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**The Dissertation Committee for Celeste Cleo Fernandez Certifies that this is the  
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**Contextualizing School Mobility: Investigating the Influence of  
Racially/Ethnically-Relevant Factors on Students' Mobility Experiences**

**Committee:**

Aprile Benner, Supervisor

Su Yeong Kim

Fatima Varner

Megan Kuhfeld

**Contextualizing School Mobility: Investigating the Influence of  
Racially/Ethnically-Relevant Factors on Students' Mobility Experiences**

**by**

**Celeste Cleo Fernandez**

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## **Abstract**

### **Contextualizing School Mobility: Investigating the Influence of Racially/Ethnically-Relevant Factors on Students' Mobility Experiences**

Celeste Cleo Fernandez, Ph.D.

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Supervisor: Aprile D. Benner

Understanding the impact of school mobility on student outcomes has been of keen interest to researchers and policymakers for decades. However, studying the influence of school mobility is complicated by the many confounding student and contextual characteristics that are related to both the initiation of student mobility and students' educational outcomes. Through two studies, the current dissertation sought to disentangle some of the confounding factors of school mobility by focusing on how changes in racially/ethnically relevant contextual factors—including school racial composition and school racial climate—influenced students' academic outcomes over time. Study one utilized data from the Northwest Evaluation Association's (NWEA) anonymized longitudinal student achievement database and followed 230,055 Kindergarten to 2<sup>nd</sup> grade students over four years to examine how changes in school racial composition across a non-normative school move influenced students' math and reading achievement trajectories. Study one also explored variation in these associations by race. The second study utilized data from a longitudinal community-based sample and followed 697 students across the high school transition.

The aim of study two was to identify subpopulations of students with distinct academic trajectories across the high school transition and determine whether changes in students' perceptions of school racial climate from middle school to high school influenced their school performance and attendance trajectories across the transition. Both studies identify disruptions in students' academics across a school move. Study one finds an influence in changing school racial composition on students' achievement following a school move with Latino/a/x students being particularly sensitive to declining same-ethnic peers across a school move. Study two identifies three distinct school performance trajectories in middle school and high school and finds that changes in school racial climate perceptions across the high school transition influence students' high school performance and attendance. The current study contributes to the ongoing school mobility literature by contextualizing school mobility within a diversifying education system and serves to identify factors that may enhance student outcomes during periods of transition.

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## **CHAPTER 1: GENERAL INTRODUCTION**

School mobility has been a topic of interest to researchers and policymakers for decades as the United States has one of the highest rates of school mobility in the world (Mehana & Reynolds, 2004; Reynolds et al., 2009; Welsh, 2017). Understanding the impact of school mobility on student outcomes is relevant to both educational policy and equity. School and district officials initiate normative school moves through the establishment of promotional school change patterns as well as non-normative school moves through policies that propose closing traditional public schools, financially support the transfer of students out of under-performing schools, and force school changes for disciplinary reasons, including suspensions and expulsions. Student homelessness and the economic insecurity of students' families are additional factors that may contribute to increased student mobility. Therefore, structural policies focused on housing and income stability can also be influential for students' mobility experiences (Rumberger, 2015). Understanding how to promote student well-being in the face of school mobility can also serve to reduce educational disparities, as school mobility is disproportionately experienced by racial/ethnic minorities and students from low-income families (U.S. Government Accountability Office, 2010). The current dissertation sought to expand current knowledge on school mobility by focusing on how two types of mobility—normative and non-normative mobility—influence students' academic trajectories and how the impact of mobility is moderated by changing school contexts and students' race/ethnicity.

Studying the influence of school mobility is complicated by the many confounding student and contextual characteristics that are related to both the initiation of student mobility and students' educational outcomes. These complexities are reflected in the extant literature on school mobility,

which shows mixed findings as to how mobility influences students' academic trajectories (for review, see Welsh, 2017). The current dissertation sought to address these issues surrounding school mobility by documenting the impact of school mobility on students' academic well-being and investigating how individual characteristics and both structural and interpersonal aspects of the school context serve as sources of variation in how mobility impacts students' academic trajectories. The studies in this dissertation can help disentangle some of the confounding factors of school mobility, which will help pinpoint which students are most susceptible to the consequences of mobility and the reasons why some students maintain or improve their academic trajectories following a school move.

