = "a few (10-20%)", 3 = "some (20-40%)," 4 = "about half (40-60%)," 5 = "more than half (60-80%)," 6= "most (80-90%)," or 7 = "all or almost all (90-100%)." By combining ratings of 1 and 2 as well as the ratings of 6 and 7, responses were converted to a 5-point scale to achieve equal intervals of 20% range between categories (*M* = 2.23; *SD* = 1.30).

Perceived Same Ethnicity Incongruence

Parallel to the measure of perceived same ethnicity peers in the classroom, the number of perceived same ethnicity peers in school was measured by 1-item that asked "how many students in your school are from your ethnic group?" Students responded on a 7-point scale: 1 = "none or hardly any (less than 10%)," 2 = "a few (10-20%)", 3 = "some (20-40%)," 4 = "about half (40-60%)," 5 = "more than half (60-80%)," 6= "most (80-90%)," or 7 = "all or almost all (90-100%)." A 5-point scale was created to match the perceived same ethnic peers measure (*M* = 2.64, *SD* = 1.16). To calculate perceived same ethnicity incongruence, a student's response for the number of perceived same ethnicity peers in their school was subtracted from the response for the number of perceived same ethnicity peers in math class. A score of 0 therefore indicated no incongruence. Higher positive scores indicated more perceived students of one's ethnic group in math compared to the school (i.e., over-representation of one's ethnic group in math), whereas higher negative scores indicated more perceived representation of same-ethnic peers in school compared to math class (i.e., under-representation in math class). For example, if a student reported a 5 for the perceived number of same ethnic peers in math class and a 3 for the perceived number of same ethnic peers in school, the perceived same ethnicity incongruence would be +2, indicating more same ethnic peers in math class than in school (M = -.41, SD = 1.14).

Covariates:

Individual level. Although gender has been shown to impact math attitudes (Graham & Moraels-Chicas, 2015), there has been a decreasing gap in math motivation beliefs, self-concept, achievement, and attitudes between boys and girls (Guo, Marsh, Parker, Morin, & Yeung, 2015; Else-Quest, Hyde, & Linn, 2010). This decreasing gap was also reflected in the current study since the percentage of males to females enrolled across each math course sequence was very similar: For example, Algebra Repeaters showed a 50% split in male to female representation and in Advanced Math (i.e., the highest sequence), 48% males and 51% females were enrolled in this sequence. Therefore, while gender could be important to consider in studies on math motivation, it is clear that enrolment differences across sequences were not as apparent with this sample. Instead, this dissertation focuses on understanding the role of ethnicity and the related school context. Nonetheless, gender served as an important covariate in this study and was measured using self-reported biological sex, which comprised of either a male or female identification.

Students' 8th grade math grades were also used as a covariate and served as a proxy for student achievement in math. Math grades were calculated in the Fall and Spring of the 8th grade and each comprised of five categories: A = 4, B = 3, C = 2, D = 1, and F = 0. For each participant, an aggregate mean of these two grades was created. Responses ranged from 0 to 4 (M = 2.80; SD = 1.06). Parental level of education was also included as a proxy for socio-economic status. Parental level of education was taken from parent surveys that asked parents to report their highest level of education. Responses consisted of six different categories that ranged from: *elementary/junior high school* = 1, *some high school* = 2, *high school diploma or GED* = 3, *some college* = 4, *4-year college degree* = 5, *or graduate degree* = 6 (M = 3.97; SD = 1.5).

School level. Ninth graders in this study transitioned to 152 high schools. All school-level covariates were created using publically available data from the California Department of Education (CDE). For each school-level variable, data were collected for the year each student was enrolled in the 9th grade. Free Reduced Lunch Percentages served as a proxy for school socioeconomic status (SES) and was represented by the proportion of students eligible for free-reduced lunch in each school, which ranged from .02 to .99 (M = .45; SD = .22); higher values indicated more need and therefore lower school socioeconomic status. Furthermore, in order to control for the academic rigor of each high school, an Advanced Placement Student Access Indicator (APSAI) was created for each school. The APSAI measure was adopted from Ornelas and Solórzano's (2004) study, which controlled for the available number of advanced placement (AP) courses in the school while also considering the size of the school. This indicator was created by dividing the total high school student enrollment (e.g., 2,000) by the total number of

AP courses available at the high school (e.g., 20). The lower the ratio of students to AP courses in the school, the higher the ranking of the school. For example, an APSAI indicator of 100 in School 1 and an APSAI of 40 in School 2 would suggest that School 2 provided more opportunities for each student in the school to take AP courses. In the current sample, APSAI ranged from 22.6 to 624 (*M* = 64.6; *SD* = 25.8), indicating large variability in the opportunity to take more advanced placement courses within the participating schools.

Lastly, two important ethnic demographic variables of schools were included as covariates. In order to include an objective measure of the number of same ethnic peers in school, student enrollment totals disaggregated by ethnicity were collected from CDE for each participating high school. To calculate the proportion of same ethnicity peers in each school, the enrollment total for each ethnic group from that school was separately divided by the total enrollment number of all students in that school. Since CDE does not disaggregate data for certain pan ethnic groups, only data for Latino, Black, Asian, and White students was collected and included as a control in the main analysis (*M* = .42; *SD* = .20).

Using the proportion scores for the objective number of same ethnic peers in school, the ethnic diversity of each school was computed using Simpson's Index (1949):

$$D_c = 1 - \sum_{i=1}^{g} p_i^2.$$

To calculate *D*C (i.e., the ethnic diversity of a given school) the value of *p* which represents the proportion of students in a school who belonged to one ethnic group *i* was determined. P^2i was then summed across groups in a school and then subtracted from 1. This equation accounted for the probability that any two students who were chosen at random in a school were from different ethnic groups. The possible values of *D*C ranged from 0 to 1 with values closer to 1 indicating greater school ethnic diversity (*M* = .62, *SD* = .13, range = .03 to .80).

Dependent Variables:

Math Motivation

After listing their math class in the 9th grade, students indicated how much they agreed with 18 statements about their experiences in math that year (see Appendix A). These items were meant to capture four types of motivational constructs: *Perceived Math Competence* (e.g., "I solve math problems without too much difficulty"), *Math Importance* (e.g., "Math is one of the most important subjects a person can study"), *Math Anxiety* (e.g., "I feel stressed out during math class"), and *Belonging in Math* (e.g., "I feel like I fit in with the other students in my math class"). Items were rated on a 5-pont scale from 1 = *no way!* to 5 = *for sure yes!*. As described in the Results below, the 18 statements were subjected to both an exploratory factor analysis with the full sample and confirmatory factor analysis with the analytic sample. Table 3 shows the means, standard deviations, and range of all continuous independent and dependent variables in the study.

Results

Descriptive Analysis

All descriptive results are in reference to the full sample including all ethnic groups. As expected with the *Algebra for All* initiative in California, half of the students in the sample were enrolled in Algebra 1 in the 8th grade (as previously shown in Table 1). These findings were consistent with reports from the California Department of Education (2013), which suggested that 58% of students in California public schools were now taking Algebra 1.

According to data that I collected from the California Department of Education (data taken from the year students were enrolled in the 8^{th} grade), all 26 middle schools in southern and northern California from which participants were recruited, offered Algebra 1 to students. However, there was some variation in the proportion of 8^{th} grade students who actually took Algebra 1 in each school. In order to illustrate this difference, an Algebra Availability Score was created by taking the total number of 8^{th} graders enrolled in school and dividing that by the total number of Algebra 1 courses offered in that middle school. A lower ratio suggested more opportunities to take Algebra 1 in middle school. As an example, School x offers 5 Algebra courses and has 200 8^{th} graders enrolled in the school (Algebra Availability Score = 40), whereas School y offers 10 Algebra courses and has 200 8^{th} graders enrolled in the school (Algebra Availability Score = 20). This example suggested that in a school with the same number of 8^{th} graders, School y provided double the opportunity to enroll in Algebra 1 in the 8^{th} grade. The current 26 middle schools recruited in this study showed a range of 17.86 to 148 (M = 50.27, SD = 32.61), suggesting considerable variation in Algebra availability.

Geometry course offerings across each middle school were also examined. From the 26 schools, only 18 schools offered geometry in middle school. Similar to the Algebra Availability Score, a Geometry Availability Score was also created for each school by taking the total number of 8^{th} graders at that school and dividing that value by the total number of Geometry courses offered in the school. Across the 18 middle schools offering geometry, these ratios ranged from 69 to 705 (M = 313.31; SD = 196.76). Since higher values indicated less Geometry courses available per pupil, the higher mean and range of these ratios indicated that Geometry was far less offered in middle school and even when it was, there were only a few courses actually available per 8^{th} grade pupil.

With 31% of middle schools not offering Geometry in this sample (*n* = 8), more investigative work was done to help inform whether these schools had certain characteristics that set them apart from schools that did offer Geometry. Foremost, it was found that schools that did not offer Geometry had higher free reduced lunch percentages (*M* = .65) than schools that did offer Geometry (*M* =.43). These results suggested that schools with lower socioeconomic status (i.e., higher free reduced lunch percentages) were less likely to offer Geometry. A similar trend was apparent for school achievement. *Academic Performance Index* (API) taken from CDE data was used as a proxy for school achievement. An API score could range from the lowest score of 200 to the highest possible school of 1000. In this case, middle schools that did not offer Geometry (*M* = 759.25) showed a lower average API score than schools that did offer Geometry (*M* = 842.22). Furthermore, using Simpson's Diversity Index of each middle school, it was found that schools that offered Geometry tended to be more ethnically diverse (*M*= .65) than schools that did not (*M* = .58). To make matters worse, middle schools that did not offer Geometry compared to those that did, showed a higher proportion of Latino (*M* = .41 vs. *M* = .31) and Black (*M* = .32 vs. *M* = .15) students enrolled in school. In total, these findings further confirm the differences between certain middle schools in providing access to higher level math courses. Since there were less advanced math courses offered in middle schools containing more students of color, these inequalities could further perpetuate gaps in future math achievement potential and access to STEM.

As participating students transitioned to high school (n=152), they enrolled in various math courses; however, the most common courses students took in the 9th grade were Algebra 1 (37%), Algebra 2 (20%), and Geometry (38%) (as previously outlined in Table 2). Furthermore, the most common enrollment trend from 8th to 9th grade was Algebra 1 to Geometry (35% of the full sample). These data were consistent with a prior study using a larger dataset of 24,000 students from California, which indicated that among all math paths they found, the most common was Basic Math in the 7th grade, Algebra 1 in the 8th grade, Geometry in the 9th grade, and Algebra 2 in the 10th grade (Finkelstein, Fong, Tiffany-Morales, Shields, & Huang, 2012). Another relevant yet less common sequence was Algebra 1 in 8th grade to Algebra 2 in 9th grade (5% of the full current sample). According to CDE data, 8% (*n* = 12) of the high schools in this sample did not offer Geometry to 9th graders, which implies that alternative paths like Algebra 2 after Algebra could have been taken. Additionally, 14% (*n* = 21) of high schools in the sample showed that more than 70% of 9th grade students were enrolled in Algebra 1 or Algebra 2, yet less than 10% were enrolled in Geometry. These results further delineated that although few followed this sequence, certain schools did deliberately enroll students in Algebra 2 after being enrolled in Algebra 1.

Another interesting math course sequence showed that 15% of all students in the sample who took Algebra in the 8th grade ended up repeating it in 9th grade. This finding was also consistent with Finkelstein and others' (2012) Californian study on math course taking, which showed that 23% of 9th graders retook Algebra after taking it in the 8th grade. In this sample, mean grades from Fall (*M* =1.95) to Spring (*M* = 1.58) of 8th grade showed a slight decrease for these Algebra Repeaters, suggesting that on average these students did poorer in Algebra 1 by the end of the 8th grade. In fact, by the Spring semester, 74% (*n* = 397) of these students received a C or below in Algebra. These very findings illustrated that most students who repeated Algebra were actually doing poorly in Algebra 1 in 8th grade, which is why high schools could have made them retake the course. Nonetheless, for the remaining students who received a higher grade, it is not clear why they repeated Algebra. After calling all 26 middle schools, it appears that some schools had different criteria for what entailed a passing Algebra 1 grade (which could range from a B- or lower). Unfortunately, no current math test scores were available for viewing, which could also have been considered when making decisions about math placement in high school.

While many factors (e.g., high school expectations, test scores, student choice, etc.) could influence high school math placement, additional descriptive findings suggested that Algebra Repeaters who did relatively well in Algebra (i.e., B- or higher) in the 8^{th} grade were more likely to transition to academically rigorous and higher resourced high schools than Repeaters who did poorer in Algebra (i.e., C or lower). To be specific, higher achieving Algebra Repeaters were more likely to attend high schools with higher socioeconomic status (i.e., lower free reduced lunch percentages) (M = .44) than students who received a C or below in Algebra (M =.55). Similarly, higher achieving Algebra Repeaters transitioned to schools with lower APSAI mean scores (i.e., a lower value indicating more AP courses in school per pupil) (M = 62. 32) than lower achievers (M = 73.07). In other words, higher achieving Repeaters were more likely to attend high schools that were more academically rigorous since they provided greater opportunities to enroll in AP courses. Appendix B further highlights that amongst the Algebra Repeater students, Asian students when compared to other ethnic groups, held the highest grades in Algebra (B – average) before transitioning to Algebra again in high school. Collectively, these additional results illustrated that more rigorous and more resourced high schools may be expecting more from students when determining whether a person should repeat Algebra or instead transition to a more advanced course. However, what remains unclear is whether certain schools may also be expecting more from certain ethnic groups (e.g., Asian students who tended to receive higher grades in Algebra) due to stereotypes about math or if rather they tended to transition to high schools with higher passing expectations.

Analytic Sample

Now that the descriptive results have been outlined with the full sample, I turn to the inclusion criteria for the analytic sample. Given sample size limitations with math course type, only the four numerically largest ethnic groups were included in the analytic sample: White, Black, Asian, and Latino. Additionally, only the following four prominent math course sequences were included in the analytic sample: First Time Algebra Takers, Algebra Repeaters, Algebra Succeeders, and Advanced Math. Students who omitted a self-reported math class but filled out the math motivation items were excluded from the analysis (n = 43). Lastly, although participants transitioned to various high schools, only California public high schools were included in the analysis in order to eliminate possible biases found in more affluent private or out of state schools' math placements. This inclusion criterion yielded a total of 2,938 participants who attended 142 public high schools in California.

Missing Data

Missing data accounted for 16% (n = 464) of the current sample and was due to missing values on one or a combination of variables used in the study. It was assumed that this data were missing at random (MAR; Arbuckle and Wothke 1999). In order to adjust for this missingness in the analysis, full-information maximum-likelihood (FIML) estimation was implemented, which appropriately handled missing data assumed to be MAR (Enders, 2010; Schafer and Graham 2002). The FIML estimator retains cases with missing data and uses all available data. It is also a preferable method since it relies on fewer decisions than multiple imputation (Allison, 2012). In order to run the FIML estimation in STATA 14, the analysis was conducted under the structural equation modeling (SEM) command.

Measurement Models

Exploratory Factor Analysis of Math Motivation

Using the full sample, the 18 items in the math motivation questionnaire were assessed using an exploratory factor analysis. Principal component analysis was used as an extraction method with varimax rotation. A total of four meaningful factors were extracted. These factors and their item loadings are displayed in Table 4. For any items that loaded on more than one factor, the factor that fit the item most conceptually was considered. The first factor accounted for 35% of the variance (eigenvalue = 6.34) and included four items (e.g., "I'm good at math"). This factor was labeled *Perceived Math Competence.* The second factor accounted for 9.74% of the variance (eigenvalue = 1.75) comprised of six items (e.g., "I have good friends in my math class"). This factor was labeled *Belonging in Math*. The third factor accounted for 8.71% of the variance (eigenvalue = 1.57) and included five items (e.g., "high school math is helpful no matter what job I have"). I labeled this factor as *Math Importance*. Lastly, the final factor comprised of 6.65% of the variance (eigenvalue = 1.20) and included three items (e.g., "studying math makes me feel nervous"), labeled as Math Anxiety. Table 4 shows the exploratory factor analysis results and detailed how each item was assessed. The Cronbach's alpha values showed that items in each factor held together with high agreement: Math Competence (α = .74), Belonging in Math (α =.80), Math Importance (α = .78), and Math Anxiety (α = .70).

Confirmatory Factor Analysis

Since there were a few cross loadings in the exploratory factor analysis results, some decisions were made about what items to group together according to how they matched conceptually to the factor. As a result, a confirmatory factor analysis (CFA) was also run separately for each outcome using the current analytic sample. Table 5 shows the results from the CFA that was run separately for each outcome. Although the $\chi 2$ test is commonly implemented to assess fit (Cochran, 1952), it is highly sensitive to sample size and could reject reasonable models with large sample sizes (Van de Schoot, Lugtig, & Hox, 2012). As a result, an adequate fit was mainly determined using the Comparative Fit Index (CFI) (CFI; Bentler, 1990). Guidelines outlined by Hu and Bentler (1999) suggest that an adequate fit should be a value of CFI that is greater than .95; however, Marsh, Hau, and Wen (2004) suggests that this cut off is too restrictive and a range of .92 to .94 could also be considered a reasonably good model fit. Following the Marsh et al. (2004) guidelines, it was found that Belonging in Math (CFI = .93), Math Competence (CFI = .92), and Math Anxiety (CFI = 1) all had a good model fit. Math Importance, however, did not meet this cut off (CFI = .85). To improve model fit, one item (i.e., *Math is Boring*) was removed from Math Importance, which raised the CFI to .94, now suggesting a better model fit. Consequently, all analysis presented using Math Importance excluded this item and reflected instead a four item scale. Appendix C shows the standardized path coefficients for each factor (see Table C1-Table C4).

Analytic Models

For all analytic models, clustering between schools was adjusted for using the Cluster command in STATA 14. School-level predictors were also grand mean centered and student-level continuous predictors were group mean centered to ease the interpretation of the results and to obtain less biased within-school estimates (Enders & Tofighi, 2007; Raudenbush & Bryk, 2002). The intraclass correlations for Math Competence (ICC = .02; *SE* =.01), Belonging in Math (ICC = .02; *SE* = 01), Math Importance (ICC = .002; *SE* = .01), and Math Anxiety (ICC =

.03; *SE* = .01) showed a range of 0 to .03 suggesting that only a small percent of the variability in school adjustment was between schools. Table 6 shows the correlations among all continuous variables in the analysis, including the outcomes.

Math Course Sequence and Ethnicity

Before presenting the main results from the analysis, it is important to highlight that enrollment in certain math course sequences differed based on ethnicity. Table 7 shows the frequencies and proportions of the four largest ethnic groups in each of the four math course sequences. Table 7 also shows the means and standard deviations of perceived same ethnic peers in math split by ethnicity and math sequence. Foremost, this table demonstrates that a larger proportion of Latino and Black students took Algebra 1 and repeated Algebra in 9th grade when compared to White and Asian students. This disproportion was consistent with the higher mean of perceived same ethnic peers in math that Latino and Black students reported relative to their White and Asian counterparts in these sequences. The inverse was true for Advanced Math where there was greater enrollment of White and Asian students compared to Latino and Black students. Consistently, White and Asian students in Advanced Math also perceived a higher average number of same ethnic peers in math within this sequence than did Latino and Black students. Interestingly, however, the ethnic breakdown for students classified as Algebra Succeeders was a lot more evenly distributed. These students represented those who were positively impacted by the *Algebra for All* initiative since they successfully passed Algebra 1 in middle school and matriculated to either Geometry or Algebra 2 in high school. Since the Algebra Succeeder group showed more even representation across ethnic groups, this reinforced the very notion that the *Algebra for All* policy could help level the playing field for certain ethnic groups that otherwise would have been placed into lower math, due to practices like racialized academic tracking (Oakes, 2008).

To further describe the interplay between math course sequence and ethnicity, the Table in Appendix D also shows the expected means of the four math course sequences split by ethnicity for each outcome. Additionally, the table formerly presented in Appendix B shows the average math grades in the 8th grade split by math course sequence and ethnicity. Overall, across every ethnic group, Algebra Repeaters held the lowest grades followed by First Time Algebra Takers, Algebra Succeeders, and then students in Advanced Math (who held the highest grades in math).

Results For Perceived Same Ethnic Peers in Math

Math Course Sequence & Perceived Same Ethnic Peers

Transitioning now to the results for the main analysis, the first research question addressed whether math course sequence from the 8th to the 9th grade predicted students' 9th grade math motivation. The second research question investigated the association between perceiving more same ethnic peers in math class and math motivation. To examine these questions, unconditional mean models for each math motivation outcome tested the main effects of math course sequence (Algebra Succeeders as reference group), perceived same ethnic peers in math, and all other covariates: gender (males as the reference group), ethnicity (White students as the reference group), parent level of education, 8th grade math grades, school free reduced lunch percent, school ethnic diversity, objective same ethnicity percent in school, and AP student access index. Algebra Succeeders were selected as the reference group since they had the most even ethnic representation across math course sequences.