### **Types of School Mobility**

As alluded to above, student mobility falls into two forms: normative mobility (i.e., structured school transitions due to grade promotion, such as the move from middle to high school) and non-normative mobility, which is typically conceptualized as school moves that occur for any reason other than a natural progression through the schooling system (e.g., residential move, parental choice, school closures). In considering how both normative and non-normative mobility influence students' academic outcomes, life course theory is a useful theoretical frame. According to life course theory, transition points can introduce changes to social roles, relationships, and contexts, and these changes have the potential to alter the course of one's developmental trajectories, including academic trajectories (Elder, 1985). However, the extent to which a transition impacts development is largely influenced by one's position in a stratified society as well as by the similarity between the pre-and post-transition contexts (Benner, 2011; Elder, 1998).

Many studies on school mobility find both non-normative and normative mobility to be disruptive for students' academic trajectories, with mobility associated with lower test scores, increased grade retention, and higher dropout rates (Welsh, 2017). A handful of recent studies, however, find null relationships or positive relationships between mobility and academic achievement when accounting for students' demographic backgrounds, including racial/ethnic background or change in school quality following a school move (Sutton et al., 2018; Vandell et al., 2021). These findings highlight how one's position in a stratified society and contextual changes can influence the impact transitions have on students' outcomes.

In U.S. schools, race/ethnicity is an influential stratification marker, and because of this, changes in certain aspects of the school context, such as school racial composition and school racial climate, may be particularly salient to certain racial groups. Taken together, the inconsistent findings on school mobility's impact along with the tenets proposed by life course theory suggest that to more effectively assess the consequences of school mobility for student outcomes, research must place student mobility within the larger developmental and environmental contexts in which it occurs, the focus of this set of dissertation studies. In particular, I aimed to examine how shifting racial/ethnic educational contexts contributed to variation in the influence of school mobility on students' academic outcomes, focusing on racial/ethnic educational contexts spanning structural characteristics, such as school racial diversity, and interpersonal processes, such as school racial climate.

### **School Racial Diversity**

Focusing on race/ethnicity-based aspects of the school context is pertinent given the increasing racial/ethnic diversity of America's school-aged children. The Condition of Education

report by the National Center for Education Statistics (NCES; 2021) notes that between 2009 and 2018, the percentage of public school students who were Hispanic increased from 22 to 27 percent, while the percentage of students who were White and Black decreased from 54 to 47 percent and 17 to 15 percent, respectively. These changes in the demographic landscape of American schools are likely to influence the educational experiences of children and adolescents given that the school context is a critical sociocultural context wherein developmental trajectories unfold (Elder, 1985). The demographic make-up of schools is also particularly relevant to students' mobility experiences as school moves necessitate a change in this developmentally critical sociocultural context.

Life course theory also suggests that the extent to which one successfully navigates a transition may vary by whether they experience a pronounced change in their sociocultural contexts across the transition (Benner, 2011; Elder, 1998). As such, prominent changes in race/ethnicity-based aspects of the school context, such as school racial composition following a school move, can have a large influence on students' academic functioning. For example, in one study, a decrease in same-ethnic peers from elementary to middle school was associated with lower feelings of belonging and lower grades among Latino/a/x students in middle school, but these effects were only significant when students attended nondiverse middle schools (Morales-Chicas & Graham, 2017). This evidence demonstrates the influential role of race/ethnicity-based structural components of the school context for students' academic trajectories following a school move, which I aimed to expand upon in the current dissertation.

### **School Racial Climate**

Aside from structural aspects of the school context, proximal interpersonal processes that occur in school can also play a large role in students' academic adjustment following a school

move. The life course theory principle of linked lives acknowledges the influence of interpersonal relations and interactions on developmental trajectories (Elder & Shanahan, 2006). School racial climate is one proximal aspect of the school context and refers to students' perceptions of within-school interactions and socialization around race and culture (Byrd, 2017). A healthy school racial climate is a reflection of positive race-based interpersonal interactions occurring in school and is linked to a host of positive academic outcomes, such as students' grades, educational expectations, and academic motivation (Benner et al., 2015; Byrd & Chavous, 2011; Kiang et al., 2015). While research has investigated changes in perceptions of general school climate across school transitions (Barber & Olsen, 2004; Benner & Graham, 2007), minimal work has investigated how changes in school racial climate between sending schools (the schools students are leaving) and receiving schools (the schools students are moving to), might predict students' academic trajectories following a school move, another aim of the current dissertation.

### **Students' Race/Ethnicity**

As suggested by the life course theory, investigating both structural and interpersonal aspects of the school context as moderators of school mobility's impacts is important given how closely tied these two contextual factors are in influencing development across the life course. However, the way these processes unfold may further vary as a function of students' own race/ethnicity. In the U.S., schools are embedded within a stratified society in which race/ethnicity is a notable marker of one's position in the stratification system. As such, race/ethnicity confers advantages for certain racial groups and disadvantages for others, which may shape the success with which students navigate school moves and the influence school contextual changes have on their mobility experiences (Benner, 2011). Indeed, racial/ethnic minority students tend to be more

severely impacted by non-normative school moves than White students (Xu et al., 2009), and concerning normative transitions, the extent to which changes in school racial composition influence the success with which students navigate the high school transition seems to be particularly strong for students from racial/ethnic minority backgrounds (Benner & Graham, 2009). Research, however, has seldom investigated racial/ethnic differences in the relations between both normative and non-normative mobility and school contextual changes in younger populations. Thus, further investigation of racial/ethnic differences in mobility experiences is needed to better understand the interplay between mobility and school contextual changes.

### **Overview of the Two Studies**

Taken together, changes in school racial composition and student perceptions of their schools' racial climate, as well as students' own racial/ethnic background are all critical contextual factors that can influence how students navigate their non-normative and normative mobility experiences as well as the impact of mobility on students' academic trajectories. The current two-study dissertation, rooted in the life course theory, focused on both non-normative (Study 1) and normative (Study 2) mobility. Each study addressed how changes in racially/ethnically relevant contextual factors—including school racial composition (Study 1) and school racial climate (Study 2)—across a school move influenced students' post-mobility academic achievement and achievement growth over time (Study 1) as well as students' achievement and attendance trajectories (Study 2) and whether these relations were consistent across racial/ethnic groups (Study 1). Focusing on contextual and individual racial/ethnic factors can provide insights on how to best support mobile students in a diversifying school system and identify differences in needed transition supports by race/ethnicity.

Specifically, in Study 1, I focused on non-normative mobility in elementary school and examined how changes in two measures of school racial composition, the racial diversity of the student body and the proportion of same-ethnic peers in school, across a non-normative school move influence students' math and reading achievement trajectories. I utilized data from the Northwest Evaluation Association's (NWEA) anonymized longitudinal student achievement database, conducting piecewise latent growth curve modeling to first examine mobile students' pre-mobility and post-mobility achievement trajectories. I also placed attention on how these achievement trajectories across a school move compared to non-mobile students' achievement trajectories over the same time period. The purpose of this first research aim was to establish how students' achievement trajectories are influenced by a non-normative move. Building upon these patterns, my subsequent research questions examined how changes in school racial composition across non-normative school moves influenced students' post-mobility achievement trajectories. Specifically, I examined how the change in two distinct measures of school racial composition (i.e., school racial diversity and the proportion of same-ethnic peers) between the sending and receiving schools influenced students' post-mobility achievement and achievement growth over time. Related to this aim, I also investigated whether the influence of changing school racial composition was conditioned by the composition of the sending schools students attended. To achieve this, I examined the influence of the interaction between the sending school racial composition and the change in school racial composition across a non-normative move on students' post-mobility academic achievement immediately following the school move and over time. Lastly, Study 1 examined whether the influence of school racial composition on students'

achievement trajectories across a school move varied by students' own race/ethnicity (see Figure 1 for conceptual model).

Study 2 utilized survey and school records data from an ongoing, longitudinal project conducted in the Southern U.S. and examines the role of racial/ethnic-based aspects of the school context in influencing students' school mobility experiences. However, Study 2 focuses on the normative transition from middle school to high school and took a person-centered approach to examine how interpersonal aspects of the school context (i.e., perceptions of school racial climate), rather than structural aspects, influence students' school performance and attendance trajectories across the transition to high school. First, I utilized growth mixture modeling to assess how students' school performance and attendance trajectories unfolded from middle school to high school and identified subpopulations of students who exhibited distinct school performance and attendance trajectories before and after the high school transition. After separately establishing distinct school performance and attendance trajectory classes, I utilized regression analyses in an SEM framework to examine whether perceptions of school racial climate (i.e., middle school perceptions and the difference in perceptions of the racial climate of one's middle school versus high school) are related to immediate changes in school performance and attendance across the high school transition as well as high school performance and attendance trajectory class memberships. Finally, I conducted latent transition analysis to examine whether school climate is related to shifts in school performance and attendance trajectory class memberships from middle school to high school (see Figure 2 for conceptual model).