Starting with the main effects of the covariates, Table 8 shows that females when compared to males reported less perceived Math Competence ($\beta = -.21$, $p < .001$), lower Math Belonging ($\beta = -.15$, $p < .001$), poorer perceived Math Importance ($\beta = -.26$, $p < .001$), and higher Math Anxiety ($\beta = .28$, $p < .001$). Additionally, as 8th grade math grades increased, Math Competence ($\beta = .19$, $p < .001$), Math Belonging ($\beta = .10$, $p < .001$), and Math Importance ($\beta = .17$, $p < .001$) increased, whereas Math Anxiety ($\beta = -.17$, $p < .001$) decreased. Furthermore, an increase in the percent of the objective number of same ethnic peers in school was associated with lower Math Competence ($\beta = -.28$, $p < .05$) and lower sense of Belonging in Math ($\beta = -.26$, $p < .05$). An increase in parent level of education was also associated with a slight decline in sense of Belonging in Math ($\beta = -.02$, $p < .05$) and Math Importance ($\beta = -.04$, $p < .01$). Similarly, an increase in free reduced lunch (indicating lower socioeconomic status in school) was linked to higher Math Importance ($\beta = .21$, $p < .05$).

Ethnic differences also emerged across the two math motivation outcomes (see Table 8). Black students ($\beta = .11$, $p < .05$) and Latinos ($\beta = .10$, $p < .05$) reported higher sense of Belonging in Math than White students. In addition, Black ($\beta = .25$, $p < .001$), Asian ($\beta = .18$, $p < .01$), and Latino ($\beta = .29$, $p < .001$) students reported higher Math Importance than White students.

Turning to the main effects of math sequence (Algebra Succeeders as the reference category), Table 8 shows that First Time Algebra Takers felt less Belonging in Math and less Math Importance than Algebra Succeeders. In addition, Algebra Repeaters reported more perceived Math Competence and less Math Anxiety than Algebra Succeeders. Finally, students in Advanced Math reported more perceived Math Competence and more Math Importance than Algebra Succeeders.

The reference group was also rotated to capture differences across all math course sequences. Figure 1 shows the expected mean values of each math course sequence on math motivation when controlling for perceived same ethnic peers in math as well as all other covariates. The results can be summarized as follows:

Perceived Math Competence (left panel of Figure 1). First Time Algebra Takers reported lower Math Competence than Algebra Repeaters ($\beta = -.32$, $p < .001$) and students in Advanced Math ($\beta = -.19$, $p < .01$). On the other hand, Algebra Repeaters reported the highest overall Math Competence when compared to First Time Algebra Takers ($\beta = .32$, $p < .001$), Algebra Succeeders ($\beta = .23$, $p < .001$), and students in Advanced Math ($\beta = .13$, $p < .05$). Students in Advanced Math had significantly higher perceived Math Competence, than First Time Algebra Takers ($\beta = .19$, $p < .01$) and Algebra Succeeders ($\beta = .10$, $p < .05$).

Sense of Belonging in Math and Math Importance (second and third panels). Again, First Time Algebra Takers reported lower math motivation. First Time Algebra Takers reported lower sense of Belonging in Math than Algebra Repeaters ($\beta = -.16$, $p < .01$), Algebra Succeeders ($\beta = -.12$, $p < .01$), and students in Advanced Math ($\beta = -.13$, $p < .001$). Similarly for Math Importance, First Time Algebra Takers also reported lower Math Importance than Algebra Repeaters ($\beta = -.23$, $p < .001$), Algebra Succeeders ($\beta = -.18$, $p < .001$), and students in Advanced Math ($\beta = -.40$, $p < .001$). Alternatively, students in Advanced Math reported the highest Math Importance when compared to First Time Algebra Takers ($\beta = .40$, $p < .001$), Algebra Repeaters ($\beta = .17$, $p < .05$), and Algebra Succeeders ($\beta = .22$, $p < .001$).

Math Anxiety (right panel). First Time Algebra Takers reported more Math Anxiety than Algebra Repeaters ($\beta = .31$, $p < .001$), whereas Algebra Repeaters reported significantly lower

Math Anxiety than Algebra Succeeders (β = -.29, $p < .001$), and students in Advanced Math (β = -.35, $p < .001$).

In summary, as hypothesized for Research Question 1, math course sequence was associated with math motivation. Taking Algebra in 8th grade did not undermine math motivation in 9th grade. On the contrary, results of these main effects showed that students who took Algebra for the First Time in the 9th grade reported the lowest overall math motivation. Students who repeated Algebra showed lower Math Anxiety and more Math Competence when taking Algebra a second time. Lastly, students in Advanced Math reported the most Math Competence and Math Importance when compared to all the math sequence groups.

To answer Research Question 2, the results in Table 8 also showed that an increase in perceived same ethnic peers in math was associated with more Math Belonging (β = .06, $p < .001$). Perceived same ethnic peers did not predict any other math motivation outcome. These findings aligned well with the Research Question 2 hypothesis, which suggested that more perceived same ethnic peers would matter most for sense of Belonging in Math.

Perceived Same Ethnic Peers and Math Course Sequence in Each Ethnic Group

Research Question 3 then examined if for certain ethnic groups, the association between perceiving more same ethnic peers in math and math motivation depended on students' math course sequence. To address this research question, the analysis for each outcome was conducted separately for each ethnic group and the interaction between math course sequence and perceived same ethnic peers was tested. The results for these analyses are displayed in Tables 9 through 12. Before introducing the results for the two way interactions with perceived same ethnic peers, it is important to note that the main effect for the objective number of same ethnic peers in school on math motivation differed once the analysis was disaggregated by ethnicity. In particular, a higher objective number of same ethnic peers at the school level was associated with worse math motivation but only for White students (see Table 9) and Asian students (see Table 11).

As for the main results displayed in Tables 9-12, the results can be summarized as follows: For White students, a significant two way interaction between math course sequence and perceived same ethnic peers was found for Math Competence ƛ (3, N = 802) = 10.10, p < .05, Math Belonging ƛ(3, N = 802) = 18.90, p < .001, and Math Anxiety ƛ(3, N = 802) = 10.99, p < .05. For Black students, a significant two way interaction was only found for Belonging in Math ƛ(3, N = 336) = 8.75, p < .05. For Asian students a significant two way interaction was found for Math Belonging ƛ(3, N = 512) =12.14, p < .01. For Latinos, perceiving more same ethnic peers in math was also associated with higher Belonging in Math (β = .07, p < .001) and lower Math Importance (β = -.07, p < .05), but these associations did not depend on students' math course sequence. To further interpret the significant interactions for White, Black, and Asian students, differences between simple slopes of perceived same ethnic peers and course sequence are presented below:

White students. Starting with Math Competence, the findings for White students showed that more perceived same ethnic peers in math was associated with higher Math Competence for students in Advanced Math (β = .15, p < .001) when compared to Algebra Succeeders (β = .19, p < .01) (see Table 9, Model 2 and Figure 2). For sense of Belonging in Math, the perceived number of same ethnic peers in math was associated with higher Math Belonging for First Time Algebra Takers (β = .13, p < .01), Algebra Repeaters (β = .24, p < .001), and students in Advanced Math (β = .07, p < .05) when compared to Algebra Succeeders. For Math Anxiety, the perceived number of same ethnic peers was associated with lower Math Anxiety for Algebra Repeaters (β = -.21, p < .01) when compared to Algebra Succeeders (see Table 9 and Figure 4) and independently for students in Advanced Math ($\beta = -.10$, $p < .01$). Consistent with prior main effect results for White students, perceiving more same ethnic peers was not beneficial for Algebra Succeeders, however, for students who shared the plight of having to pass Algebra a second time or who were taking the highest level of math, perceiving to be being around similar ethnic peers in math was associated with higher Math Competence, more Belonging in Math, and lower Math Anxiety.

In sum, these results for White students showed variation as a function of math sequence and perceived same ethnic peers for Math Competence, Math Belonging, and Math Anxiety. Perceiving more same ethnic peers in math was related to better motivation on these three dimensions for every math sequence group except Algebra Succeeders.

Black students. For Black students, the data for one case in the Advanced Math group was removed because it was an outlier. The results showed that the perceived number of same ethnic peers did not matter for Algebra Succeeders (see Table 10 Model 2); however, for Black students in Advanced Math, perceiving more same ethnic peers in math was associated with higher sense of Belonging in Math ($\beta = .55$, $p < .05$). Figure 5 further illustrated that for Black students in Advanced Math, perceiving more same ethnic peers was protective when compared to First Time Algebra Takers ($\beta = .63$, $p < .01$), and Algebra Succeeders ($\beta = .44$, $p < .05$). Therefore, for Black students who were in the highest level math course sequence (i.e., Advanced Math), perceiving more same ethnic peers in math was advantageous; however, given the small n =13 for the Black Advanced Math group, these results should be interpreted with caution.

Asian students. For Asian students, the only significant interaction involved Math Belonging (see Table 11, Model 2). Perceiving more same ethnic peers was associated with more

Math Belonging for the First Time Algebra Takers group (β = .28, $p < .001$). Figure 6 further showed that compared to other math course sequence groups, perceiving more same ethnic peers in math was protective for Asian First Time Algebra Takers when compared to Algebra Repeaters (β = .27, $p < .01$) and students in Advanced Math (β = .25, $p < .01$). These findings implied that for Asian students who tend to be under-enrolled in lower level math courses, perceiving more same ethnic peers in math for students taking Algebra for the First time in the 9th grade enhanced sense of Belonging in Math.

To summarize: (1) For White students, perceiving more same ethnic peers in math was related to more perceived Competence, more Belonging, and less Anxiety for all math sequence groups except Succeeders. (2) For Black students, only Math Belonging varied as a function of ethnic context and course sequence such that students in Advanced Math reported higher sense of Belonging in math when they perceived more Black students in their math class. (3) For Asian students, compared to the other math sequence groups, First Time Algebra Takers felt more like they belonged in math when they perceived more Asians in their math class. (4) For Latinos more perceived same ethnic peers in math was associated with higher Belonging in Math and lower Math Importance, but association did not depend on students' math sequence.

Results For Ethnic Incongruence

Perceived Ethnic Incongruence on Math Motivation

In order to also take the school ethnic context into account, Research Question 4 investigated if perceiving more same ethnic peers in math class compared to the school (ethnic incongruence) predicted math motivation. To examine this question, the unconditional mean models featured in Table 13 tested the main effects of math course sequence, perceived ethnic incongruence between math class and school, and all other covariates on each math motivation outcome. The findings showed that, as predicted, more perceived same ethnic peers in math class than school was associated with higher sense of Belonging in Math ($\beta = .04$, $p < .01$). Ethnic incongruence was also associated with higher Math Competence ($\beta = .04$, $p < .05$). All other predictors except for the objective number of same ethnic peers in school, which was no longer significant for any outcome, showed the same results as when perceived same ethnic peers was in the models. Figure 7 also shows the expected mean values of each math course sequence on math motivation when controlling for perceived ethnic incongruence as well as all other covariates.

Perceived Same Ethnic Incongruence and Math Course Sequence within Ethnic Group

The last Research Question 5 examined the association between ethnic incongruence and math course sequence for each ethnic group. To address this research question, the analysis for each outcome was conducted separately by ethnic group, and the interaction between math course sequence and ethnic incongruence was tested. The results for these analyses are displayed in Tables 14 through 17. For White and Asian students, more objective same ethnic peers in school was still associated with worse math motivation. However, when looking at the role of perceived same ethnic peers in school, an increase in perceived same ethnic peers in math than the school was associated with higher Math Belonging ($\beta = .10$, $p < .001$) and higher Math Importance ($\beta = .10$, $p < .01$) for Asian students, regardless of their math course sequence. More novel was a significant two way interaction between ethnic incongruence and math course sequence for Latinos' sense of Belonging in Math $\lambda(3, N = 1{,}132) = 9.16$, $p < .05$. The interactions for each ethnic group are interpreted below:

White students. For White students, there was now only a significant interaction between perceived ethnic incongruence and math course sequence for Math Belonging $\lambda(3, N = 802)$

=8.84, $p < .05$. This interaction replicated the finding for perceived same ethnic peers. Ethnic incongruence was associated with higher Math Belonging for White Algebra Repeaters ($\beta = .17$, $p < .01$), especially when compared to Algebra Succeeders ($\beta = .18$, $p < .01$) (see Table 14 Model 2) (see Figure 8).

Black students. For Black students (see Table 15), the results stayed the same as when the perceived number of same ethnic peers variable was in the model and replicated a significant two way interaction for Belonging in Math ƛ(3, N = 336) = 22.11, $p < .001$. The Belonging in Math results for Black students in the Advanced Math group were also replicated. As shown in Figure 9, for Black students in Advanced Math, perceiving more same ethnic peers in math than in school was associated with higher sense of Belonging in Math, especially when compared to First Time Algebra Takers ($\beta = .54$, $p < .001$), Algebra Repeaters ($\beta = .42$, $p < .01$), and Algebra Succeeders ($\beta = .38$, $p < .001$). As with the previous findings for Black students, the small n=13 for the Advanced Math group suggests that the results should be interpreted with caution.

Latino students. For Latinos, adding ethnic incongruence in the models did result in a new significant two-way interaction ƛ(3, N = 1,132) = 9.19, $p < .05$. While ethnic incongruence for the Algebra Succeeder group did not predict Math Belonging (see Table 17 Model 2), perceiving more same ethnic peers in math class compared to the school was associated with higher Math Belonging for Algebra Repeaters ($\beta = .11$, $p < .05$) and students in Advanced Math ($\beta = .18$, $p < .01$). Figure 10 illustrates these slopes and further showed that the slope for Advanced Math significantly differed from the slope for First Time Algebra Takers ($\beta = .15$, $p < .05$) and Algebra Succeeders ($\beta = .16$, $p < .05$). Therefore, for Latinos experiencing a shared plight of having to repeat Algebra or being in the highest level of math, perceiving more similar peers in math class compared to their representation in the school protected Sense of Belonging in Math.

Summary of Results

Considering first the main effects of course sequence, First Time Algebra Takers reported the lowest overall math motivation compared to the other math sequence groups. Additionally, higher parent level of education was linked to lower sense of Belonging and Importance in Math, while higher lower free reduced lunch percentage in school (i.e., higher socioeconomic status of the school) was linked to just lower Math Importance. When looking at the objective number of same ethnic peers at the school level, more same ethnic peers in school was associated with worse sense of Belonging in Math and lower Math Competence. However, as hypothesized for the perceived ethnic context, perceiving more same ethnic peers in math class was only significantly related to greater sense of Belonging in math.

I then turned to the analyses of perceived same ethnic peers and math sequence for each ethnic group. To start, the objective number of same ethnic peers in school now only mattered for White and Asian students, suggesting worse math motivation with a higher number of same ethnic peers in school. Alternatively, when looking at the perceived ethnic context in math, the number of same ethnic peers in math did not predict math motivation for Algebra Succeeders from any ethnic group. However, perceiving more same ethnic peers in math was protective for White students' sense of Belonging in Math and other math course sequence groups. In general, perceiving more same ethnic peers was most beneficial for White students since a higher number of perceived same ethnic peers not only buffered Math Belonging but also Math Competence and Math Anxiety within the Advanced Math sequence. Asian students' sense of Belonging in Math also increased with more perceived same ethnic peers in the First Time Algebra group.

Alternatively, more perceived same ethnic peers in math was associated with higher sense of Belonging in Math for Black students in Advanced Math. For Latinos, more perceived same ethnic peers was associated with higher Belonging and lower Math Importance but this effect did not depend on math course sequence.

When replacing perceived same ethnic peers with perceived ethnic incongruence in the models, only some of the ethnic group findings were replicated. For White students, more perceived same ethnic peers in the classroom compared to the school was associated with higher Belonging in Math but now only for Algebra Repeaters. For Black students, perceiving more same ethnic peers in math than school was still associated with higher sense of Belonging in Math. Additionally, for Asian students, more perceived same ethnic peers in math compared to the school was associated with higher Math Belonging and Math Importance but this association no longer differed as a function of math course sequence. A new additional finding was found for Latinos, in that more perceived same ethnic peers in Advanced Math than in school was linked to higher sense of Belonging in Math. These findings highlighted the importance of considering not only the context of the math classroom but to also shed light on how the ethnic context of the classroom differs from the school.

Discussion

Over the years, many researchers have tried to understand the disparities in achievement, motivation, and participation in advanced math courses that continually exist between more affluent White and Asian students when compared to Black, Latino, and other students of color from lower socioeconomic backgrounds. The present study also found similar gaps in advanced math enrollment and aimed to elucidate what role the school and the associated context played in widening these disparities and influencing motivation in math.

To help mitigate achievement gaps in math, the push toward 8th grade Algebra began as a policy initiative aimed to increase early access to Algebra and encourage students to take advanced math in the future. Despite this concerted effort to increase Algebra enrollment, there have been mixed results about the overall advantages that this policy initiative has created for student learning and math enrollment. For example, some studies suggest that taking Algebra in middle school leads to higher math performance and a more rigorous math path in the future (Domina, 2014; Spielhagen, 2006). In contrast, other studies found that enrolling students in Algebra in middle school may have little impact on learning or math test scores (Loveless, 2008; Liang et al., 2012). The present study aimed to better understand the trends in Algebra enrollment timing during the transition to high school as well as the effect different math course sequences have on math motivation.

The results of this dissertation showed that students who did not take Algebra in middle school (i.e., First Time Algebra Takers) reported the lowest math motivation. In contrast, taking Algebra in middle school yielded more positive math motivation in 9th grade, but the specific impact depended on the math course sequence students were in. For example, students in Advanced Math reported the highest Math Importance and Math Competence when compared to other groups. This finding was not surprising given that these students also achieved the highest grades in 8th grade math and were on the most accelerated math trajectory. What was more interesting was that students who repeated Algebra reported less Math Anxiety and felt more Competence in Algebra after taking it a second time. Currently, there is mixed evidence on the benefits of repeating algebra, especially when students are pushed to take Algebra in middle school. Some studies have found that repeating Algebra was associated with higher achievement in math (Fong, Jaquet, & Finkelstein, 2014), whereas other studies found more grim statistics

(Finkelstein et al., 2012; Waterman, 2010). With Algebra being a gatekeeper course to future math, it was interesting to learn in the present study that repeating Algebra was found to bolster perceived competence and lessen anxiety for students who needed a refresher course. Nevertheless, since this study lacked a measure of math achievement in high school, it remains unclear how repeating Algebra could actually affect math performance as students move forward through their math sequence. Future studies should investigate whether this increased confidence and lessened anxiety could actually help students to pass the course or instead diminish their effort.

Although some students have to repeat Algebra when they start high school, the majority of students successfully pass this course and transition to more advanced math in high school. In this sample, 50% of students enrolled in 8th grade Algebra and transitioned to 9th grade Algebra 2 or Geometry (i.e., Algebra Succeeders). While all middle schools offered Algebra to 8th graders, there was considerable variation in 8th grade Algebra course placements between schools. The results were consistent with Domina's (2014) study, which also found similar trends. Nonetheless, more encouraging was the more equal access to Algebra in the 8th grade across different ethnic groups, which was apparent for the Algebra Succeeder group. To illustrate, the Algebra Succeeders group showed fairly even numerical representation of Black, White, Asian, and Latino students compared to other math course sequences. These results showed alignment with the goals of the *Algebra for All* policy initiative and suggested that students of different ethnic backgrounds were getting a more equal opportunity to enroll in 8th grade Algebra.

Did Perceiving More Same Ethnic Peers in Math Protect Math Motivation?

The second critical component of this dissertation was to examine whether perceiving more same ethnic peers in math class moderated the association between math course sequence and math motivation. During the high school transition, when peer networks are disrupted, courses could provide an opportunity to build new friendships. At higher levels of math, these friendships could also serve as a sort of social support to get through the more difficult math content. It was hypothesized that perceiving more same ethnicity peers in math would be associated with higher math motivation, specifically belonging in math and especially for students of color. As anticipated, these results showed that perceiving more same ethnic peers was positively associated with Belonging in Math. However, after considering math course sequence, the benefits of perceiving more same ethnic peers really depended on student's ethnic background.

Contrary to what we expected, White students' math motivation was most buffered when they perceived more same ethnic peers in math. For example, for White students, perceiving more same ethnic peers in math was associated with higher Math Competence when in Advanced Math and less Math Anxiety for both the Advanced Math and Algebra Repeater group. Therefore, when posed with a challenge to either pass the gatekeeper Algebra course for Repeaters or take a more Advanced Math sequence in the 9th grade, perceiving oneself to be around similar peers helped students stay motivated in math. In this case, perceiving more similar ethnic peers in math perhaps provided White students with more peer support as a source of capital to get through these courses.