In the current dissertation, I took a race/ethnicity-centered approach to understand how two distinct forms of school mobility, non-normative mobility and normative school transitions,

influence students' academic outcomes and experiences. I focused on how race-related aspects of the school context, both structural and interpersonal, influenced the impact mobility had on students' academic outcomes, and how these processes might be further influenced by students' own racial/ethnic background. Taking a racially/ethnically sensitive approach to studying mobility can help provide a more complete picture of mobility experiences for racially/ethnically diverse student populations by identifying the specific patterns of racial/ethnic context change (e.g., moving to a more diverse school or less diverse school) that might be most beneficial to or limiting for students' academic trajectories and for whom these contextual aspects matter most. Further, making the distinction between non-normative and normative mobility is critical, as each form of mobility is initiated for different reasons, thus likely having disparate impacts on academic outcomes.

The findings from the current dissertation can expand current knowledge on students' mobility experiences, especially for students of racial/ethnic minority backgrounds. By examining how the impact of school mobility differs by both the school context and students' racial/ethnic background, we can pinpoint which students are in most need of support during school transition periods and shed light on how aspects of the school context, such as school racial climate, can positively influence students' academic trajectories following a school move.

Figure 1: Conceptual Model Detailing Components for Study 1

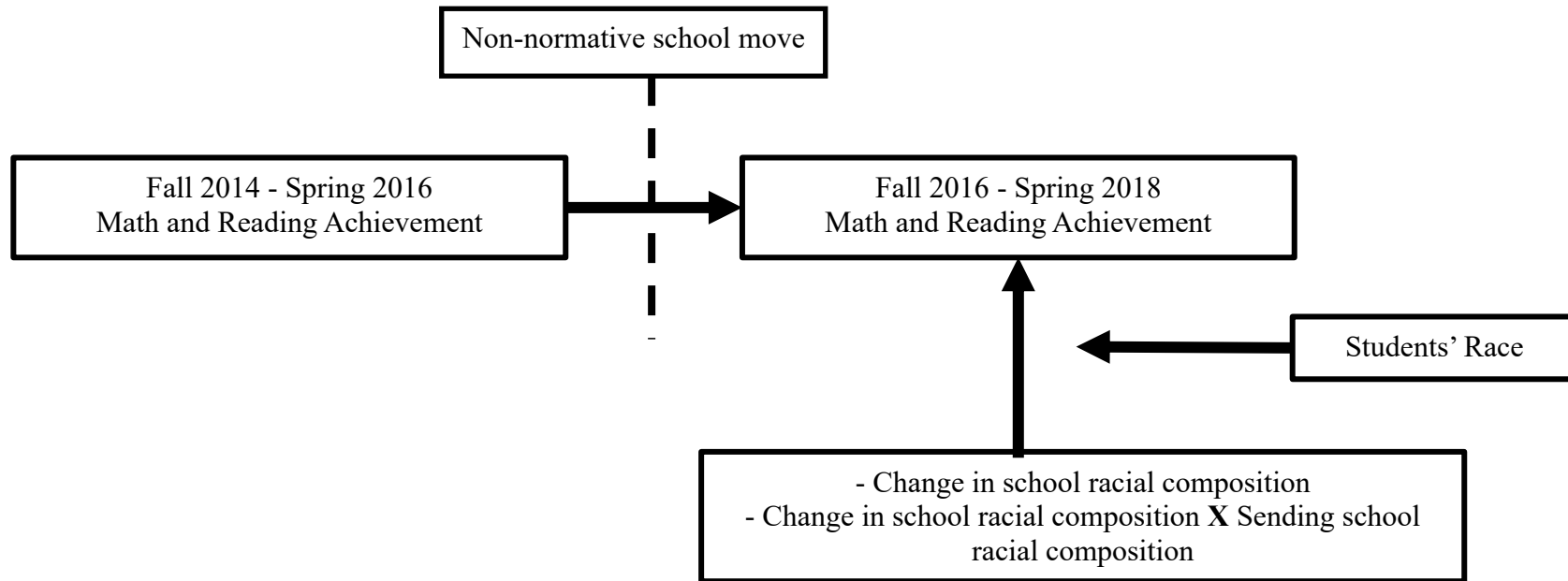
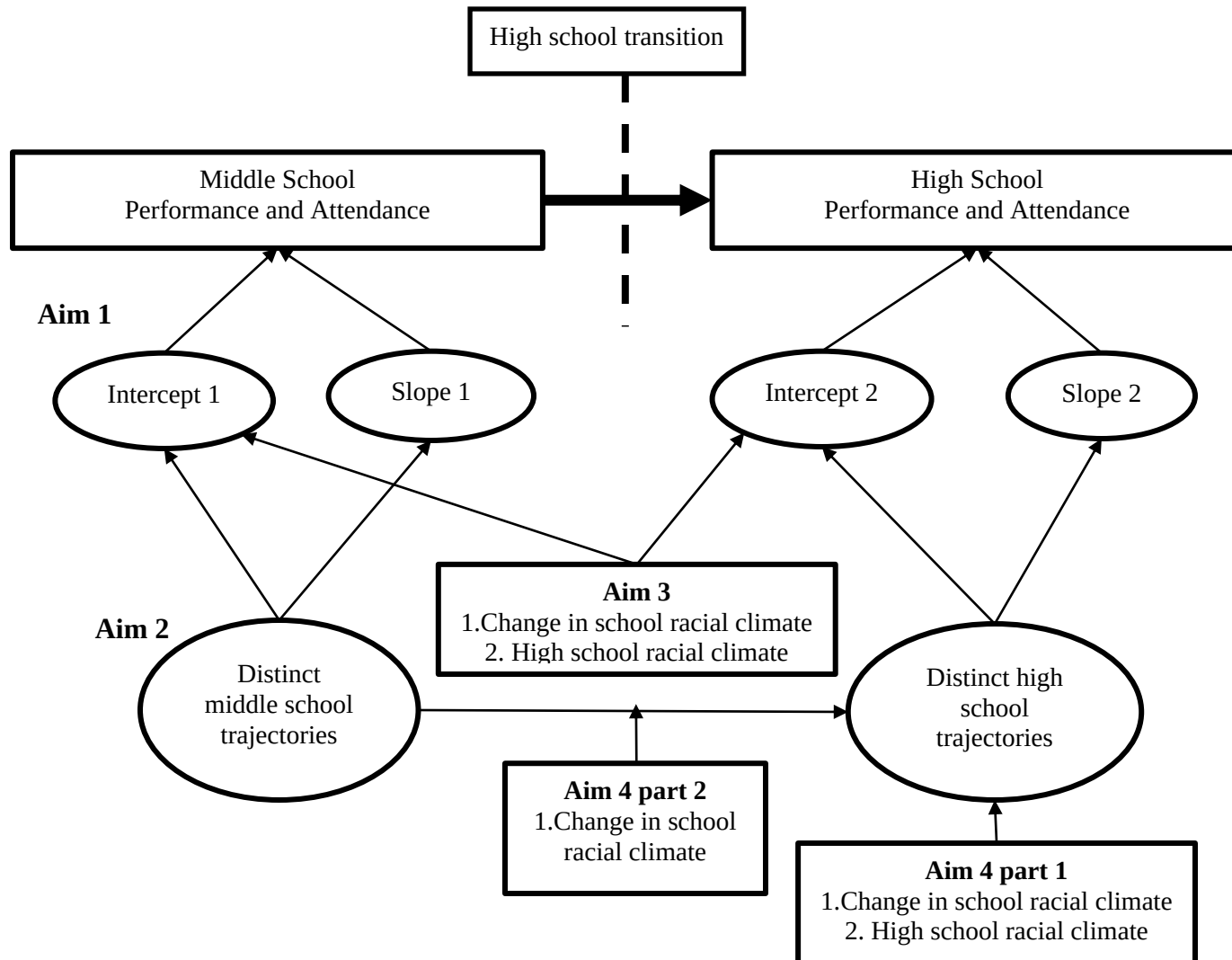