White students' sense of Belonging in Math also increased when they perceived more same ethnic peers in math class within every math course sequence group except Algebra Succeeders. Therefore, as the societal majority ethnic group, there was something that eased feelings of connectedness to a math course when there were similar perceived same ethnic peers around, regardless of whether the class was a more or less advanced. While few studies have examined the psychosocial adjustment of White students in varying ethnic contexts, recent and emerging research on White adults showed that a numerical decline of same ethnic peers threatens status and produces more resistance to diversity (Danbold & Huo, 2015). In a smaller setting like a classroom where ethnicity is more salient, this threat may be more apparent, which could partly explain why perceiving more similar peers in math may be protective for White students' sense of Belonging in Math. Alternatively, for the Algebra Succeeders group which has a more equal distribution of ethnic group representation in this sample, more exposure and contact with ethnically diverse peers in 8th grade math could have minimized the need for perceiving more same ethnic peers. In fact, within the Algebra Succeeder group, the perceived number of same ethnic peers in math did not predict math motivation for any ethnic group. Perhaps the greater ethnic diversity of 8th grade math with Succeeders allowed for better intergroup attitudes and comfort when interacting with different ethnic peers (e.g., Chen & Graham, 2015; Knifsend & Juvonen, 2014; Thijs & Verkuyten, 2014). This hypothesis could be tested in future research by examining the actual ethnic composition of 8th grade Algebra classes, which was not yet available in this ongoing study.

For Asian students who were First Time Algebra Takers, sense of Belonging in Math was higher when they perceived more same ethnic peers in math. When looking at the actual objective ethnic representation of each math sequence in this sample, Asian students were largely under-enrolled as First Time Algebra Takers. Given that Asian students consistently outperform other ethnic groups in national mathematics achievement tests (NCES, 2013), being placed in 9th grade Algebra goes against the achievement norm for this group. Therefore, for Asians students who come from a more collectivist society (Ruby, Falk, Heine, Villa, & Silberstein, 2012), perceiving more same ethnic peers in this lower level math course sequence could make them feel less like an outsider and instead buffer feelings of Belonging in Math.

Furthermore, consistent with the proposed hypothesis, Black students' sense of Belonging in Math was buffered when students perceived more same ethnic peers in Advanced Math. When examining the actual representation of this math course sequence in the current sample, there was an under-enrollment of Black students in Advanced Math. In adolescence, however, we know that the principle of homophily suggests a strong preference toward same ethnicity peers as friends (McPherson, Smith-Lovin, & Cook, 2001); therefore, being underrepresented in class could not only decrease perceived fit but also limit the opportunity for friendships with same ethnic peers at a time when they especially matter. Moreover, for Black students, having similar ethnic friends in advanced math classes could serve as a source of social support by increasing fit and confidence in these courses (Tyson, 2011). As a result, more perceived similar ethnic peers, especially for Black students in advanced math, could be protective for sense of Belonging in Math. Although the findings for Black students were consistent with prior literature, they should be interpreted with caution given the small cell size for this Advanced Math group.

Similarly perceiving more same ethnic peers in math was protective for Latinos' sense of Belonging in Math but the inverse was true for Math Importance, regardless of what math course sequence students were in. For a collectivist group like Latinos (Segal, Gerdes, Mullins, Wagaman, Androff, 2011), it makes sense why perceiving more same ethnic peers in math class would be protective for sense of Belonging at every level of math. However, it is less clear why Math Importance decreased when Latinos perceived more same ethnic peers in math. Although significant effects of school ethnic diversity were not found for this group, it is important to mention that Latinos tend to attend more segregated schools (Gándara & Aldana, 2014). Based on past literature, more segregated schools and predominately minority schools tend to provide lower quality instruction and fewer resources, which negatively impacts math outcomes (e.g., achievement and complex mathematical thinking) (Mickelson et al., 2013; Martin, 2012; Riegle-Crumb & Grodsky, 2010). Predominately minority schools also tend to offer fewer quality math courses and when advanced course are available, teachers tend to present more watered down curriculum (Darling-Hammond, 2004). Therefore, while more same ethnic peers could protect sense of Belonging in Math, the inadvertent consequences of perceiving more same ethnic Latinos in math could also suggest that students are in more segregated schools that offer less quality curriculum, resources, and instruction; this in turn, could help explain why Math Importance suffers. Future studies should delve deeper into this work to find important school moderators that could explain this association.

The School Ethnic Context Also Mattered

After considering how the ethnic context of the math classroom differed from the school (incongruence), the results for Black students in Advanced Math were replicated but some of the findings for White students were not. In other words, perceiving more same ethnic peers in math class compared to the school was also associated with higher sense of Belonging in Math for Black students (to be interpreted with caution given small cell size). Nonetheless, for White students, perceiving more same ethnic peers in math relative to the school was now less important for math motivation in Advanced Math. In this case, a more incongruent ethnic context showing more perceived same ethnic peers in Advanced Math than school reflects a typical academic tracking pattern where there are more White students in Advanced Math than in the school. As a result, when taking into account ethnic incongruence, it is clearer why perceiving more same ethnic peers in math than in school was less impactful for White students since similar ethnic peers were probably already in abundance in class. Nevertheless, for White Algebra Repeaters, perceiving more same ethnic peers in math class versus school still positively impacted Belonging in Math, but only when compared to Algebra Succeeders. These findings suggest that when taking into account the perceived context of the math class and school, more similar peers in math during a shared plight of having to pass this gatekeeper course helps.

The results also changed for Asian and Latino students after considering the incongruence between math class and school. For Asian students more perceived same ethnic peers in math class than school was associated with higher Math Belonging and higher Math Importance, however, this association no longer differed by students' math course sequence. For Asian students who are not only stereotyped to be good at math but who also consistently outperform other ethnic groups in math (Trytten, Lowe, & Walden, 2012), perceiving more same ethnic peers in math than school may make this identity more salient, in turn, increasing feelings of Belonging and Importance in Math.

In contrast, perceiving more same ethnic peers in math class than school was protective for Latinos' sense of Belonging in Advanced Math. Since Latinos are typically underrepresented in Advanced Math courses and especially within highly segregated schools (Oakes, 1995), some students often avoid enrolling in higher level math because they would rather take classes with their friends (Walker & McCoy, 1997). A qualitative study captured this phenomenon for Latinos from a student's perspective. When asked how they felt in Advanced Math, a student responded: "Well, I kind of feel uncomfortable. Not many Mexicans and Hispanics are in those classes. And so it kind of makes me feel uncomfortable" (Davidson, 1996, p. 101). As a result, Latinos perceiving more same ethnic peers in math compared to the school could buffer sense of belonging in these more advanced courses. Overall, these findings highlight the complexity of the various roles the ethnic context could have on math motivation and more importantly that it really depends on students' ethnic background and the common experiences these students have in varying math course sequences.

In addition to these results, several noteworthy main effects with other important predictors were found. For example, females consistently reported lower math motivation than males. These findings were similar to prior research indicating that males report overall more positive math attitudes than females (Else-Quest, Mineo, & Higgins, 2013). Additionally, consistent with prior literature (e.g., Else-Quest et al., 2013), the higher the grades in the 8th grade math were, the more positively students rated each math motivation measure. What was surprising, however, was that an increase in parental level of education was associated with lower ratings of Math Importance and Math Belonging. Similarly, higher free reduced lunch in school (i.e., lower socioeconomic status) was also associated with higher Math Importance. Future studies should further probe what school and parental mechanisms (e.g., parent's careers and school math culture) could explain these results.

In addition to these results, the objective number of same ethnic peers in school was also negatively associated with sense of Belonging in Math and Math Competence. In other words, when controlling for all other variables, the more same ethnic peers there were in school the worse Math Competence and Belonging that was reported in class. However, after splitting the analyses by ethnic group, it was apparent that this finding was only true for White and Asian students. In this case, a higher number of same ethnic peers in school was linked to worse math motivation outcomes. These findings suggested that at the school level, a higher representation of same ethnic peers for White and Asian students did not necessarily help their math motivation in the classroom. This could be the case because schools with a higher representation of White and Asian students tend to be of higher socioeconomic status and higher achievement. For example, Orfield and Frankenberg (2014) found that schools with a high number of White and Asian students that also tended to have very few Black and Latino students (less than 0-10%) contained only a small percentage of students living in poverty. As a result, these higher income schools were more likely to offer more educational resources and quality education, which may make math courses more competitive and difficult to excel in. The present study indicated that this potentially more rigorous context could also lessen motivation in math for White and Asian students.

The results from this dissertation also shed light on the importance of examining students' *perceived* math ethnic context and the role of ethnicity when looking at the intersecting role of math course sequence on math motivation. Various studies have documented the overall advantages of enrolling in advanced math courses, such as better college related outcomes and a higher chance of pursuing STEM fields (Tyson et al., 2007; Riegle-Crumb, 2006; Adelman, 1998). However, few studies to my knowledge have looked at the psychological and motivational influences that enrolling in certain math sequences could have on students within varying ethnic contexts. This study suggested that for some ethnic groups, perceiving more same ethnic peers in more advanced math could be advantageous, whereas, for other ethnic groups more similar ethnic peers in lower level math sequences could be more protective for math motivation. This study also highlighted the importance of further contextualizing results with the objective ethnic context and broader context of the school to help explain differences in math motivation.

The results of this study also raise more questions about other important factors that could influence math motivation outcomes. For instance, little is known about how internalization of stereotypes regarding math could actually change these associations. In addition, it is well documented that certain underrepresented ethnic groups could fall short on their math trajectory for reasons outside of their motivational schemas. In other words, differential opportunities provided in school could help explain differences in math related outcomes. In the present study, it was clear from the descriptive results that certain schools provided more positional advantage to take advanced math trajectories. Nonetheless, while a push to get students to take Algebra earlier on has created more heterogeneous classes for these students, it is unknown what math teachers are actually doing within these classrooms to encourage integration and avoidance of reinforcing differences between groups. Moreover, for students on the higher and lower tails of the math course sequences, homogeneity among ethnic groups still exists, which we learned could have implications for math motivation.

Study Strengths and Limitations

A major strength of this study was the large variability in the ethnic diversity of schools, which is necessary when studying the role of the ethnic context. Therefore, although the study focused on the perceived ethnic context, diverse demographic contexts were actually available to students, which allowed for variability in student perceptions of math and school. No such information, however, was available regarding the math classrooms. A follow-up study should look at whether students' perceptions of the classroom demographics actually match the objective ethnic demographics of the classroom, and whether a mismatch is telling of how students actually feel in the class. Other important classroom contextual variables were also unknown, such as quality of teaching that could also influence motivational outcomes in math.

Future research should examine whether teacher quality and teacher engagement influences math motivation above and beyond the ethnic context.

Despite the novel approach to examining the importance of the math and school ethnic context, it is unclear how the ethnic climate of the classroom was or how strongly students actually identified with their ethnic group. These variables may serve as central moderators to the role of the ethnic context. For example, prior research on math level and math attitudes looked at the moderating role of school ethnic climate and found that a more positive ethnic climate buffered the negative association of perceiving few same ethnic peers in math on math competence and belonging in math (Graham & Morales-Chicas, 2015). Moreover, the current study did not examine students' ethnic identity, which could alter the salience and importance of perceiving similar ethnic peers.

Another limitation in the study was in the study analytic design. Given the complexity of the research questions, the examination of relations between ethnic context and math course sequence on math motivation was conducted separately by ethnic group. As a result, differences between ethnic groups could not be statistically tested. In addition, disaggregating by ethnicity also showed some small cell sizes, especially for Black students in the Advanced Math Group; therefore, since there was a significant two way interaction found for this group, it is important to interpret the results for Black students with caution. Furthermore, while each outcome was tested separately in different models, testing all as latent variables together in one model could have better explained the strength of some associations over others. Lastly, the study could have been richer if more time points of math course and math motivation were available to see how these results held over time.

Policy Implications

Collectively, the results of this dissertation offer important insight and policy recommendations for math education. For example, the descriptive results from the current study showed large variability between schools in Algebra and Geometry courses per pupil; this variability supports the notion that schools often reinforce gaps by providing fewer opportunities to enroll in advanced math as early as middle school. While enrollment in middle school Algebra serves as one of the key gatekeepers into more advanced math in high school, enrollment in middle school Geometry could also automatically catapult a student into a higher math sequence and put them at a curricular advantage. Given this reality, it was alarming to learn that some middle schools simply did not offer Geometry. To make matters worse, these schools compared to schools that did offer this course, tended to be from lower socioeconomic status and were lower performing. Moreover, since these schools were more likely to enroll Black and Latino students, this lack of opportunity could further perpetuate inequalities in math access and success. This important finding reinforces that middle schools provide a critical starting point for later course-taking trends. In turn, students' course-taking patterns are often less about student agency or choice and more about what opportunities their schools offer.

Since certain middle schools did not offer the same opportunities to enroll in middle school Algebra and Geometry, we should redirect our attention about course-taking to focus less on students and more on what the schools provide. Attention to variation in the application of *Algebra for All* in California is a start. Furthermore, while 8th grade Algebra enrollment is variable between schools, the overall ethnic breakdown of each math sequence showed that the *Algebra for All* policy initiative has funneled more diverse students into 8th grade Algebra that traditionally would have been placed into lower math. While this theoretically should have important implications for students' math potential, prior research suggests that a trajectory toward higher level math is not always found for these students (Liang et al., 2012; Domina et al., 2014). Therefore, the present research took a deeper look at certain psychological and contextual mechanisms that may affect students within different math course sequences. The findings from this research do suggest that enrolling in Algebra during middle school boosted math motivation in 9^{th} grade but the effects really depended on the perceived ethnic context and the type of math course sequence students were in.

The results of this dissertation also urge teachers, policy makers, and researchers to be more cognizant of certain issues that may arise within each type of math classroom. For example, math teachers in particular, should think about ways to better integrate students of different ethnic backgrounds within more ethnically segregated math classrooms. When math classrooms are segregated, students in the numerical minority might even be hesitant to ask questions or speak up in class for fear of saying the wrong thing (Walker & McCoy, 1997). However, teaching and learning math does not have to be a color-blind experience (Walker, 2007). That is, teachers and schools should be mindful of not reinforcing stereotypes in math and instead in providing equitable opportunities for students even at the highest math levels and especially in under resourced schools.

To better understand how ethnic diversity and culture play out in mathematics instruction and math classroom climate, researchers should also pursue more qualitative research. Despite the clear disparities in ethnic representation and achievement across math levels, very few studies to date have focused on the benefits of diversity in American math classrooms. A recent study helped reinforce the importance of this work by interviewing 16 elementary math teachers from Greek-Cypriot who were working in schools with high immigrant populations. The results of this small-scale qualitative study found that within these diverse math classrooms, teachers provided more linguistic support rather than incorporating the students' diverse backgrounds (Xenofontos, 2016). This study highlights the often missed opportunities of teaching and learning from diverse students in math classrooms. It is important to realize that ethnic minority students and immigrant students bring with them their cultural values and aspirations (even when related to math) that are not always talked about in the classroom (Kitchen, 2005).

Prospective studies should also highlight the variability in background that certain pan-ethnic groups have. For example, students of Mexican decent have different sociopolitical histories, variable immigration patterns, and their own unique culture that differs from other Latinos (e.g., Cubans, Puerto Ricans, and Salvadorians). In the present study, Latinos were combined as one ethnic group, as were various pan-ethnic Asian students. However, to enrich this work, future studies should disaggregate pan-ethnic groups to examine differences in perceptions of similar ethnic peers and if precursors to math motivation differ between these disaggregated groups.

Future research must also take into account the new shift toward Common Core State Standards that will bring significant changes to student's math trajectories once again. These standards, which almost all states in the United States have adopted, move toward taking pre-algebra in the 8^{th} grade and Algebra in 9^{th} grade. While this aims to ensure mastery of fundamental skills before jumping to Algebra 1, this curricular deceleration will also have important consequences for the ethnic context of math courses. In this case, a more universal curriculum may reinforce diversity in math classrooms, yet limit students who are more prepared for higher level math. Over time, it will be important to capture changes that result from this policy and more importantly how this new policy will play a role in math motivation and achievement.

Conclusion

The current study highlights how students' math course sequences between 8th and 9th grade were associated with math motivation and more importantly how this link differed after taking ethnicity and ethnic context into account. The most important take home message from this study is that math motivational patterns do not occur in a vacuum. That is, although certain ethnic groups could report different motivational patterns related to math, the ethnic context of the classroom and school they are in could also shape this experience. The present study focused on the perceived number of same ethnic peers in math as well as the ethnic incongruence between the math classroom and the school. For some ethnic groups, the role that the perceived number of same ethnic peers played on math motivation really depended on the type of math course sequence students were in and what that sequence represented. However, one consistent and relevant finding that emerged for every ethnic group was that the number of perceived same ethnic peers in math did not predict math motivation for students in the Algebra Succeeder sequence. This finding draws support for the *Algebra for All* policy initiative suggesting that more diversity and opportunity to take Algebra earlier on could protect math motivation and level the playing field amongst all students. Overall, these results raised important questions about how former and more recent policy concerns are affecting the ethnic demographics of schools, which could subsequently influence the social landscape of the classroom. As Common Core continues to evolve, it will be imperative to re-examine how these math sequences and ethnic contexts change and more importantly how they influence math motivation.

Table 1

Frequency and Percent of Math Courses Taken in the 8th Grade

Math Course	**Frequency**	**Percent**
General Math	156	0.04
Pre Algebra/Algebra Readiness	594	0.17
Algebra	1761	0.50
Geometry	601	0.17
Missing	395	0.11
Total	3507	

Table 2

Frequency of Self Reported Math Courses Students Took in the 9th Grade

9th Grade Math Course	**Frequency**	**Percent**
Math Essentials or basic math	9	.003
Algebra Readiness	6	.002
Pre Algebra	17	.005
Algebra 1	1231	.35
Algebra 2	672	.19
Geometry	1285	.37
Math Analysis or Pre-Calculus	17	.005
Trigonometry	4	.001
Integrated Math 1	1	.000
Integrated Math 2	29	.008
Integrated Math 3	3	.001
Two or More Classes Listed	71	.02
Other	3	.001
Calculus	3	.001
Missing	156	.04
Total	3507	100.0

Table 3

Descriptives Among All Continuous Variables

Variables	Mean	*SD*	Range
School Free Reduced Lunch Percent	0.45	0.22	0.02 - 0.99
APSAI	64.60	25.80	22.58 – 1085.00
Math Grade in 8^{th} Grade	2.80	1.06	00 – 4.00
Parental Level of Education	3.97	1.50	1 – 6
School Diversity	0.62	0.13	0.03 -0.80
Objective Same Ethnic Peers in School	0.42	0.20	00 - 0.98
Perceived Same Ethnic Peers in Math	2.23	1.30	1 – 5
Perceived Incongruence in Math	-0.41	1.14	-4 – 4
Belonging in Math	3.68	0.68	1 – 5
Math Importance	3.25	0.86	1 – 5
Math Competence	3.52	0.79	1 – 5
Math Anxiety	2.67	0.88	1 – 5

Note. For School Free Reduced Lunch Percent higher values indicate lower Socioeconomic status of the school

Table 4

Rotated Component Matrix Showing Factor Loadings for Math Motivation

	Math Motivation			
Items:	Factor 1: Competence	Factor 2: Belonging	Factor 3: Importance	Factor 4: Anxiety
My math teacher thinks I understand math well.	**.766**	.209	.151	-.090
I solve math problems without too much difficulty.	**.708**	.037	.146	-.075
I'm good at math.	**.692**	.093	.279	-.298
I feel stressed out during math class.	-.599	-.081	-.059	**.572**
My math teacher helps me when I have difficulty in math class.	**.537**	.394	.126	-.014
I have good friends in my math class.	-.006	**.693**	.205	.043
I feel like I fit in with other students in my math class.	.160	**.683**	.185	-.059
I feel like nobody pays attention to me in my math class.	-.036	**-.651**	.022	.379
I feel respected in math class.	.358	**.632**	.151	-.102
I often feel left out in math class.	-.245	**-.562**	-.003	.460
I feel comfortable in math class.	.467	**.486**	.302	-.300
Math is one of the most important subjects a person can study.	.140	.157	**.785**	.056
High school math is helpful no matter what job I have.	.160	.164	**.770**	.019
I want to take as much math as I can when I'm in school.	.192	.154	**.743**	-.188
Studying math makes me feel nervous.	-.463	-.062	.023	**.641**
I try to say as little as possible in my math class.	.011	-.356	.051	**.629**
Math is boring	-.183	-.020	**-.481**	.612
I only take math because I have to.	-.118	-.064	**-.573**	.596

Note. Bolded values represent which each item corresponds to a particular factor by value and conceptually; Italicized items will be reverse coded

Table 5

Fit Indices for the CFA Models

	Math Competence	Belonging in Math	Math Importance	Math Anxiety
Fit Indexes	One Factor CFA	One Factor CFA	One Factor CFA	One Factor CFA
ƛ^{2}	230.13***	315.97***	191.13***	0
RMSEA	.21***	.11***	.19***	0
CFI	.92	.93	.94	1
TLI	.75	.88	.82	1
BIC	28842.57	40413.96	30382.473	22988.709
AIC	28771.68	40413.97	30311.581	22935.543