Figure 2: Conceptual Model Detailing Components of Study 2



## **CHAPTER 2: NON-NORMATIVE SCHOOL MOBILITY, SHIFTING SCHOOL RACIAL COMPOSITION, AND ACADEMIC SUCCESS**

Non-normative mobility is prevalent in the U.S., with an analysis of a nationally representative sample of the Early Childhood Longitudinal Study-Kindergarten Cohort showing that more than 50% of students experienced at least one non-normative school move between kindergarten and 5<sup>th</sup> grade (Princiotta et al., 2006). Given its widespread occurrence, many researchers and policymakers have taken a keen interest in documenting the prevalence of student mobility and understanding its impact on students' academic success. Many studies suggest that non-normative school moves are disruptive for students' academic trajectories (Goldhaber et al., 2022; Gruman et al., 2008; Herbers et al., 2013; LeBoeuf & Fantuzzo, 2018), while others demonstrate differences in non-normative mobility's influence depending on the contextual differences between the sending and receiving schools or on students' race/ethnicity (Han et al., 2017; U.S. Government Accountability Office, 2010; Xu et al., 2009). These mixed findings point to the need for more extensive research on school mobility within the context of development while also considering individual differences, central goals of the current study.

More specifically, the current study aimed to first document patterns of achievement growth across a non-normative move occurring in elementary school, a critical developmental period in which students are establishing foundational learning skills (Duncan et al., 2007). Here, I determined the influence of non-normative school moves on students' academic growth by comparing the academic trajectories of mobile students with non-mobile students. I then examined how changes in the person-context intersection between school racial composition and student

race/ethnicity influenced individual variation in achievement growth following a non-normative move, which has received far less attention in the non-normative mobility literature. The influence of this person-context interaction, however, may vary depending on how school racial composition is conceptualized, and thus the current study investigated two specific aspects of school racial composition—the proportion of same-ethnic peers and racial/ethnic diversity of the student body. The extent to which these person-context interactions influence mobility experiences may be further dependent on students' own race/ethnicity, given evidence suggesting racial/ethnic variation in the impacts of mobility as well as in the impacts of school racial composition for students' well-being (Benner & Crosnoe, 2011; Xu et al., 2009). As such, race/ethnicity is an important characteristic to consider when studying variation in the impact of school mobility.

The current study took a racially/ethnically sensitive approach to studying non-normative mobility by examining a) how mobile students' pre-mobility achievement trajectories compared to their post-mobility achievement trajectories with attention to how these trajectories compared to non-mobile students' achievement trajectories, b) whether school racial composition (i.e., school racial diversity and the proportion of same-ethnic peers) across the non-normative move impacted post-mobility academic growth trajectories, and c) whether the relations between mobility, school racial composition and students' post-mobility academic trajectories varied by students' own race/ethnicity. These aims can provide a deeper understanding of how contextual and individual factors related to race intersect and lead to variations in non-normative mobility's impact on students' academic achievement. These insights can inform targeted interventions to support mobile students in an education system marked by increasing racial/ethnic diversity and racial/ethnic stratification.

## **The Importance of Non-Normative Mobility**

Non-normative mobility is typically conceptualized as school moves that occur for any reason other than a natural progression through the schooling system. For example, a student may move from one elementary school to a new elementary school due to a residential move or a school closure. Research focused on understanding the impacts of non-normative mobility for students' academic success is critical for several reasons. First, non-normative mobility is a widespread occurrence in the U.S. For example, in their study of roughly 61,000 students in Tennessee, Grigg and colleagues (2012) found that between 8 and 15 percent of students experienced non-normative mobility in any given school year. Moreover, Hanushek et al. (2004) documented that about one-third of Texas public school students moved schools non-normatively at least once in a three-year span. Even more telling, in a nationally representative sample of kindergartners who were followed through 5<sup>th</sup> grade, researchers found that more than 50% of students made at least one non-normative school move within that time frame (Princiotta et al., 2006).

Second, studying non-normative mobility also serves to inform education and economic reform efforts. Mobility is often initiated by school and district policies that close public schools due to under-enrollment, support the transfer of students out of under-performing schools, and impose disciplinary practices that push students out of schools, such as suspensions and expulsions. Studies demonstrating how school mobility impacts students' achievement can inform political leaders of the potentially detrimental consequences of such policies that instigate student mobility. Relatedly, structural aspects of society, such as student homelessness and economic insecurity, are also contributors to increased student mobility rates (Rumberger, 2015). Therefore, documenting the influence non-normative mobility has on student achievement and factors that

support mobile students' academic success may push policymakers to enact economic programs that would decrease the prevalence of mobility, such as affordable housing initiatives (ibid), and inform interventions to support mobile students who face other struggles tied to SES and related factors.