Note. Standardized values are presented. Results for Math Importance excludes one 1 item which improved fit. SRMR, Standardized root mean squared residual was not reported because of missing values. CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root Mean Square Error of Approximation; BIC, Bayesian Information Criterion; AIC, Akaike Information Criterion.
*$p < .05$, **$p < .01$, ***$p < .001$

Table 6

Correlations Among All Continuous Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. School Free Reduced Lunch Percent	---											
2. APSAI	.25**	---										
3. Math Grade in 8th Grade	-.18**	-.10**	---									
4. Parental Level of Education	-.36**	-.13**	.21**	---								
5. School Diversity	-.57**	-.26**	.10**	.25**	---							
6. Objective Same Ethnic Peers in School	.25**	.09**	.01	-.02	-.38**	---						
7. Perceived Same Ethnic Peers in Math	.14**	.02	.01	-.13**	-.13**	.05*	---					
8. Perceived Incongruence in Math	.011	.00	.09**	.05**	-.02	.00	.55**	---				
9. Belonging in Math	.01	.01	.12**	.02	-.02	.00**	.06**	.07**	---			
10. Math Importance	.08**	.03*	.18**	-.04*	-.05**	-.00	.02	.06**	.46**	---		
11. Math Competence	-.02	.02	.19**	.08**	-.01	-.01	.02	.08**	.54**	.49**	---	
12. Math Anxiety	.01	.01	-.09**	-.05**	-.03	.01	.01	-.05**	-.50**	-.38**	-.53**	---

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

Table 7

Frequency, Proportions, and Means of Math Course Sequence by Ethnicity

Math Course Sequence	White			Asian			Black			Latino		
	N	Prop.	*PSEP* Mean *SD*	*n*	Prop.	*PSEP* Mean *SD*	*n*	Prop.	*PSEP* Mean *SD*	*n*	Prop.	*PSEP* Mean *SD*
First Time Taking Algebra	99	0.13	2.39 (1.24)	34	0.07	1.52 (.76)	94	0.31	1.73 (1.11)	304	0.29	2.64 (1.31)
Algebra Repeaters	114	0.15	2.21 (1.09)	37	0.08	1.95 (1.03)	74	0.25	2.18 (1.42)	242	0.23	2.72 (1.42)
Algebra Succeeders	352	0.47	2.65 (1.17)	220	0.45	2.31 (1.43)	120	0.40	1.53 (.96)	459	0.43	2.47 (1.30)
Advanced Math	186	0.25	2.86 (1.18)	194	0.40	2.65 (1.42)	13	0.04	1.33 (.89)	58	0.05	1.95 (1.12)
Total	751			485			301			1063		

Note. Prop. equals proportion and represents the total number of students enrolled in that math course sequence for that ethnic group

Table 8

Main Effects of Each Predictor Including Perceived Same Ethnic Peers in Math on Each Outcome

Math Motivation	Math Competence	Math Belonging	Math Importance	Math Anxiety
Parameter	Model 1	Model 1	Model 1	Model 1
Constant	3.59***	3.74***	3.30***	2.54***
	(.05)	(.04)	(.05)	(.06)
Female	-0.21***	-0.15***	-0.26***	0.28***
	(.03)	(.02)	(.03)	(.03)
School Free Reduced Lunch Percent	-0.08	-0.02	0.21*	-0.04
	(.11)	(.09)	(.10)	(.14)
APSAI	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.19***	0.10***	0.17***	-0.17***
	(.02)	(.01)	(.02)	(.02)
Parent Level of Education	0.01	-0.02*	-0.04**	-0.01
	(.01)	(.01)	(.01)	(.01)
School Diversity	-0.11	-0.16	-0.04	-0.28
	(.16)	(.10)	(.13)	(.21)
Objective Same Ethnic Peers in School	-0.28*	-0.26*	-0.18	0.16
	(.14)	(.10)	(.14)	(.11)
Black	0.09	0.11*	0.25***	-0.08
	(.06)	(.05)	(.07)	(.07)
Asian	-0.06	-0.07	0.18**	0.06
	(.04)	(.05)	(.07)	(.06)
Latino	0.06	0.10*	0.29***	0.00
	(.05)	(.05)	(.08)	(.07)
First Time Algebra Takers	-0.09	-0.12**	-0.18***	0.02
	(.06)	(.04)	(.05)	(.05)
Algebra Repeaters	0.23***	0.05	0.05	-0.29***
	(.06)	(.04)	(.05)	(.07)
Advanced Math	0.10*	0.01	0.22***	0.06
	(.05)	(.04)	(.06)	(.07)
Perceived Same Ethnic Peers in Math	0.03	0.06***	0.02	0.00
	(.01)	(.01)	(.02)	(.02)

Note. * $p<.05$; ** $p<.01$; *** $p<.001$; Algebra Succeeders were held as the reference group

Table 9

Results for White Students Testing the Association between Perceived Same Ethnic Peers in Math and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.47***	3.50***	3.69***	3.73***	3.18***	3.20***	2.68***	2.65***
	(.06)	(.06)	(.05)	(.05)	(.09)	(.09)	(.09)	(.09)
Female	-0.22***	-0.22***	-0.19***	-0.19***	-0.32***	-0.32***	0.29***	0.30***
	(.06)	(.05)	(.04)	(.04)	(.07)	(.07)	(.05)	(.04)
School Free Reduced Lunch Percent	-0.44	-0.37	-0.20	-0.06	-0.79*	-0.74	0.42	0.31
	(.36)	(.39)	(.32)	(.33)	(.37)	(.39)	(.52)	(.52)
APSAI	0.00	0.00	0.00	0.00	0.00*	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.14***	0.14***	0.11***	0.11***	0.16**	0.16**	-0.14**	-0.14**
	(.03)	(.03)	(.03)	(.03)	(.05)	(.05)	(.04)	(.04)
Parent Level of Education	0.08**	0.08**	0.03	0.03	0.01	0.01	-0.10**	-0.10**
	(.03)	(.03)	(.02)	(.02)	(.04)	(.04)	(.03)	(.03)
School Diversity	0.29	0.42	-0.09	0.02	-0.74	-0.70	-0.15	-0.25
	(.43)	(.41)	(.17)	(.17)	(.54)	(.53)	(.34)	(.32)
Objective Same Ethnic Peers in School	-0.96**	-0.89*	-0.76**	-0.70*	-1.06***	-1.03***	1.26*	1.20*
	(.35)	(.37)	(.26)	(.27)	(.27)	(.28)	(.58)	(.59)
Perceived Same Ethnic Peers in Math	0.04	-0.04	0.07*	0.00	0.04	0.00	-0.06**	0.01
	(.04)	(.05)	(.03)	(.04)	(.03)	(.05)	(.02)	(.04)
First Time Algebra Takers	-0.06	-0.08	-0.22***	-0.25***	-0.25*	-0.26*	0.02	0.04
	(.09)	(.08)	(.05)	(.06)	(.10)	(.10)	(.11)	(.10)
Algebra Repeaters	0.30**	0.28**	0.14	0.14*	0.07	0.07	-0.38***	-0.38***
	(.10)	(.11)	(.07)	(.06)	(.09)	(.10)	(.10)	(.10)
Advanced Math	0.10	0.01	0.03	0.00	0.29**	0.27**	0.10	0.15
	(.06)	(.06)	(.04)	(.04)	(.09)	(.10)	(.07)	(.08)
Perceived Same Ethnic Peers in Math X First Time		0.13		0.13*		0.03		-0.10
Algebra Takers		(.07)		(.06)		(.09)		(.10)
Perceived Same Ethnic Peers in Math X Algebra		0.11		0.24***		0.11		-0.21**
Repeaters		(.09)		(.06)		(.11)		(.07)
Perceived Same Ethnic Peers in Math X Advanced		0.19**		0.07*		0.05		-0.11
Math		(.07)		(.03)		(.08)		(.06)

Note. * p<.05 ; ** p<.01 ; *** p<.001; Algebra Succeeders were held as the reference group

Table 10

Results for Black Student Testing the Association between Perceived Same Ethnic Peers in Math and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.65***	3.66***	3.63***	3.69***	3.45***	3.58***	2.41***	2.39***
	(.14)	(.15)	(.14)	(.15)	(.12)	(.13)	(.15)	(.16)
Female	-0.09	-0.09	-0.12	-0.14	-0.31***	-0.33***	0.12	0.12
	(.10)	(.10)	(.08)	(.09)	(.09)	(.09)	(.09)	(.09)
School Free Reduced Lunch Percent	0.04	0.03	0.41	0.34	0.66**	0.58*	-0.09	-0.10
	(.31)	(.32)	(.30)	(.29)	(.23)	(.23)	(.41)	(.41)
APSAI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.13**	0.13**	0.06	0.07	0.15**	0.16**	-0.08	-0.08
	(.04)	(.04)	(.05)	(.04)	(.05)	(.05)	(.06)	(.06)
Parent Level of Education	0.06	0.06	-0.02	-0.02	0.03	0.02	0.03	0.03
	(.03)	(.03)	(.03)	(.03)	(.04)	(.05)	(.04)	(.04)
School Diversity	0.29	0.28	0.25	0.15	0.46	0.35	-0.91	-0.93
	(.28)	(.31)	(.27)	(.25)	(.24)	(.22)	(.52)	(.51)
Objective Same Ethnic Peers in School	-0.02	-0.02	-0.53	-0.56	-0.16	-0.15	-0.36	-0.37
	(.40)	(.40)	(.34)	(.34)	(.34)	(.33)	(.40)	(.41)
Perceived Same Ethnic Peers in Math	0.07	0.08	0.03	0.11	-0.03	0.12	0.04	0.03
	(.05)	(.07)	(.05)	(.09)	(.06)	(.09)	(.05)	(.09)
First Time Algebra Takers	-0.12	-0.12	0.05	-0.06	-0.16	-0.30*	0.13	0.14
	(.14)	(.14)	(.14)	(.15)	(.13)	(.12)	(.11)	(.12)
Algebra Repeaters	0.19	0.18	0.17	0.14	0.20	0.09	-0.12	-0.10
	(.14)	(.16)	(.15)	(.18)	(.17)	(.15)	(.18)	(.19)
Advanced Math	0.38*	0.12	0.37*	0.85	0.24	-0.26	-0.25	-0.55
	(.15)	(.42)	(.16)	(.15)	(.30)	(.63)	(.26)	(.35)
Perceived Same Ethnic Peers in Math X First Time		-0.01		-0.19		-0.23		0.00
Algebra Takers		(.13)		(.14)		(.13)		(.11)
Perceived Same Ethnic Peers in Math X Algebra		-0.01		-0.04		-0.20		0.05
Repeaters		(.10)		(.13)		(.13)		(.12)
Perceived Same Ethnic Peers in Math X Advanced		-0.24		0.44*		-0.51		-0.28
Math		(.45)		(.19)		(.54)		(.48)

Note. * p<.05 ; ** p<.01 ; *** p<.001; Algebra Succeeders were held as the reference group

Table 11

Results for Asian Student Testing the Association between Perceived Same Ethnic Peers in Math and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.51***	3.51***	3.66***	3.67***	3.48***	3.49***	2.65***	2.65***
	(.07)	(.08)	(.05)	(.05)	(.06)	(.07)**	(.06)	(.07)
Female	-0.15	-0.15	-0.09	-0.10	-0.19*	-0.20*	0.18*	0.18*
	(.08)	(.08)	(.07)	(.07)	(.09)	(.09)	(.08)	(.08)
School Free Reduced Lunch Percent	-0.28*	-0.27*	-0.04	-0.02	0.05	0.03	0.00	-0.02
	(.13)	(.14)	(.26)	(.26)	(.24)	(.23)	(.25)	(.25)
APSAI	0.00*	0.00*	0.00	0.00	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.19***	0.20***	0.07	0.08	0.13**	0.14**	-0.16**	-0.17**
	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.06)
Parent Level of Education	-0.01	-0.01	-0.04	-0.05	-0.04	-0.05	0.03	0.02
	(.03)	(.03)	(.04)	(.03)	(.05)	(.05)	(.03)	(.03)
School Diversity	0.28	0.30	0.27	0.32	-0.07	-0.08	-0.07	-0.13
	(.30)	(.32)	(.44)	(.46)	(.48)	(.48)	(.54)	(.55)
Objective Same Ethnic Percent in School	-0.37*	-0.37*	-0.44*	-0.46*	-0.55**	-0.56**	-0.11	-0.13
	(.01)	(.15)	(.19)	(.21)	(.18)	(.18)	(.23)	(.24)
Perceived Same Ethnic Peers in Math	0.03	0.01	0.04	0.13*	0.11**	0.12*	0.09**	0.09
	(.03)	(.03)	(.12)	(.06)	(.04)	(.06)	(.03)	(.05)
First Time Algebra Takers	0.08	0.15	-0.01	0.25	0.05	0.06	-0.09	-0.28
	(.16)	(.19)	(.09)	(.14)	(.11)	(.12)	(.14)	(.22)
Algebra Repeaters	0.16	0.14	-0.01	-0.07	0.00	-0.14	-0.21	-0.18
	(.15)	(.15)	(.09)	(.09)	(.13)	(.12)	(.15)	(.21)
Advanced Math	0.03	0.03	-0.07	-0.07	0.10	0.09	0.05	0.05
	(.08)	(.08)	(.06)	(.06)	(.08)	(.08)	(.08)	(.08)
Perceived Same Ethnic Peers in Math X First Time		0.06		0.15		0.00		-0.17
Algebra Takers		(.12)		(.09)		(.11)		(.13)
Perceived Same Ethnic Peers in Math X Algebra		-0.01		-0.11		-0.17*		0.04
Repeaters		(.08)		(.07)		(.08)		(.10)
Perceived Same Ethnic Peers in Math X Advanced		0.01		-0.10		0.02		0.00
Math		(.07)		(.05)		(.07)		(.08)

Note. * p<.05 ; ** p<.01 ; *** p<.001; Algebra Succeeders were held as the reference group

Table 12

Results for Latino Students Testing the Association between Perceived Same Ethnic Peers in Math and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.65***	3.65***	3.82***	3.82***	3.52***	3.52***	2.55***	2.56***
	(.04)	(.04)	(.04)	(.04)	(.06)	(.06)	(.05)	(.05)
Female	-0.25***	-0.17***	-0.18***	-0.17***	-0.23*	-0.23*	0.35***	0.35***
	(.05)	(.04)	(.04)	(.04)	(.04)	(.04)	(.05)	(.05)
School Free Reduced Lunch Percent	-0.23	-0.30	-0.30*	-0.29*	0.14	0.15	0.39*	0.38*
	(.16)	(.14)	(.14)	(.13)	(.20)	(.20)	(.18)	(.17)
APSAI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.23***	0.11***	0.11***	0.11***	0.18***	0.18***	-0.22***	-0.22***
	(.03)	(.02)	(.02)	(.02)	(.03)	(.03)	(.03)	(.03)
Parent Level of Education	-0.01	-0.03*	-0.03*	-0.03*	-0.06***	-0.06***	-0.00	-0.01
	(.02)	(.01)	(.01)	(.01)	(.02)	(.28)	(.02)	(.02)
School Diversity	-0.22	0.14	0.01	0.01	0.56	0.60	-0.68	-0.67
	(.26)	(.31)	(.29)	(.28)	(.26)	(.28)	(.35)	(.34)
Objective Same Ethnic Peers in School	-0.02	0.01	0.27	0.27	0.44	0.48	-0.58	-0.56
	(.29)	(.28)	(.31)	(.30)	(.32)	(.31)	(.35)	(.34)
Perceived Same Ethnic Peers in Math	0.04	0.02	0.07***	0.03	-0.02	-0.07*	-0.02	-0.01
	(.02)	(.03)	(.02)	(.02)	(.02)	(.03)	(.03)	(.04)
First Time Algebra Takers	0.11	-0.12	-0.11	-0.11	-0.15*	-0.17**	0.00	0.01
	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.05)	(.05)
Algebra Repeaters	0.21**	0.21**	0.02	0.02	0.05	0.06	-0.34***	-0.34***
	(.08)	(.08)	(.07)	(.07)	(.08)	(.08)	(.08)	(.09)
Advanced Math	0.31**	0.35***	0.06	0.08	0.26**	0.29***	-0.11	-0.15
	(.09)	(.10)	(.07)	(.08)	(.09)	(.08)	(.11)	(.11)
Perceived Same Ethnic Peers in Math X First Time		0.03		0.05		0.11		0.01
Algebra Takers		(.04)		(.03)		(.06)		(.05)
Perceived Same Ethnic Peers in Math X Algebra		0.01		0.06		0.05		-0.04
Repeaters		(.04)		(.04)		(.05)		(.06)
Perceived Same Ethnic Peers in Math X Advanced		0.17*		0.09		0.14		-0.13
Math		(.07)		(.06)		(.10)		(.08)

Note. No significant overall interaction was found for Math Competence so the significant simple effect shown will not be interpreted
* $p<.05$; ** $p<.01$; *** $p<.001$; Algebra Succeeders were held as the reference group

Table 13

Main Effects of Each Predictor Including Perceived Ethnic Incongruence Between Math and School on Each Outcome

Math Motivation	Math Competence	Math Belonging	Math Importance	Math Anxiety
Parameter	Model 1	Model 1	Model 1	Model 1
Constant	3.59***	3.74***	3.30***	2.55***
	(.04)	(.03)	(.06)	(.06)
Female	-0.20***	-0.15***	-0.26***	0.27***
	(.03)	(.02)	(.03)	(.03)
School Free Reduced Lunch Percent	-0.08	-0.02	0.20*	-0.04
	(.11)	(.09)	(.10)	(.14)
APSAI	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.19***	0.10***	0.17***	-0.17***
	(.02)	(.01)	(.02)	(.02)
Parent Level of Education	0.01	-0.02*	-0.04**	-0.01
	(.01)	(.01)	(.01)	(.01)
School Diversity	-0.06	-0.06	-0.01	-0.29
	(.15)	(.10)	(.13)	(.21)
Objective Same Ethnic Peers in School	-0.19	-0.08	-0.13	0.14
	(.10)	(.08)	(.12)	(.10)
Black	0.10	0.11*	0.26***	-0.10
	(.06)	(.05)	(.07)	(.07)
Asian	-0.07	-0.08	0.18**	0.06
	(.04)	(.05)	(.07)	(.06)
Latino	0.05	0.08	0.29***	0.00
	(.05)	(.04)	(.08)	(.06)
First Time Algebra Takers	-0.09	-0.10**	-0.18***	0.02
	(.06)	(.04)	(.05)	(.05)
Algebra Repeaters	0.22***	0.04	0.05	-0.29***
	(.06)	(.04)	(.05)	(.06)
Advanced Math	0.09	0.02	0.22**	0.07
	(.05)	(.04)	(.06)	(.08)
Ethnic Incongruence	0.04*	0.04**	0.02	-0.02
	(.02)	(.01)	(.02)	(.02)

Note. * $p<.05$; ** $p<.01$; *** $p<.001$; Algebra Succeeders were held as the reference group

Table 14

Results for White Students Testing the Association between Perceived Ethnic Incongruence and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.47***	3.48***	3.70***	3.71***	3.18***	3.19***	2.68***	2.68***
	(.06)	(.06)	(.05)	(.04)	(.09)	(.09)	(.10)	(.10)
Female	-0.22***	-0.21***	-0.18***	-0.18***	-0.31***	-0.31***	0.29***	0.29***
	(.06)	(.06)	(.04)	(.04)	(.07)	(.07)	(.05)	(.04)
School Free Reduced Lunch Percent	-0.46	-0.46	-0.24	-0.22	-0.80*	-0.75*	0.45	0.46
	(.37)	(.38)	(.34)	(.34)	(.38)	(.37)	(.53)	(.52)
APSAI	0.00	0.00	0.00	0.00	0.00**	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.14***	0.14***	0.12***	0.11***	0.16**	0.15**	-0.14**	-0.14**
	(.03)	(.03)	(.03)	(.03)	(.05)	(.05)	(.04)	(.04)
Parent Level of Education	0.08**	0.08**	0.03	0.03	0.01	0.01	-0.10***	-0.10***
	(.03)	(.03)	(.02)	(.02)	(.04)	(.04)	(.03)	(.03)
School Diversity	0.36	0.38	0.02	0.05	-0.68	-0.66	-0.24	-0.24
	(.41)	(.42)	(.14)	(.14)	(.53)	(.50)	(.34)	(.34)
Objective Same Ethnic Peers in School	-0.84*	-0.84*	-0.58*	-0.57*	-0.97***	-0.95**	1.08	1.08
	(.35)	(.35)	(.28)	(.29)	(.27)	(.27)	(.60)	(.59)
Perceived Ethnic Incongruence	0.02	-0.01	0.02	0.00	0.04	0.04	-0.04	-0.02
	(.04)	(.06)	(.02)	(.03)	(.03)	(.04)	(.03)	(.04)
First Time Algebra Takers	-0.06	-0.07	-0.23**	-0.24**	-0.24*	-0.26*	0.02	0.00
	(.10)	(.10)	(.06)	(.07)	(.10)	(.11)	(.11)	(.12)
Algebra Repeaters	0.29**	0.29*	0.12	0.13	0.07	0.08	-0.36***	-0.36***
	(.11)	(.11)	(.07)	(.07)	(.09)	(.10)	(.10)	(.10)
Advanced Math	0.10	0.08	0.03	0.02	0.29**	0.32**	0.10	0.12
	(.07)	(.06)	(.05)	(.05)	(.09)	(.10)	(.08)	(.08)
Perceived Ethnic Incongruence X First Time		0.02		-0.02		-0.10		-0.12
Algebra Takers		(.12)		(.06)		(.12)		(.11)
Perceived Ethnic Incongruence X Algebra		0.09		0.18**		0.18		0.00
Repeaters		(.11)		(.06)		(.12)		(.12)
Perceived Ethnic Incongruence X Advanced Math		0.06		0.03		-0.05		-0.04
		(.06)		(.05)		(.10)		(.06)

Note. * $p<.05$; ** $p<.01$; *** $p<.001$; Algebra Succeeders were held as the reference group

Table 15

Results for Black Students Testing the Association between Perceived Ethnic Incongruence and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.67***	3.64***	3.64***	3.67***	3.45***	3.46***	2.40***	2.38***
	(.14)	(.15)	(.14)	(.14)	(.12)	(.12)	(.14)	(.14)
Female	-0.08	-0.07	-0.12	-0.13	-0.31***	-0.31**	0.12	0.12
	(.10)	(.09)	(.08)	(.09)	(.09)	(.09)	(.09)	(.09)
School Free Reduced Lunch Percent	0.02	0.05	0.40	0.37	0.68**	0.66**	-0.13	-0.12
	(.31)	(.31)	(.31)	(.30)	(.22)	(.22)	(.42)	(.42)
APSAI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
	0.12**	0.12**	0.06	0.07	0.15**	0.15**	-0.08	-0.08
Math Grade in 8th Grade	(.05)	(.05)	(.04)	(.04)	(.05)	(.05)	(.06)	(.05)
Parent Level of Education	0.06*	0.06	-0.02	-0.02	0.03	0.03	0.03	0.02
	(.03)	(.03)	(.03)	(.03)	(.04)	(.04)	(.04)	(.04)
School Diversity	0.35	0.35	0.28	0.26	0.44	0.46*	-0.92	-0.94
	(.28)	(.28)	(.27)	(.26)	(.24)	(.23)	(.53)	(.53)
Objective Same Ethnic Peers in School	0.22	0.18	-0.41	-0.38	-0.27	-0.25	-0.22	-0.24
	(.34)	(.33)	(.31)	(.31)	(.30)	(.29)	(.37)	(.37)
Perceived Ethnic Incongruence	0.06	-0.01	0.01	0.07	0.02	0.03	-0.06*	-0.09
	(.04)	(.07)	(.04)	(.06)	(.04)	(.09)	(.03)	(.05)
First Time Algebra Takers	-0.10	-0.06	0.05	-0.02	-0.16	-0.16	0.13	0.12
	(.13)	(.15)	(.14)	(.15)	(.13)	(.12)	(.10)	(.10)
Algebra Repeaters	0.18	0.21	0.17	0.16	0.20	0.18	-0.11	-0.08
	(.14)	(.16)	(.15)	(.15)	(.17)	(.16)	(.18)	(.18)
Advanced Math	0.36*	0.49*	0.35	0.60**	0.26	0.26	-0.30	-0.30
	(.15)	(.21)	(.17)	(.20)	(.29)	(.29)	(.27)	(.24)
Perceived Ethnic Incongruence X First Time		0.11		-0.17		0.00		0.00
Algebra Takers		(.11)		(.10)		(.13)		(.08)
Perceived Ethnic Incongruence X Algebra		0.14		-0.04		-0.07		0.12
Repeaters		(.10)		(.11)		(.10)		(.11)
Perceived Ethnic Incongruence X Advanced Math		0.24		0.38***		0.00		0.02
		(.22)		(.10)		(.04)		(.10)

Note. * $p<.05$; ** $p<.01$; *** $p<.001$; Algebra Succeeders were held as the reference group

Table 16

Results for Asian Students Testing the Association between Perceived Ethnic Incongruence and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.51***	3.51***	3.66***	3.66***	3.48***	3.48***	2.65***	2.65***
	(.07)	(.07)	(.05)	(.05)	(.06)	(.06)	(.07)	(.07)
Female	-0.14	-0.14	-0.08	-0.09	-0.17	-0.17	0.19*	0.18*
	(.07)	(.08)	(.07)	(.06)	(.09)	(.09)	(.09)	(.09)
School Free Reduced Lunch Percent	-0.30*	-0.31*	-0.08	-0.08	-0.01	-0.02	-0.04	-0.04
	(.13)	(.15)	(.24)	(.24)	(.21)	(.21)	(.26)	(.25)
APSAI	0.00*	0.00**	0.00	0.00	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.19***	0.19***	0.07	0.07	0.12**	0.12*	-0.16**	-0.16**
	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.06)	(.06)
Parent Level of Education	-0.01	-0.01	-0.05	-0.05	-0.05	-0.05	0.02	0.02
	(.03)	(.03)	(.03)	(.04)	(.05)	(.05)	(.03)	(.03)
School Diversity	0.27	0.26	0.28	0.25	-0.07	-0.07	-0.05	-0.05
	(.27)	(.31)	(.44)	(.45)	(.45)	(.45)	(.55)	(.54)
Objective Same Ethnic Peers in School	-.0.33*	-0.34*	-0.21	-0.23	-0.23	-0.23	0.13	0.12
	(.14)	(.15)	(.14)	(.14)	(.13)	(.13)	(.21)	(.22)
Perceived Ethnic Incongruence	0.03	0.04	0.06*	0.10***	0.10***	0.10**	0.04	0.04
	(.02)	(.03)	(.03)	(.03)	(.02)	(.03)	(.03)	(.04)
First Time Algebra Takers	0.10	0.07	0.02	-0.04	0.03	0.03	-0.12	-0.13
	(.15)	(.14)	(.12)	(.14)	(.10)	(.11)	(.15)	(.19)
Algebra Repeaters	0.15	0.11	-0.05	-0.09	-0.06	-0.10	-0.27*	-0.31**
	(.14)	(.15)	(.09)	(.11)	(.13)	(.17)	(.13)	(.11)
Advanced Math	0.02	0.01	-0.06	-0.06	0.10	0.09	0.06	0.05
	(.08)	(.08)	(.06)	(.06)	(.09)	(.09)	(.08)	(.08)
Perceived Ethnic Incongruence X First Time		-0.03		-0.11*		-0.01		-0.01
Algebra Takers		(.14)		(.05)		(.06)		(.07)
Perceived Ethnic Incongruence X Algebra		-0.08		-0.11		-0.07		-0.08
Repeaters		(.08)		(.09)		(.10)		(.09)
Perceived Ethnic Incongruence X Advanced Math		0.01		-0.06		0.01		0.01
		(.06)		(.04)		(.06)		(.06)

Note. * p<.05; **p<.01; ***p<.001; Algebra Succeeders were held as the reference group

Table 17

Results for Latino Students Testing the Association between Perceived Ethnic Incongruence and Math Course Sequence

Math Motivation	Math Competence		Math Belonging		Math Importance		Math Anxiety	
Parameter	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	3.64***	3.64***	3.81***	3.80***	3.53***	3.52***	2.56***	2.56***
	(.04)	(.04)	(.04)	(.04)	(.06)	(.06)	(.05)	(.05)
Female	-0.24***	-0.24***	-0.17***	-0.16***	-0.24***	-0.24***	0.34***	0.34***
	(.04)	(.04)	(.04)	(.04)	(.04)	(.04)	(.05)	(.05)
School Free Reduced Lunch Percent	-0.24	-0.24	-0.30*	-0.28*	0.14	0.14	0.40*	0.40*
	(.20)	(.20)	(.14)	(.14)	(.20)	(.20)	(.18)	(.18)
APSAI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Math Grade in 8th Grade	0.23***	0.23***	0.11***	0.12***	0.18***	0.18***	-0.22***	-0.22***
	(.03)	(.03)	(.02)	(.02)	(.03)	(.03)	(.03)	(.03)
Parent Level of Education	-0.01	-0.01	-0.03*	-0.03*	-0.06***	-0.06***	0.00	0.00
	(.02)	(.02)	(.01)	(.01)	(.02)	(.02)	(.01)	(.01)
School Diversity	-0.14	-0.13	0.14	0.13	0.53	0.54*	-0.73*	-0.72*
	(.27)	(.27)	(.31)	(.30)	(.27)	(.27)	(.34)	(.34)
Objective Same Ethnic Peers in School	0.09	0.10	0.46	0.44	0.39	0.40	-0.65	-0.64
	(.28)	(.28)	(.32)	(.31)	(.29)	(.29)	(.34)	(.34)
Perceived Ethnic Incongruence	0.05**	0.05	0.05**	0.02	-0.01	-0.04	-0.04	-0.04
	(.02)	(.03)	(.02)	(.02)	(.03)	(.04)	(.02)	(.04)
First Time Algebra Takers	-0.11	-0.11	-0.09	-0.09	-0.15*	-0.15*	0.00	-0.01
	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.05)	(.05)
Algebra Repeaters	0.21**	0.21**	0.02	0.02	0.05	0.06	-0.34***	-0.33***
	(.08)	(.07)	(.07)	(.07)	(.08)	(.08)	(.08)	(.08)
Advanced Math	0.30**	0.31***	0.04	0.07	0.26**	0.26**	-0.11	-0.11
	(.09)	(.09)	(.07)	(.07)	(.09)	(.09)	(.11)	(.11)
Perceived Ethnic Incongruence X First Time		0.01		0.00		0.07		0.03
Algebra Takers		(.04)		(.03)		(.06)		(.05)
Perceived Ethnic Incongruence X Algebra		-0.02		0.09		0.02		-0.03
Repeaters		(.06)		(.06)		(.05)		(.06)
Perceived Ethnic Incongruence X Advanced Math		0.09		0.16*		0.03		-0.03
		(.07)		(.07)		(.08)		(.10)

Note. * p<.05; ** p<.01; *** p<.001; Algebra Succeeders were held as the reference group

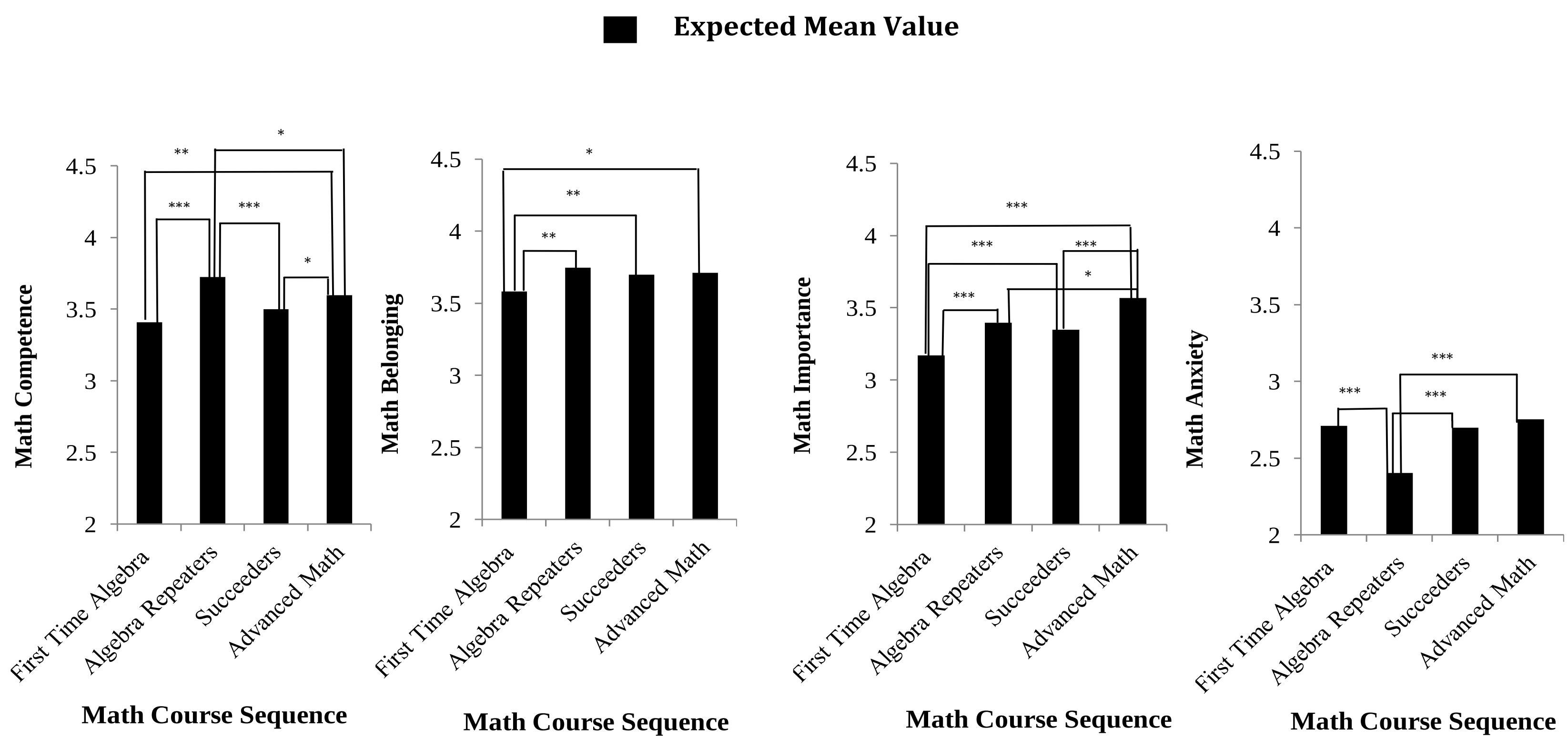

Figure 1.

The expected mean values of each math course sequence on math motivation outcomes controlling for perceived same ethnic peers in math

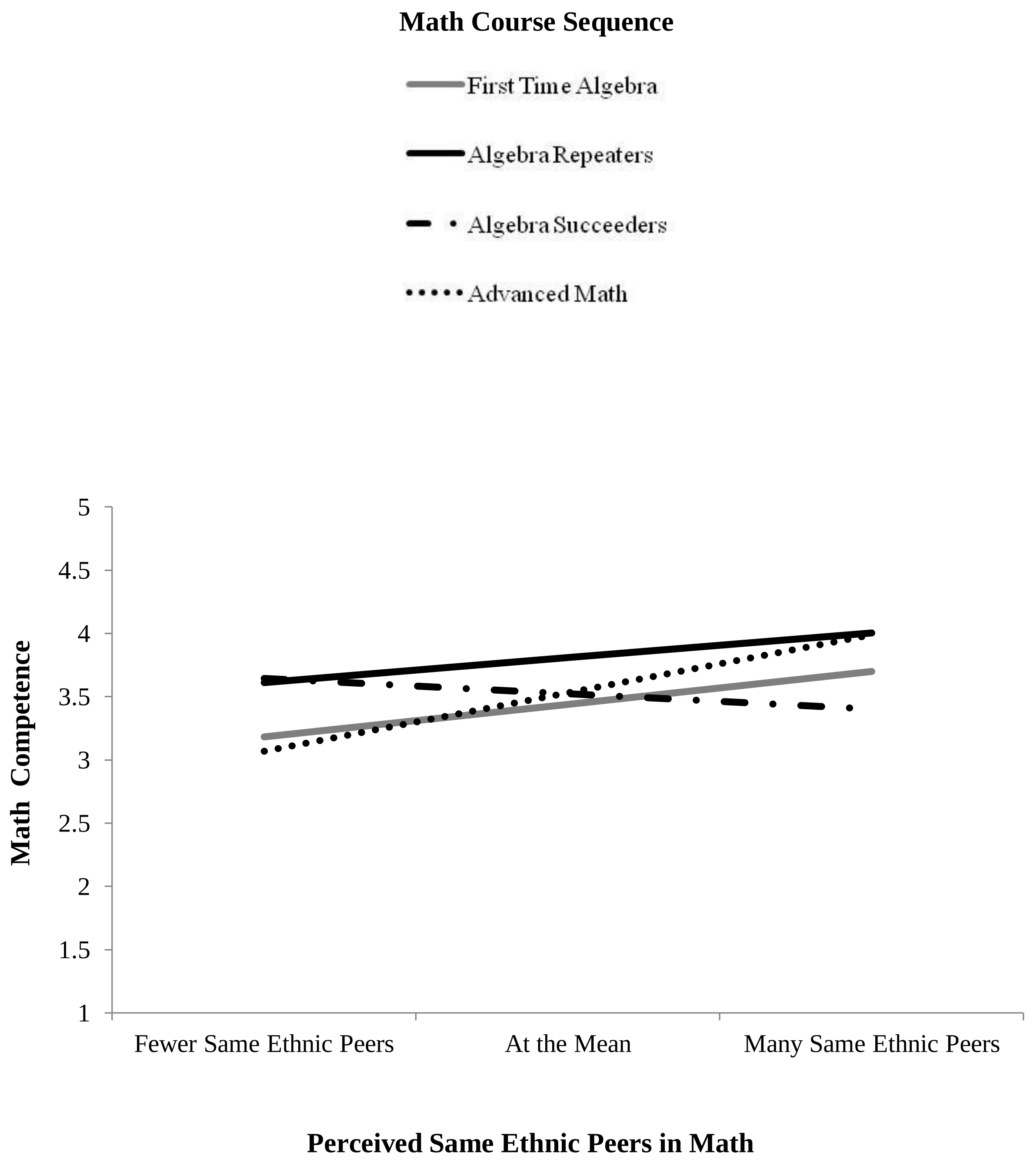

Figure 2.

The interaction between perceived school ethnic peers in math and ethnicity on Math Competence for White Students

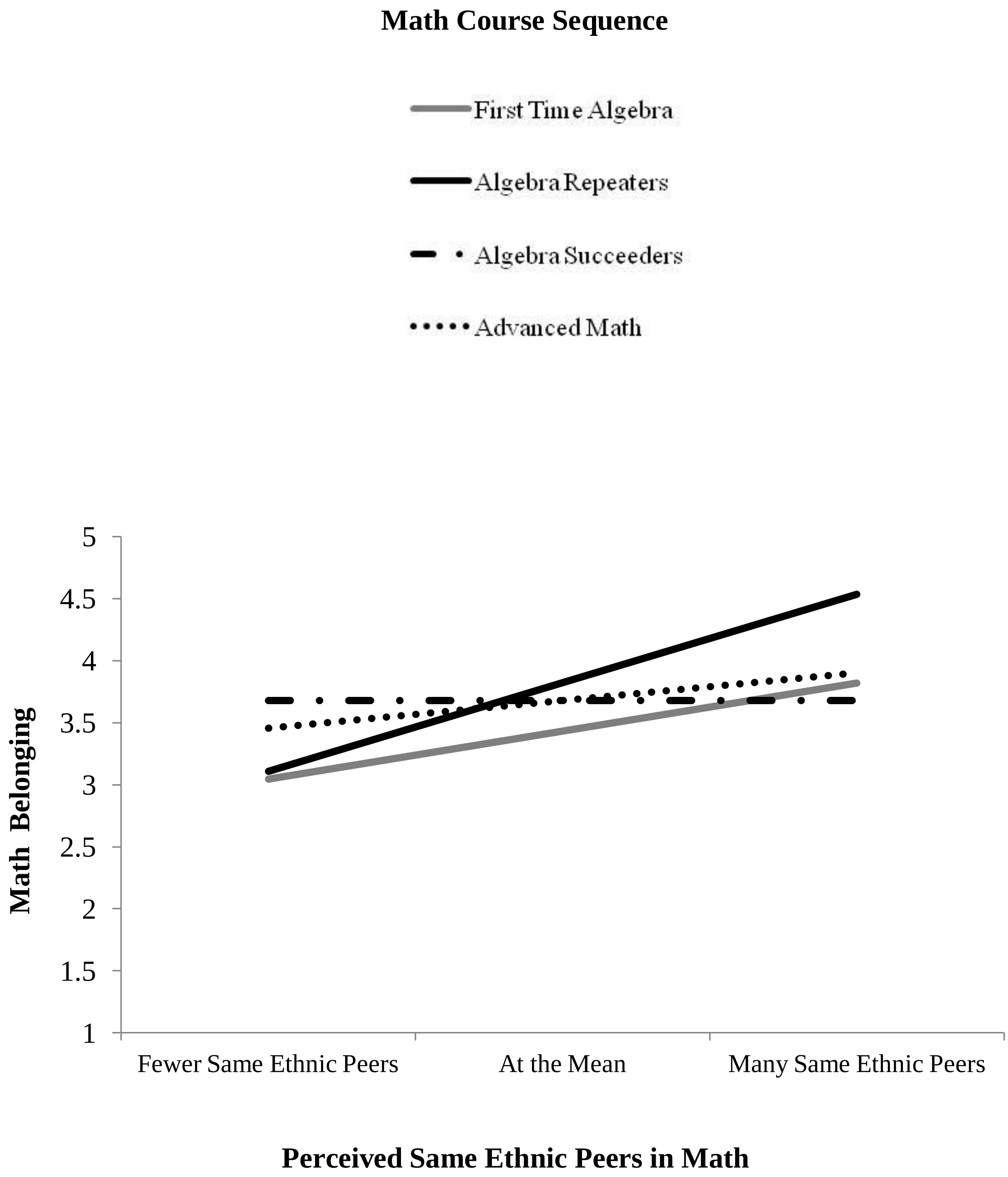

Figure 3.