Third, non-normative mobility is disproportionately experienced by racial/ethnic minorities and students from low-income families (U.S. Government Accountability Office, 2010), making non-normative mobility a potential contributor to current racial and socioeconomic disparities in academic achievement (Hanushek et al., 2004; Welsh, 2018). As such, experiences of non-normative mobility provide insights into the inequities faced by many students, and expanding current knowledge on how non-normative moves impact students can help support mobile students, inform policy, and narrow achievement gaps.

The importance of studying non-normative mobility and its impact on students is underscored by the life course theory (Elder, 1998). The life course theory is an interdisciplinary perspective that suggests that developmental trajectories are structured by various life transitions, such as school moves, and these transitions can serve as turning points that alter the path of developmental trajectories, including academic trajectories. As individuals move through life, they embody various social roles and relationships, and the life course perspective suggests that transitions are extremely influential on developmental trajectories because they necessitate changes to one's social roles, relationships, and contexts (Elder, 1985). As such, transitions, including school moves, are extremely influential for individuals' developmental trajectories.

Non-normative moves occurring in elementary school are particularly important to examine, as school mobility more frequently occurs in elementary school than in middle or high

school (Schacter, 2004). Further, during elementary school, students are establishing foundational skills in literacy and mathematics, which are necessary for later achievement (Anderson, 2017). Therefore, any transition disruptions occurring during this critical period could have significant repercussions for later academic trajectories. The importance of studying early mobility is also supported by the life course theory, which acknowledges the links between early experiences or transitions and later development (Elder, 1985). Moreover, the life course theory acknowledges the cumulative fashion by which transitions and individuals' responses to transitions influence developmental trajectories. As such, early success in navigating a school move can lead to cumulative advantages for students' later academic careers, while early challenges can have severe consequences for later academic well-being. Aside from theoretical support for studying early mobility, there is evidence to suggest that early mobility may have a particularly strong association with later academic achievement. For example, Heinlein and Shinn (2000) found that mobility occurring between kindergarten and 3<sup>rd</sup> grade was more strongly related to sixth-grade achievement than later mobility. Moreover, in their meta-analysis, Reynolds et al. (2009) demonstrated that the impact of mobility on reading achievement varied by grade level, with frequent elementary school moves having a larger negative impact than moves occurring in middle school or high school. For these reasons, the current study focused on non-normative mobility occurring in elementary school, with the hopes that understanding factors that mitigate transition disruptions in early grade levels can inform more targeted initiatives that can help students maintain their academic success as they move through the K-16 school system.

## **Non-normative Mobility and Academic Success**

Research on non-normative mobility is widespread and takes various approaches to measuring mobility and understanding the impacts non-normative mobility has on students' academic outcomes. Moreover, the impact of changing schools non-normatively is difficult to isolate as there are intersecting individual, school, and neighborhood influences that both prompt non-normative mobility and may be directly tied to students' academic outcomes (Welsh, 2017). As such, the extant literature on non-normative mobility provides mixed evidence for how students' academic outcomes are impacted by non-normative moves, which highlights the need to contextualize non-normative mobility within the larger developmental setting in which it occurs to better understand for whom non-normative mobility is most disruptive. A large share of student mobility research has provided evidence that non-normative mobility is harmful for K-12 students' academic trajectories (for review, see Welsh, 2017). For example, one descriptive study tracking students from third grade through twelfth grade showed a negative relationship between the number of non-normative moves a student made and both their achievement on statewide exams and their high school graduation rates (Goldhaber et al., 2022). These findings are corroborated by studies using more advanced statistical techniques that identified negative relationships between non-normative mobility and students' math and reading achievement (Friedman-Krauss & Raver, 2015; Lleras & McKillip, 2017; Scherrer, 2013). Another study analyzing panel data of 3<sup>rd</sup> through 8<sup>th</sup> grade students found that even when controlling for grade-level, students who moved non-normatively between school years displayed declines in their math achievement growth in the year the move occurred, and students who moved non-normatively during the school year displayed declines in their math *and* reading achievement growth (Grigg, 2012). Moreover, when examining