The interaction between perceived school ethnic peers in math and ethnicity on Belonging in Math for White Students

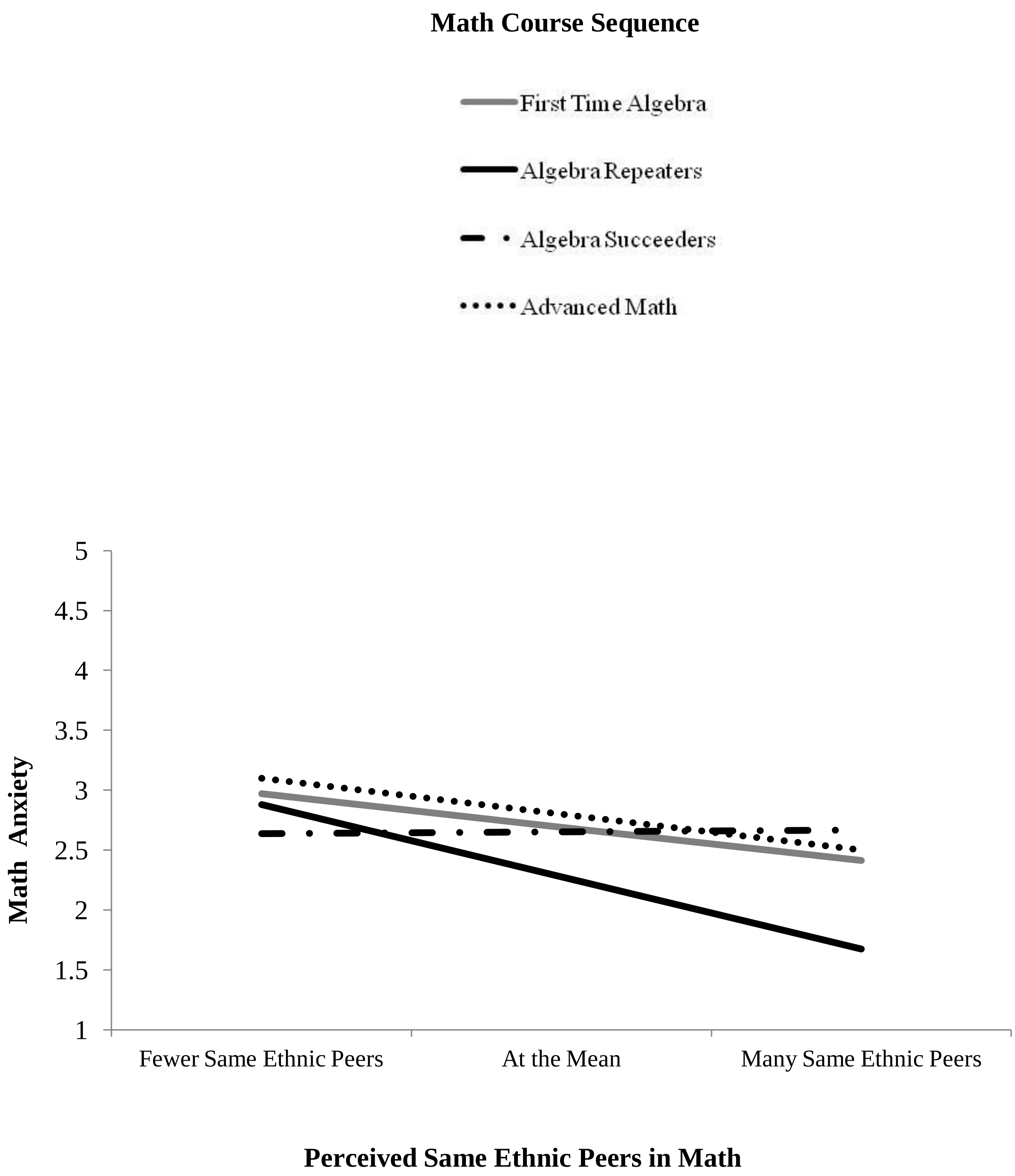

Figure 4.

The interaction between perceived school ethnic peers in math and ethnicity on Math Anxiety for White Students

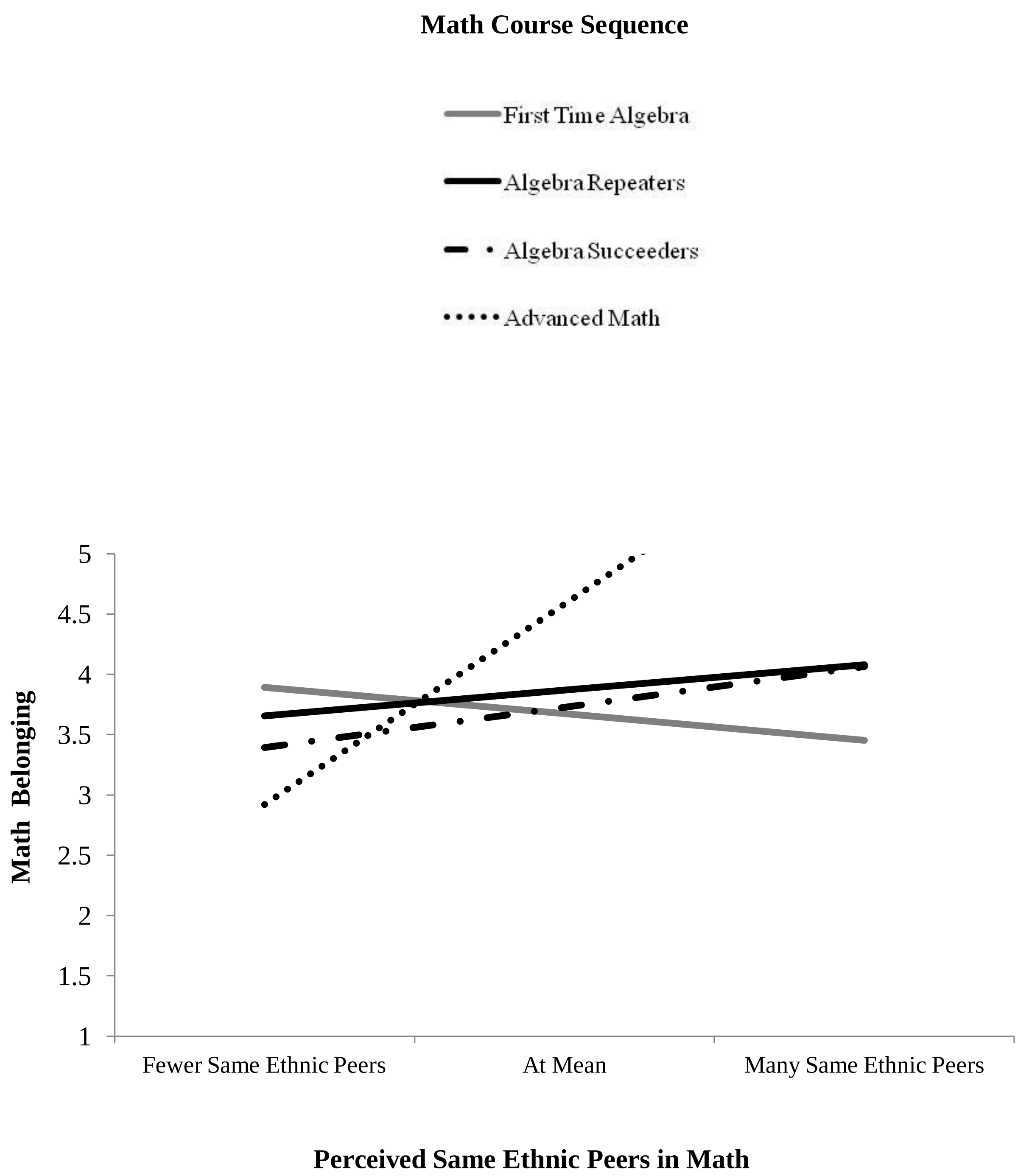

Figure 5.

The interaction between perceived school ethnic peers in math and ethnicity on Math Belonging for Black Students

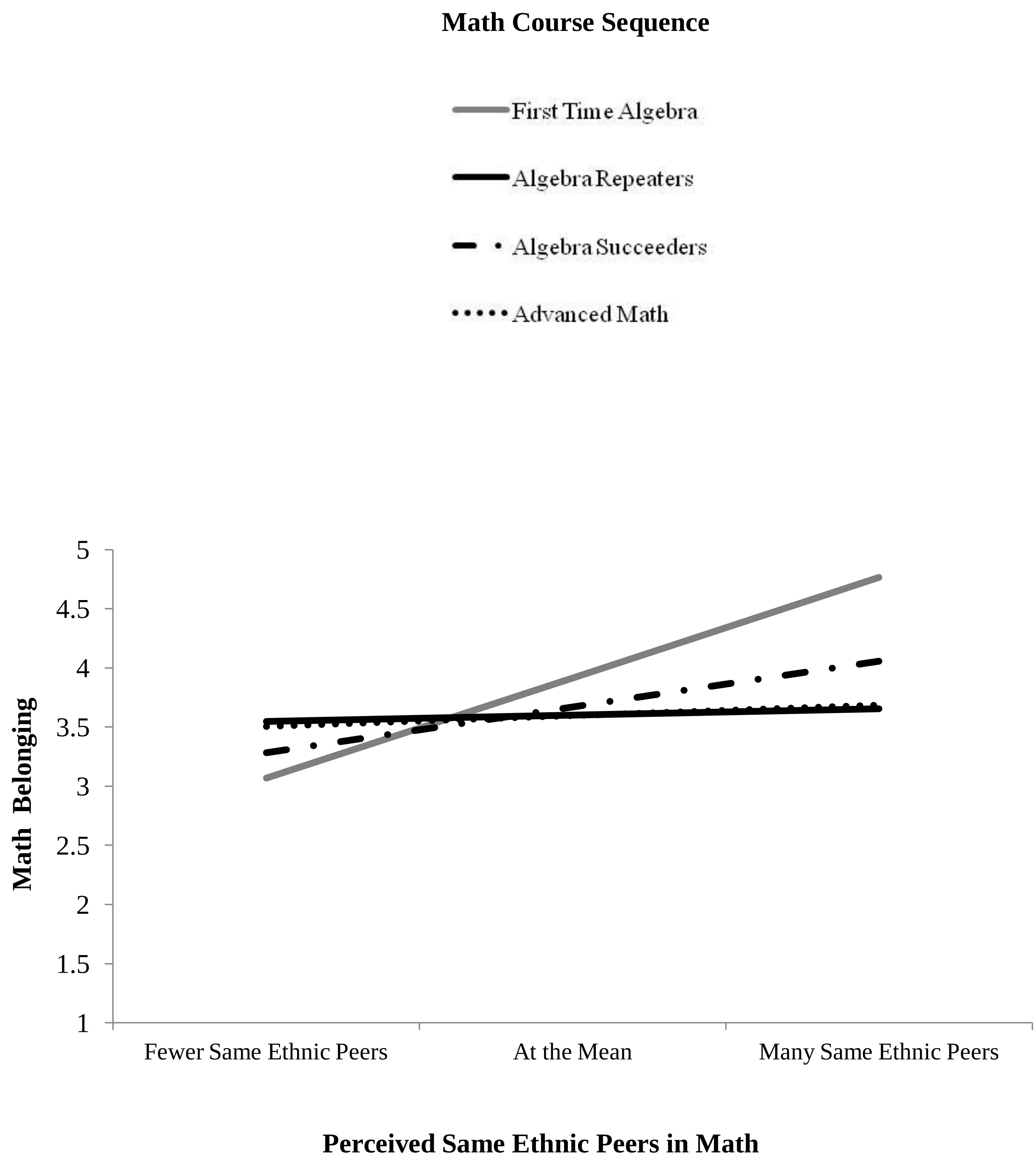

Figure 6.

The interaction between perceived school ethnic peers in math and ethnicity on Belonging in Math for Asian Students

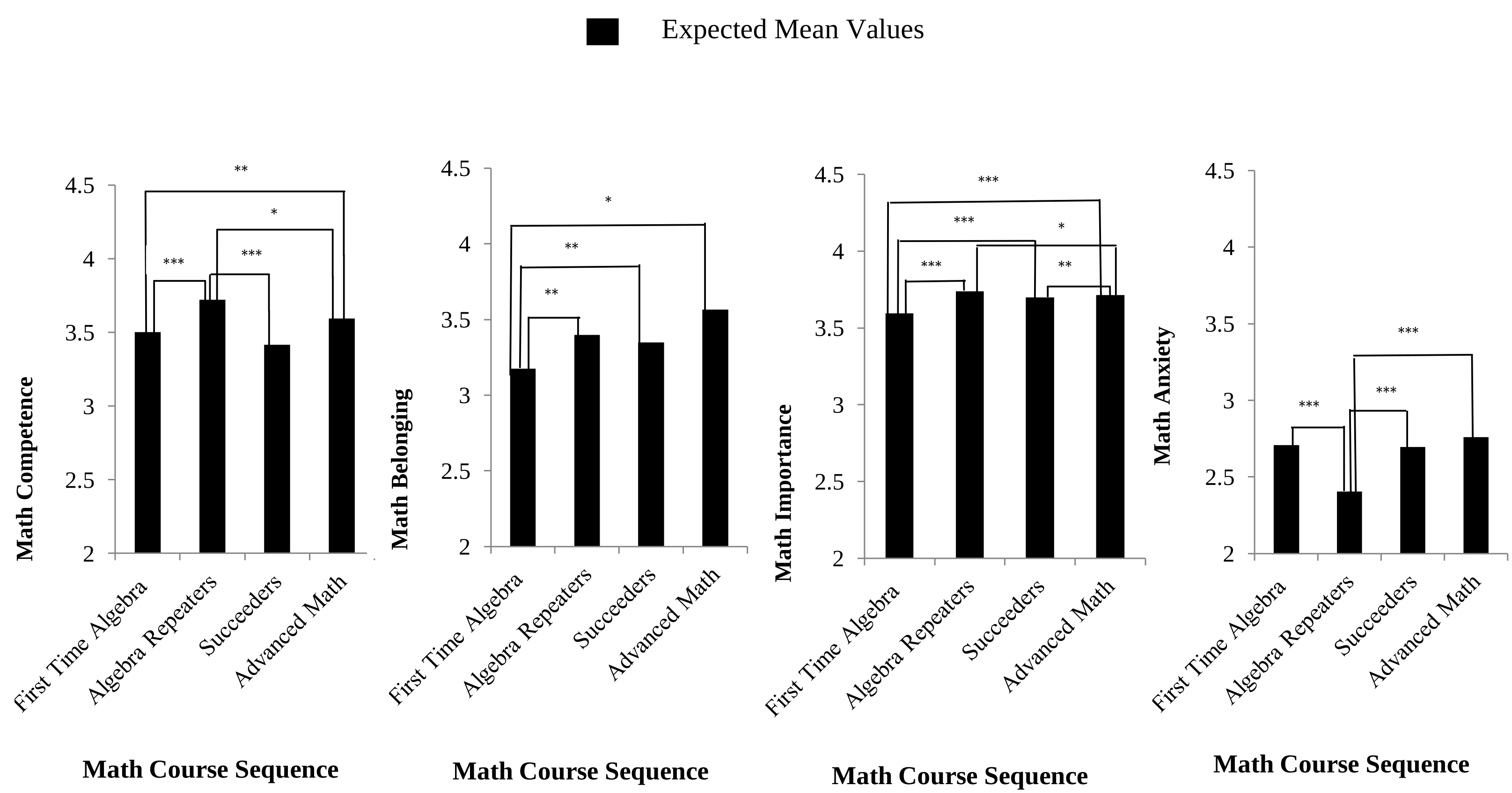

Figure 7.

The expected mean values of each math course sequence on math motivation outcomes controlling for perceived ethnic incongruence

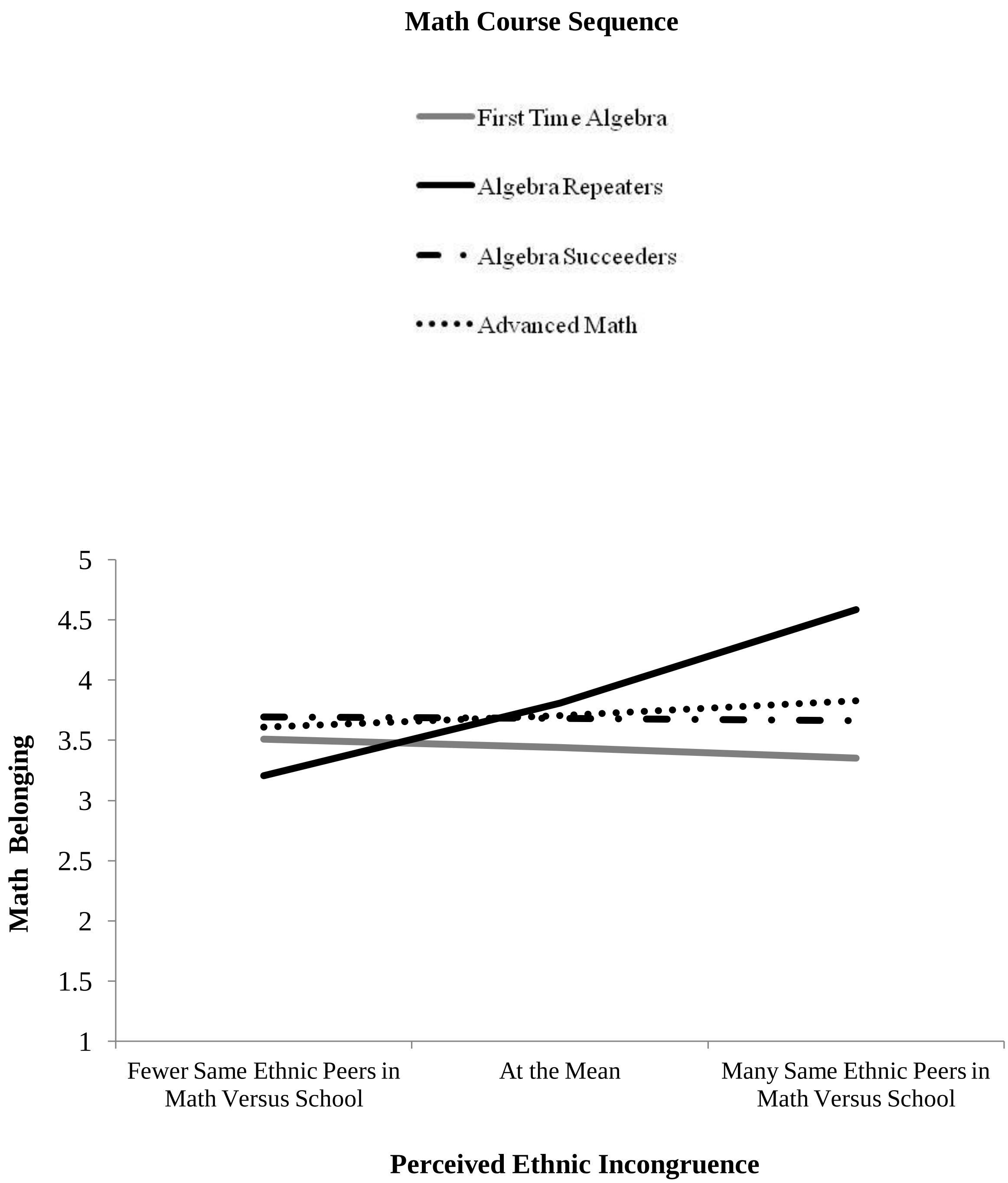

Figure 8.

The interaction between perceived incongruence in the number of same ethnic peers in math compared to the school and ethnicity on Belonging in Math for White Students

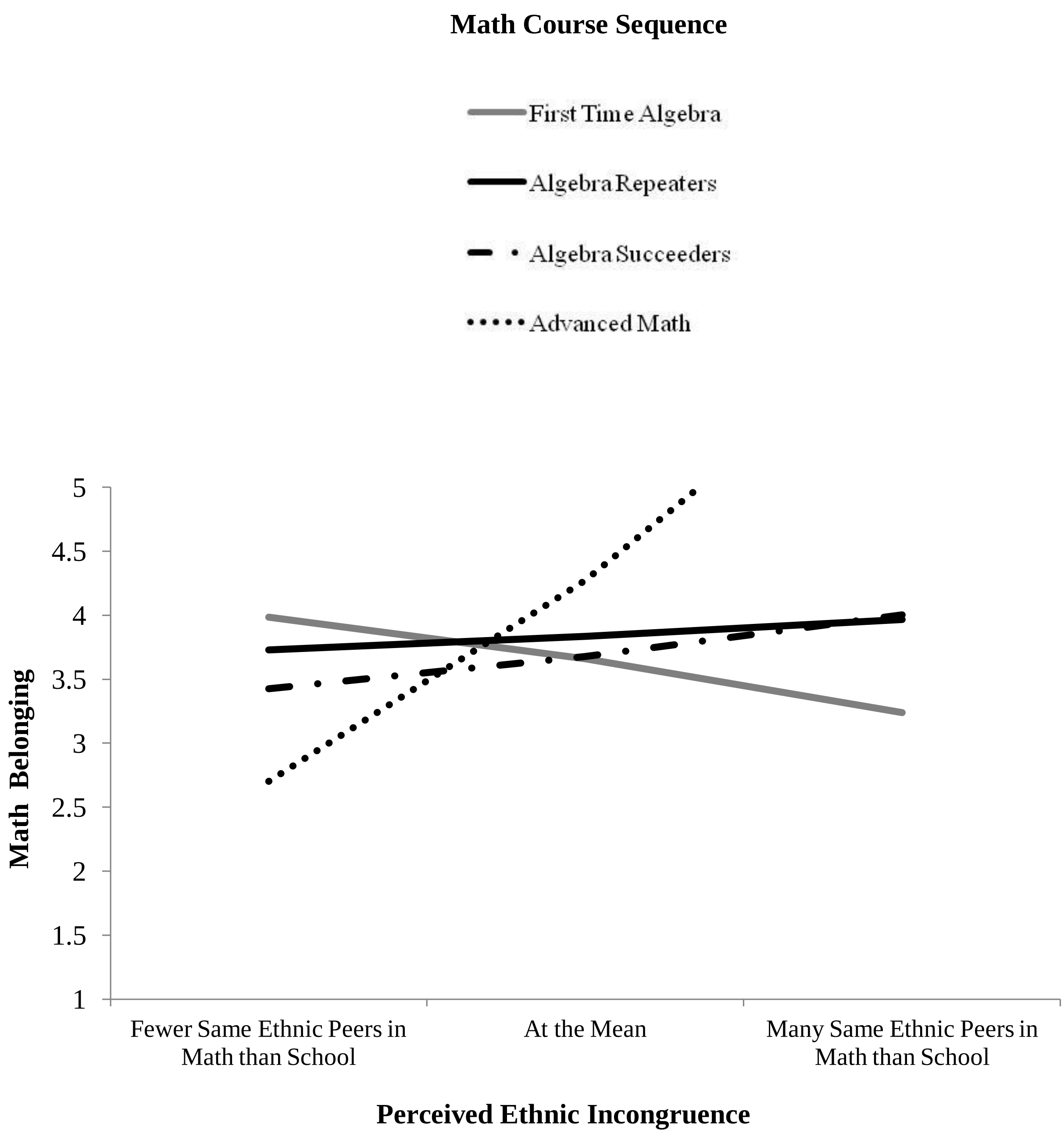

Figure 9.

The interaction between perceived incongruence in the number of same ethnic peers in math compared to the school and ethnicity on Math Belonging for Black Students

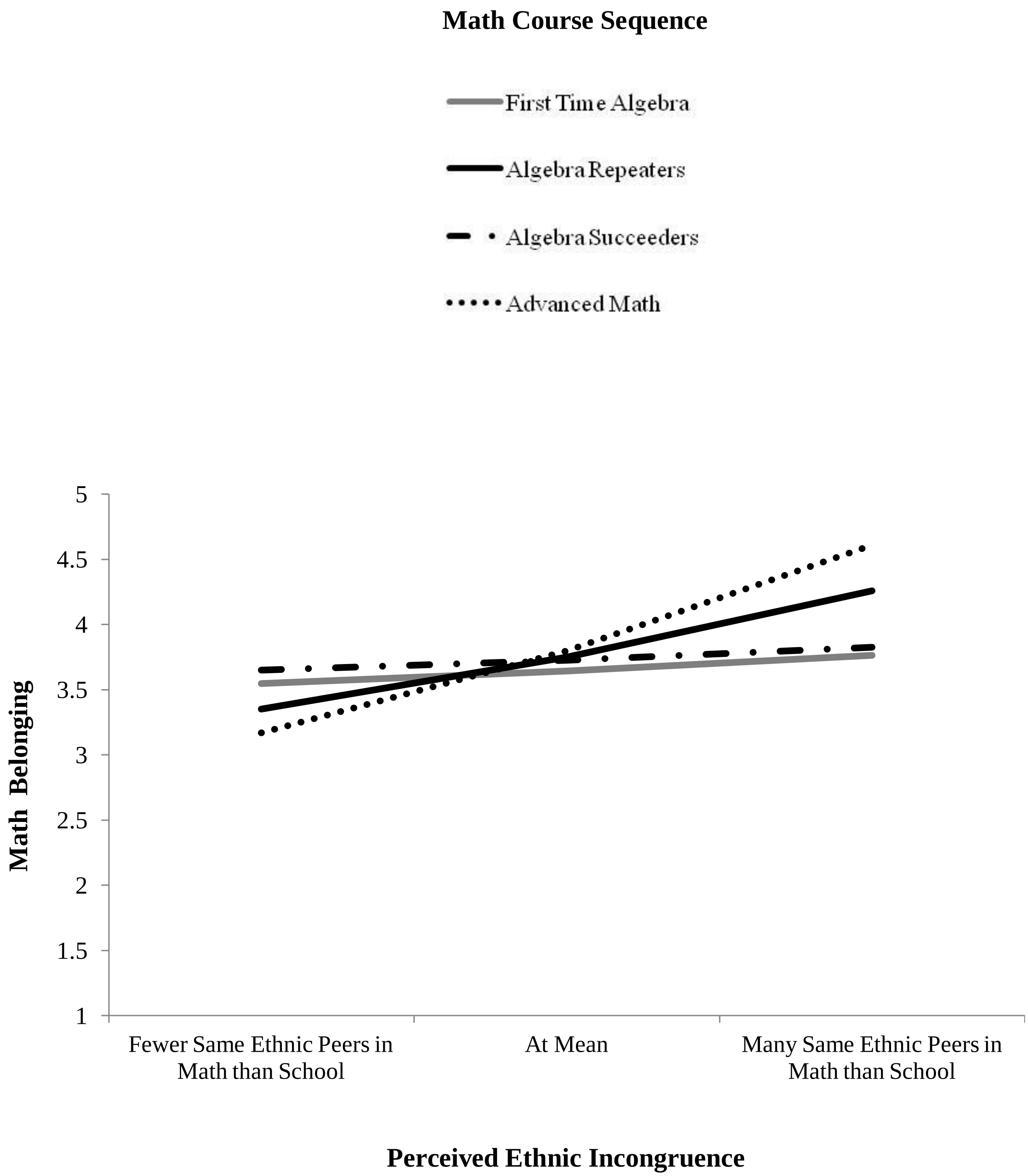

Figure 10.

The interaction between perceived incongruence in the number of same ethnic peers in math compared to the school and math course sequence on Math Belonging for Latino Students

Appendix A

Attitudes Toward Math Questionnaire

So far, we have asked you about your opinions about school in general, about teachers, and about your relationships with your classmates. Now we have some questions about academic subjects. We are particularly interested in your experiences with math in high school (e.g., pre-algebra, algebra, and geometry)

Please write which MATH class you are taking this year, in the 9th grade.

Please answer the following about your attitudes toward MATH:

	NO WAY!	No	Sort of	Yes	FOR SURE YES!
1. I feel stressed out during math class.	`	`	`	`	`
2. I solve math problems without too much difficulty.	`	`	`	`	`
3. I try to say as little as possible in my math class.	`	`	`	`	`
4. Math is one of the most important subjects a person can study.	`	`	`	`	`
5. High school math is helpful no matter what job I have.	`	`	`	`	`
6. Studying math makes me feel nervous.	`	`	`	`	`
7. I feel like I fit in with other students in my math class.	`	`	`	`	`
8. Math is boring.	`	`	`	`	`
9. I have good friends in my math class.	`	`	`	`	`
10. I want to take as much math as I can when I'm in school.	`	`	`	`	`
11. I feel comfortable in math class.	`	`	`	`	`
12. I often feel left out in math class.	`	`	`	`	`
13. My math teacher thinks I understand math well.	`	`	`	`	`
14. My math teacher helps me when I have difficulty in math class.	`	`	`	`	`
15. I only take math because I have to.	`	`	`	`	`
16. I'm good at math.	`	`	`	`	`
17. I feel like nobody pays attention to me in my math class.	`	`	`	`	`
18. I feel respected in math class.	`	`	`	`	`

Appendix B

Mean 8th Grade Math Grades split by Math Course Sequence and Ethnicity

	Ethnicity							
Math Course Sequence	White Students' Grades		Asian Students' Grades		Black Students' Grades		Latino Students' Grades	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
First Time Taking Algebra	2.53	1.07	2.62	1.09	2.53	1.05	2.46	1.01
Algebra Repeaters	1.95	0.93	2.41	1.03	1.47	0.96	1.63	1.08
Algebra Succeeders	3.15	0.74	3.35	0.71	2.85	0.92	2.87	0.88
Advanced Math	3.58	0.52	3.61	0.53	3.29	0.81	3.42	0.6

Appendix C

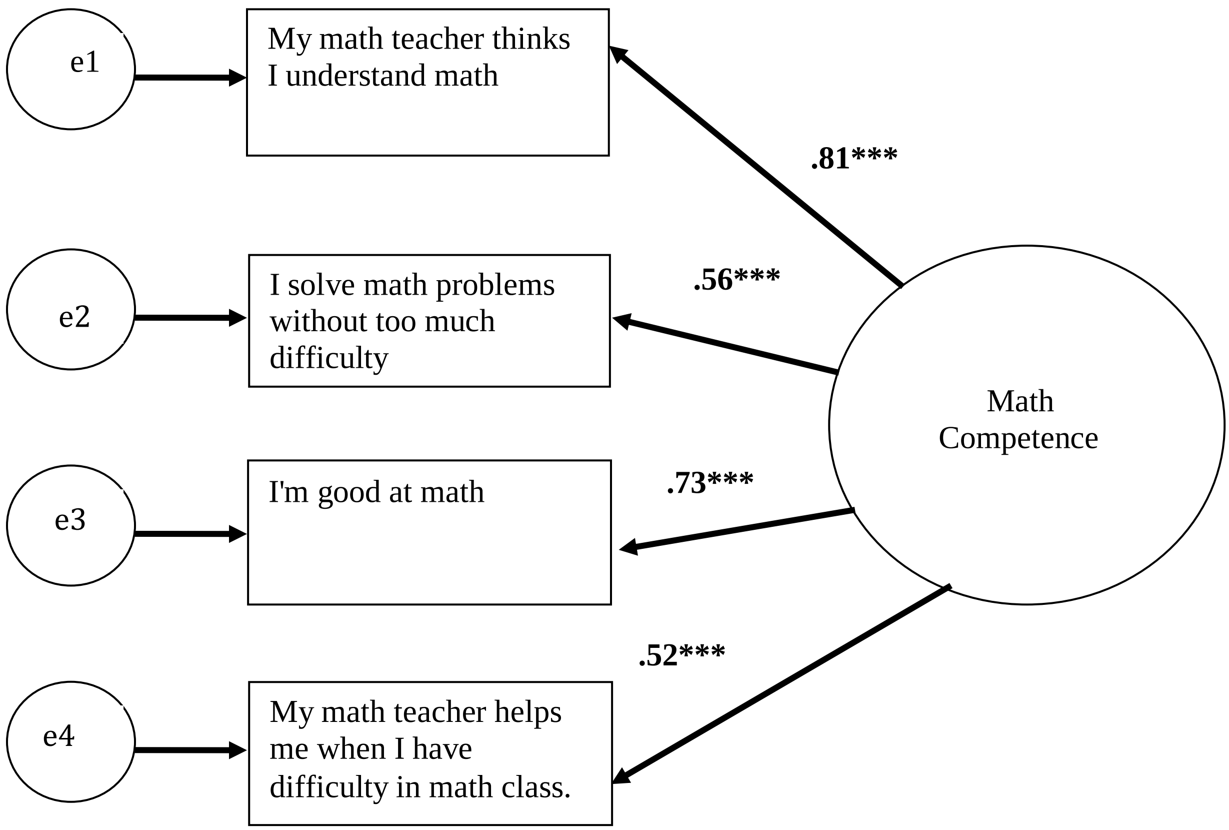

Figure C1. CFA one factor standardized path coefficients for Math Competence made up of Four Items.
*p>05, **p>.01, ***p>.001

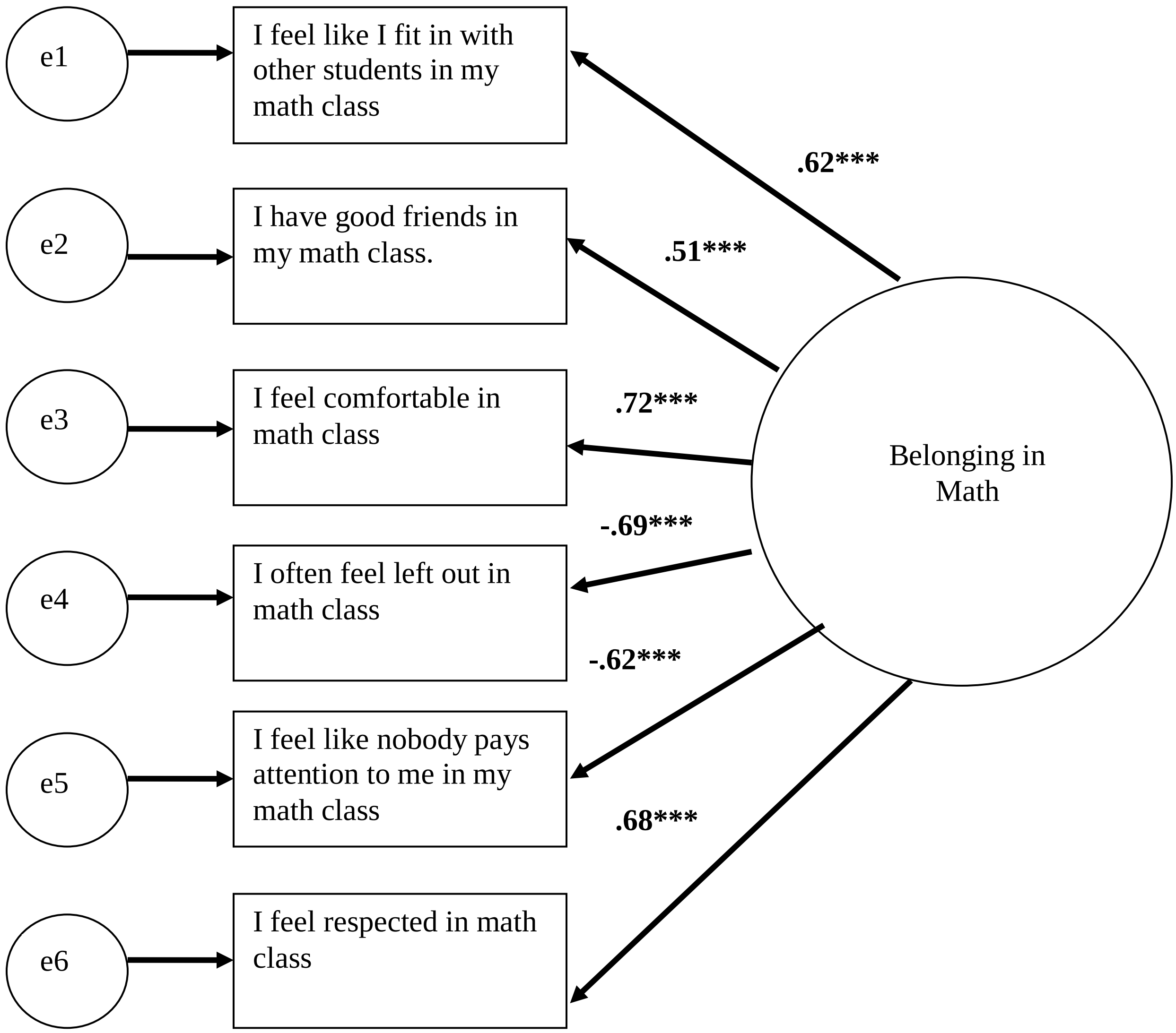

Figure C2. CFA one factor standardized path coefficients for Belonging in Math made up of six items.
*p>05, **p>.01, ***p>.001

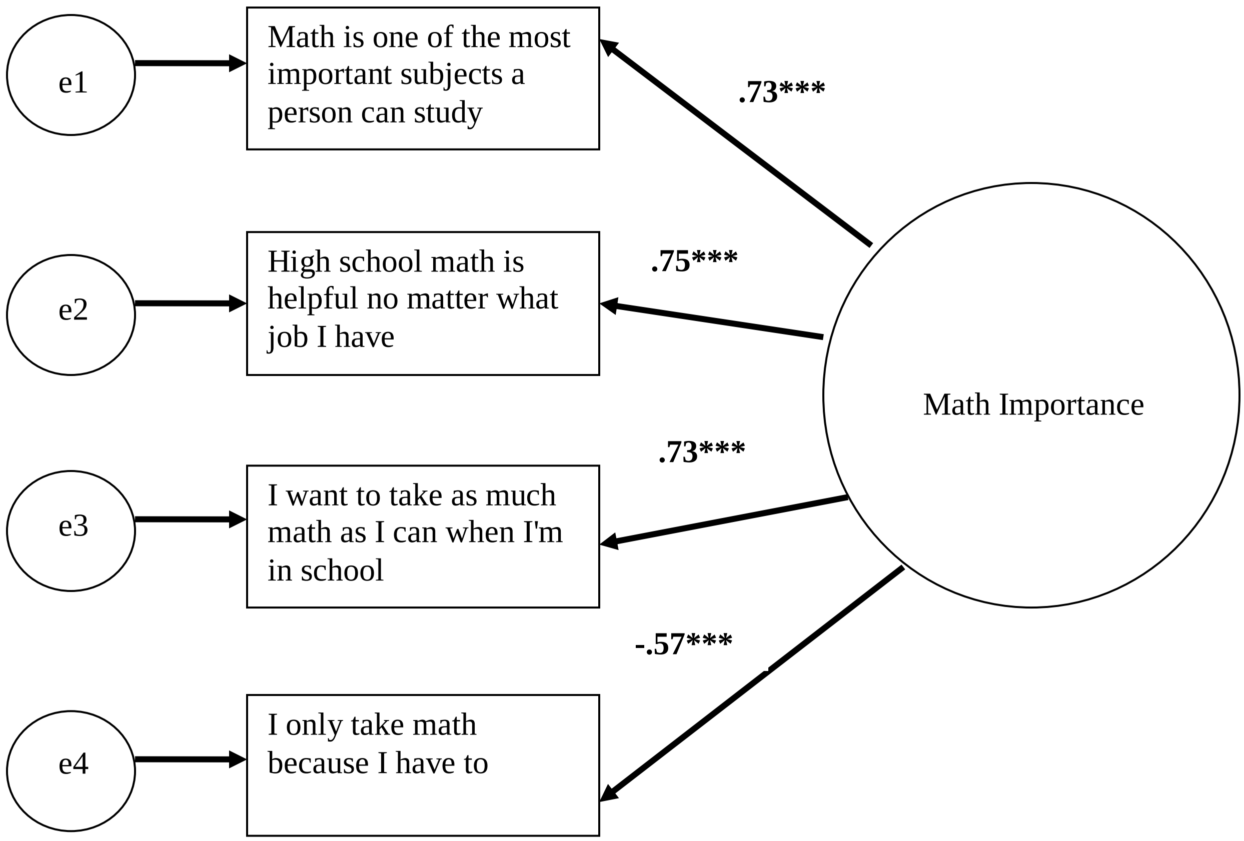

Figure C3. CFA one factor standardized path coefficients for Math Importance made up of four items. The fifth item was removed due to poor model fit.
**p*>05, ***p*>.01, ****p*>.001

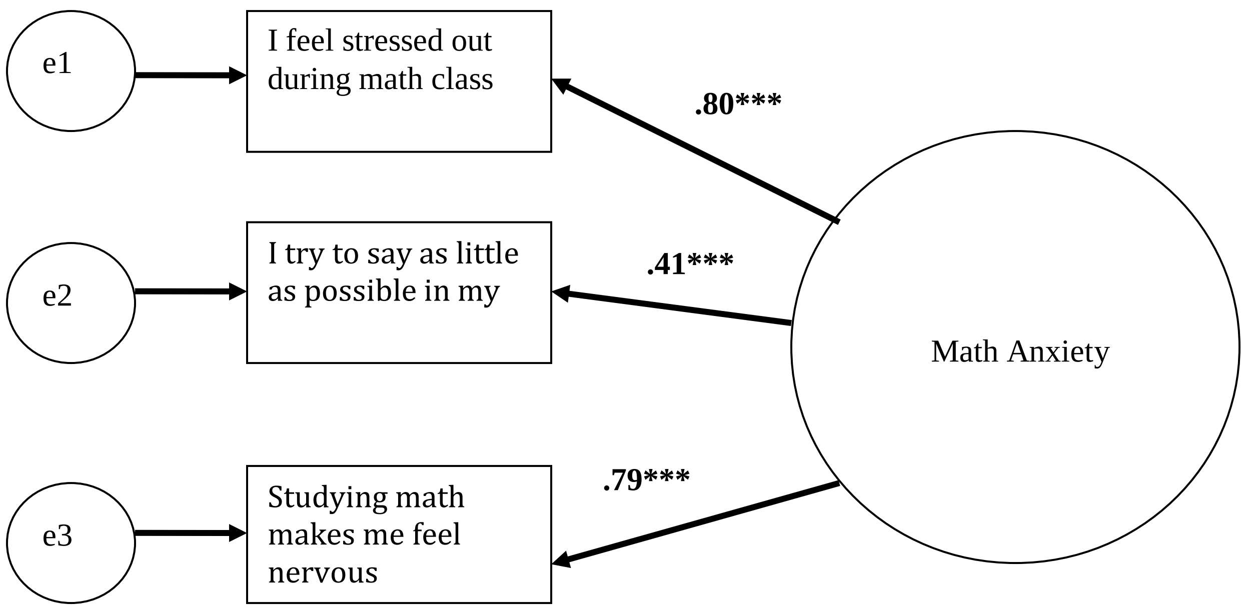

Figure C4. CFA one factor standardized path coefficients for Math Anxiety made up of three items.
**p*>05, ***p*>.01, ****p*>.001

Appendix D

Expected Mean Values and Standard Deviations of Math Course Sequence and Ethnicity on Math Motivation Outcomes

Math Motivation	Math Competence				Math Belonging				Math Importance				Math Anxiety			
	Ethnicity															
Math Course Sequence	W *M* (*SD*)	B *M* (*SD*)	A *M* (*SD*)	L *M* (*SD*)	W *M* (*SD*)	B *M* (*SD*)	A *M* (*SD*)	L *M* (*SD*)	W *M* (*SD*)	B *M* (*SD*)	A *M* (*SD*)	L *M* (*SD*)	W *M* (*SD*)	B *M* (*SD*)	A *M* (*SD*)	L *M* (*SD*)
First Time Algebra	3.36 (.82)	3.44 (.76)	3.46 (.70)	3.32 (.80)	3.38 (.72)	3.68 (.66)	3.61 (.50)	3.63 (.69)	2.71 (.87)	3.04 (.81)	3.22 (.65)	3.20 (.84)	2.76 (.96)	2.66 (.82)	2.62 (.67)	2.79 (.92)
Algebra Repeaters	3.60 (.87)	3.64 (.80)	3.43 (.83)	3.52 (.76)	3.64 (.76)	3.75 (.76)	3.48 (.80)	3.66 (.67)	2.96 (.92)	3.33 (.80)	3.11 (.90)	3.27 (.79)	2.49 (.95)	2.49 (.91)	2.56 (.84)	2.61 (.89)
Algebra Succeeders	3.54 (.77)	3.63 (.88)	3.50 (.71)	3.52 (.79)	3.70 (.65)	3.68 (.83)	3.63 (.67)	3.75 (.67)	3.06 (.89)	3.34 (.84)	3.29 (.81)	3.42 (.83)	2.62 (.85)	2.53 (.96)	2.69 (.76)	2.71 (.87)
Advanced Math	3.69 (.69)	4.02 (.53)	3.61 (.67)	3.86 (.81)	3.77 (.62)	3.96 (.79)	3.62 (.63)	3.86 (.56)	3.41 (.90)	3.57 (.88)	3.47 (.80)	3.75 (.84)	2.65 (.91)	2.23 (.69)	2.73 (.81)	2.47 (.84)

Note. W = White; B = Black; A = Asian; L = Latino

References

Adelman, C. (1998). *Women and Men of the Engineering Path: A Model for Analyses of Undergraduate Careers*. US Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

Allison, P.D., 2012. *Handling missing data by maximum likelihood*. In: SAS Global Forum: Statistics and Data Analysis. Statistical Horizons

Arbuckle, J.L. (1996). Full information estimation in the presence of incomplete data. In G.A. *Marcoulides & R.E. Schumacker (Eds.*): Advanced structural equation modeling: Issues and techniques (pp. 243- 277). Mahwah NJ: Erlbaum.

Barber, B. K., & Olsen, J. A. (2004). Assessing the transitions to middle and high school. *Journal of Adolescent Research*, *19*(1), 3-30. doi: 10.1177/0743558403258113

Barone, C., Aguirre-Deandreis, A. I., & Trickett, E. J. (1991). Means—ends problem-solving skills, life stress, and social support as mediators of adjustment in the normative transition to high school. *American Journal of Community Psychology*, *19*(2), 207-225. doi: 10.1007/BF00937928

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as fundamental human motivation. *Psychological Bulletin, 117(3)*, 497–529. doi: 10.1037/0033-2909.117.3.497

Benner, A. D. (2011). The transition to high school: Current knowledge, future directions. *Educational Psychology Review*, *23*(3), 299-328. doi: 10.1007/s10648-011-9152-0

Benner, A. D., & Graham, S. (2009). The transition to high school as a developmental process among multiethnic urban youth. *Child Development*, *80*(2), 356-376. doi: 10.1111/j.1467-8624.2009.01265.x

Bentler, P.M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107, 238-246. doi: 10.1037/0033-2909.107.2.238

Boaler, J., & Greeno, J. G. (2000). Identity, agency, and knowing in mathematics worlds. *Multiple perspectives on mathematics teaching and learning*. In J. Boaler (Ed.), Multiple perspectives on mathematics teaching and learning (pp. 171-200). Westport, CT: Ablex.

Brody, L. E., & Benbow, C. P. (1990). Effects of high school coursework and time on SAT scores. *Journal of Educational Psychology*, *82*(4), 866. doi: 10.1037/0022-0663.82.4.866

California Department of Education. (2003). *STAR 2003 test results*. [2003 STAR] Retrieved from http://star.cde.ca.gov/

California Department of Education. (2011). *STAR 2011 test results*. [2011 STAR] Retrieved from http://star.cde.ca.gov/

California Department of Education (2013). *STAR 2013 test results*. [2013 STAR] Retrieved from http://star.cde.ca.gov/

California Department of Education (2016). *Mathematics graduation requirements: Minimum graduation requirements for mathematics*. Retrieved from http://www.cde.ca.gov/ci/gs/hs/hsgrmath.asp

Chen, X., & Graham, S. (2015). Cross-Ethnic Friendships and Intergroup Attitudes Among Asian American Adolescents. *Child Development*, *86*(3), 749-764. doi: 10.1111/cdev.12339

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2012). *The aftermath of accelerating algebra:*

Evidence from a district policy initiative (No. w18161). National Bureau of Economic Research.

Cochran, W.G. (1952). The χ 2 test of goodness of fit. *Annals of Mathematical Statistics*, *23*, 315-345. Retrieved from http://www.jstor.org/stable/2236678

Currarini, S., Jackson, M. O., & Pin, P. (2010). Identifying the roles of race-based choice and chance in high school friendship network formation. *Proceedings of the National Academy of Sciences*, *107*(11), 4857-4861. doi: 10.1073/pnas.0911793107

Danbold, F., & Huo, Y. J. (2015). No longer "All-American"? Whites' defensive reactions to their numerical decline. *Social Psychological and Personality Science*, *6*(2), 210-218. doi:10.1177/1948550614546355

Davidson, A. L. (1996). *Making and molding identity in schools: Student narratives on race, gender, and academic engagement*. Albany, NY: SUNY Press.

Domina, T. (2014). The link between middle school mathematics course placement and achievement. *Child development*, *85*(5), 1948-1964. doi: 10.1111/cdev.12255

Domina, T., McEachin, A., Penner, A., Penner, E. (2014). Aiming high and falling short California's eighth-grade algebra-for-all effort. *Educational Evaluation and Policy Analysis*, 1-21. doi: 10.3102/0162373714543685

Eccles, J. S., & Roeser, R. W. (2009). *Schools, academic motivation, and stage-environment fit.* In R. M. Lerner & L. Steinberg (Eds.), Handbook of adolescent psychology: Vol. 1 (3rd ed., pp. 404 – 434). Hoboken, NJ: Wiley.

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, *21*(1), 225-241. doi: 10.1111/j.1532-7795.2010.00725.

Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: a meta-analysis. *Psychological bulletin*, *136*(1), 103-127. doi: 10.1037/a0018053

Else-Quest, N. M., Mineo, C. C., & Higgins, A. (2013). Math and science attitudes and achievement at the intersection of gender and ethnicity. *Psychology of Women Quarterly, 37*(3), 293-309. doi:10.1177/0361684313480694

Enders, C. K. (2010). *Applied missing data analysis*. Guilford Press.

Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: a new look at an old issue. *Psychological Methods, 12*(2), 121. doi: 10.1037/1082-989X.12.2.121

Finkelstein, N., Fong, A., Tiffany-Morales, J., Shields, P., & Huang, M. (2012). *College bound in middle school and high school? How math course sequences matter.* Sacramento, CA: The Center for the Future of Teaching and Learning at WestEd.

Fong, A. B., Jaquet, K., & Finkelstein, N. (2014). *Who repeats algebra I, and how does initial performance relate to improvement when the course is repeated?* (REL 2015–059). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory West. Retrieved from http://ies.ed.gov/ncee/edlabs.

Gamoran, A., & Hannigan, E. C. (2000). Algebra for everyone? Benefits of college-preparatory mathematics for students with diverse abilities in early secondary school. *Educational Evaluation and Policy Analysis*, *22*(3), 241-254. doi: 10.3102/01623737022003241

Gándara, P. C., & Aldana, U. S. (2014). Who’s segregated now? Latinos, language, and the future of integrated schools. *Educational Administration Quarterly*, *50*(5), 735-748. doi: 10.1177/0013161X14549957

Gillen-O'Neel, C., & Fuligni, A. (2013). A longitudinal study of school belonging and academic motivation across high school. *Child Development*, *84(1)*, 678-692. doi: 10.1111/j.1467-8624.2012.01862.x

Graham, S., & Morales-Chicas, J. (2015). The ethnic context and attitudes toward 9th grade math. *International Journal of Educational Psychology*, *4*(1), 1-32. doi: 10.4471/ijep.2015.01

Graham, S., Taylor, A., & Ho, A. (2009). Race and ethnicity in peer relations research. In K. Rubin, W. Bukowski, & B. Laursen, (Eds.), *Handbook of peer interaction, relationships, and groups* (pp. 394-413). New York: Guilford Press.

Graham, S., & Weiner, B. (2011). Theories and principles of motivation. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 63784). New York: Simon & Schuster Macmillan.Graham, S., & Weiner, B. (2011). Motivation: Past, present, future. In K. Harris, S. Graham, &T. Urdan (Eds), *APA Educational Psychology Handbook* (Volume 1, pp. 367-397). Washington, D.C.: American Psychological Association.

Guo, J., Marsh, H. W., Parker, P. D., Morin, A. J., & Yeung, A. S. (2015). Expectancy-value in mathematics, gender and socioeconomic background as predictors of achievement and aspirations: A multi-cohort study. *Learning and Individual Differences*, 37, 161-168. doi: 10.1016/j.lindif.2015.01.008

Hamm, J. V., & Faircloth, B. S. (2005). Peer context of mathematics classroom belonging in adolescence. *The Journal of Early Adolescence*, *25*(3), 345-366. doi: 10.1177/0272431605276932

Hu, L-T, & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55. doi: 10.1080/10705519909540118

Kelly S. P. (2008). Social class and tracking within schools. In Weis L. (Ed.), *The way class works: Readings on school, family, and the economy* (pp. 210–224). New York, NY: Routledge.

Kitchen, R. S. (2005). Making equity and multiculturalism explicit to transform mathematics education. In A. J. Rodriguez & R. S. Kitchen (Eds.), Preparing mathematics and science teachers for diverse classrooms: promising strategies for transformative pedagogy (pp. 33–60). New York, USA: Lawrence Erlbaum Associates.

Knifsend, C. A., & Juvonen, J. (2014). Social identity complexity, cross-ethnic friendships, and intergroup attitudes in urban middle schools. *Child development*, *85*(2), 709-721. doi: 10.1111/cdev.12157

Langenkamp, A. G. (2010). Academic vulnerability and resilience during the transition to high school the role of social relationships and district context. *Sociology of Education*, *83*(1), 1-19. doi: 10.1177/0038040709356563

Liang, J. H., Heckman, P. E., & Abedi, J. (2012). What do the California standards test results reveal about the movement toward eighth-grade algebra for all?. *Educational Evaluation and Policy Analysis*, *34*(3), 328-343. doi: 10.3102/0162373712443307

Long, M., Conger, D., & Iatarola, P. (2012). Effects of high school course-taking on secondary and postsecondary success. *America Educational Research Journal, 49*, 285-322. doi: 10.3102/0002831211431952

Loveless, T. (2008). *The misplaced math student: Lost in eighth-grade algebra*. Washington, DC: Brookings Institute, Brown Center on Education Policy. Retrieved from http://www.brookings.edu/reports/2008/0922_education_loveless.aspx

Marsh, H.W., Hau, K.-T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's findings. *Structural Equation Modeling*, 11, 320-341.

Martin, D. B. (2012). Learning Mathematics While Black. *The Journal of Educational Foundations*, *26*(1/2), 47-66.

Martinez, M. (2014). *Motivational predictors of math course persistence*. Retrieved from ERIC database. (ED562785)

McClure, G. T. (1998). High school mathematics course taking and achievement among college-bound students: 1987–1996. *NASSP Bulletin*, 82, 110–118. Retrieved from: https://ohiostatepress.org/index.htm?journals/jhe/jhemain.htm

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual review of sociology*, 415-444.Retrived from http://www.jstor.org/stable/2678628

Mickelson, R. A., Bottia, M. C., & Lambert, R. (2013). Effects of school racial composition on k–12 mathematics outcomes a metaregression analysis. *Review of Educational Research*, *83*(1), 121-158. doi: 10.3102/0034654312475322

National Center for Education Statistics (2013). *Nation's report card*: *A first look: 2013* *mathematics and reading (NCES 2014-451)*. Institute of Education Sciences, U.S. Department of Education, Washington, D.C. Retrieved from http://nces.ed.gov/nationsreportcard/subject/publications/main2013/pdf/2014451.pdf

Oakes, J. (2005). *Keeping track: How schools structure inequality, Second Edition*. New Haven: Yale University Press.

Oakes, J. (2008). Keeping track: Structuring equality and inequality in an era of accountability. *The Teachers College Record*, *110*(3), 700-712. Retrieved from http://tcrecord.org

Oakes, J. & Others (1990). *Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science*. Santa Monica, CA: The RAND Corporation.

Orfield, G. (2014). Tenth annual brown lecture in education research a new civil rights agenda for american education. *Educational Researcher, 43*(6), 273-292. doi: 10.3102/0013189X14547874

Ornelas, A., & Solorzano, D. G. (2004). A critical race analysis of Latina/o and African American advanced placement enrollment in public high schools. *The High School Journal, 87*(3), 15-26. doi: 10.1353/hsj.2004.0003

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). Sage.

Rice, L., Barth, J. M., Guadagno, R. E., Smith, G. P., & McCallum, D. M. (2013). The role of social support in students' perceived abilities and attitudes toward math and science. *Journal of youth and adolescence, 42*(7), 1028-1040. doi: 10.1007/s10964-012-9801-8

Riegle-Crumb, C., Farkas, G., & Muller, C. (2006). The role of gender and friendship in advanced course taking. *Sociology of Education*, *79*(3), 206-228. doi: 10.1177/003804070607900302

Riegle-Crumb, C., & Grodsky, E. (2010). Racial-ethnic differences at the intersection of math course-taking and achievement. *Sociology of Education*, *83*(3), 248-270. doi: 10.1177/0038040710375689

Ruby, M. B., Falk, C. F., Heine, S. J., Villa, C., & Silberstein, O. (2012). Not all collectivisms are equal: Opposing preferences for ideal affect between East Asians and Mexicans. *Emotion*, *12*(6), 1206. doi: 10.1037/a0029118

Rumberger, R. W., & Larson, K. A. (1998). Student mobility and the increased risk of high school dropout. *American Journal of Education*, *107(1)*, 1-35. Retrieved from http://www.press.uchicago.edu/ucp/journals/journal/aje.html

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*(2), 147–177. doi:10. 1037/1082-989X.7.2.147.

Schneider, B., Swanson, C. B., & Riegle-Crumb, C. (1997). Opportunities for learning: Course sequences and positional advantages. *Social Psychology of Education*, *2*(1), 25-53. doi: 10.1023/A:1009601517753

Segal, E. A., Gerdes, K. E., Mullins, J., Wagaman, M. A., & Androff, D. (2011). Social empathy attitudes: Do Latino students have more?. *Journal of Human Behavior in the Social Environment*, *21*(4), 438-454. doi: 10.1080/10911359.2011.566445

Seidman, E., Aber, J. L., Allen, L., & French, S. E. (1996). The impact of the transition to high school on the self-system and perceived social context of poor urban youth. *American Journal of Community Psychology*, *24*(4), 489-515. doi: 10.1007/BF02506794

Simpson, E. H. (1949, April 30). Measurement of diversity. *Nature*, 163, p. 688.

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. *The Journal of Educational Research*, *95*(6), 323-332. doi:10.1080/00220670209596607

Spielhagen, F. R. (2006). Closing the achievement gap in math: Considering eighth grade algebra for all students. *American Secondary Education*, 29-42. Retrieved from http://www.jstor.org/stable/41064581

Strutchens, M. E., & Silver, E. A. (2000). NAEP findings regarding race/ethnicity: Students performance, school experiences, and attitudes and beliefs. In E. A. Silver & P. A. Kenney (Eds.), *Results from the seventh mathematics assessment of the National Assessment of Educational Progress* (pp. 45-72). Reston, VA: National Council of Teachers of Mathematics.

Thijs, J., & Verkuyten, M. (2014). School ethnic diversity and students' interethnic relations. *British Journal of Educational Psychology*, *84*(1), 1-21. doi: 10.1111/bjep.12032

Thorndike-Christ, T. (1991). *Attitudes toward mathematics: Relationships to mathematics achievement, gender, mathematics course-taking plans, and career interests*. Bellingham, WA: Western Washington University. Retrieved from ERIC database. (ED347066).

Trytten, D. A., Lowe, A. W., & Walden, S. E. (2012). "Asians are good at math. What an awful stereotype": The Model Minority Stereotype's Impact on Asian American Engineering Students. *Journal of Engineering Education*,*101*(3), 439-468

Tyson, K. (2011). *Integration interrupted: Tracking, black students, & acting white after Brown*. New York: Oxford University Press.

Tyson, W., Lee, R., Borman, K. M., Hanson, M. A. (2007). Science, technology, engineering, and mathematics (stem) pathways: High school science and math coursework and postsecondary degree attainment. *Journal of Education for Students Placed at Risk, 12(3)*, 243-270. doi: 10.1080/10824660701601266

Van de Schoot, R., Lugtig, P., & Hox, J. (2012). A checklist for testing measurement invariance. *European Journal of Developmental Psychology*, *9*(4), 486-492. doi: 10.1080/17405629.2012.686740

Walker, E. N. (2007). Why aren't more minorities taking advanced math?. *Educational Leadership*, *65*(3), 48-53.

Walker, E. N., & McCoy, L. P. (1997). Student voices: African Americans and mathematics. In J. Trentacosta and M. J. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 34–45). Reston, VA: National Council of Teachers of Mathematics.

Walton, G. M., & Cohen, G. L. (2007). A question of belonging: race, social fit, and achievement. *Journal of Personality and Social Psychology*, *92*(1), 82-96. doi: 10.1037/0022-3514.92.1.82

Waterman, S. (2010). Pathways report: Dead ends and wrong turns on the path through algebra. *Palo Alto, CA: Noyce Foundation.* Retrieved on June, 18, 2014. Retrieved from http://www.nsd1.noycefdn.org/documents/Pathways_Report.pdf

Xenofontos, C. (2016). Teaching mathematics in culturally and linguistically diverse classrooms: greek-cypriot elementary teachers' reported practices and professional needs. *Journal of Urban Mathematics Education*,*9*(1). Retrieved from http://education.gsu.edu/JUME