the short-term impact of student mobility in elementary school, LeBoeuf and Fantuzzo (2018) found that students who changed schools had lower concurrent reading achievement scores than non-mobile students even after controlling for student characteristics. This study also examined the cumulative effect of non-normative mobility, finding a negative cumulative effect of mobility on third-grade reading achievement, with students showing a greater loss in their reading achievement scores with each additional move they made between kindergarten and 3<sup>rd</sup> grade (ibid). Additionally, a meta-analysis focused on 16 studies of non-normative mobility found student mobility across K-12 grade levels to be associated with lower math and reading achievement and higher dropout rates even when controlling for a variety of factors, including prior achievement and family SES (Reynolds et al., 2009). Collectively, these studies provide strong evidence of the negative effects of non-normative mobility.

There is, however, evidence of variation in the impacts of non-normative mobility based on certain contextual factors. For example, a study by Schwartz et al. (2017) found that the link between non-normative mobility and students' academic performance lost statistical significance after accounting for factors that predict mobility, including the number of years until the student reached the terminal grade of their school and the sale of the family's home. Additionally, null effects of mobility have been found after controlling for individual factors such as race/ethnicity, maternal education levels, and maternal vocabulary levels (Vandell et al., 2021). It has also been posited that moving to a higher-quality school could have positive effects on students' academic achievement (Hanushek et al., 2004). Research focused on changes in school quality across a school move is largely situated in school closure literature but does indeed find that the influence of this form of non-normative mobility varies depending on the change in school-level academic

performance between the sending and receiving school. For example, studies examining the impact of school closures show that school closures benefitted the academic trajectories of students who transferred to higher-performing schools but had negative consequences for students placed in equally or weaker-performing schools (de la Torre & Gwynne, 2009; Han et al., 2017). Research has also found that moving from a closed school to a higher-performing school mitigated the negative impact of changing schools, such that students who moved to higher-performing schools showed less decline in their academic achievement compared to students who moved to lower-performing schools (Engberg et al., 2012).

Taken together, these findings suggest that the nature of the contextual changes experienced across a transition as well as an individual's demographic characteristics impact the extent to which a transition has a negative influence on one's developmental trajectory. Life course theory also supports these notions, as it acknowledges the role of individual characteristics, structural aspects of developmental contexts, such as school-level characteristics, and distal elements of society, such as social stratification systems, as sources of variation in one's developmental trajectory and transition experiences (Elder, 1998). These empirical and theoretical underpinnings point to the need to contextualize student mobility. In order to truly understand the role mobility plays in shaping students' academic trajectories, research must consider how changes and individual differences in the social context after a school move influence students' post-mobility trajectories. Much of the existing literature focused on the contextual influences on mobility experiences has concentrated on school-level academic performance. The current study expanded on this literature by exploring another critical aspect of the school context, the school

racial/ethnic composition, which is a particularly timely school factor to consider given the demographic shifts in the U.S. school-age population (Frankenberg et al., 2019).

### **School Racial Composition and Students' Mobility Experience**

School moves impose a change in students' school environment, which is an important sociocultural context in adolescents' lives. Life course theory suggests that as changes in sociocultural contexts become more salient, successfully navigating a transition may become more difficult (Benner, 2011). Research examining the role of school context changes in relation to non-normative mobility has been fairly limited to the school closure research described above examining changes in school-level academic performance (e.g., Engberg et al., 2012; Han et al., 2017). However, school racial composition is another structural aspect of schools that has been shown to be particularly influential on academic development and achievement gaps (Graham & Morales-Chicas, 2015; Mickelson et al., 2013).

Examining how changes in school racial composition influence mobility experiences and academic achievement is complicated by the fact that school composition typically encompasses two distinct dimensions—racial/ethnic diversity of the student body and proportion of same-ethnic peers—each of which can have varying impacts on student outcomes. School racial/ethnic diversity refers to the extent of racial/ethnic heterogeneity of the student body, encompassing both the number of racial/ethnic groups represented in the school and the relative proportional representation of each group (Benner & Crosnoe, 2011), whereas the proportion of same-ethnic peers refers to simply the proportion of students at a school that match the race/ethnicity of the target student (*ibid*). The current study focused on isolating how these two distinct aspects of

school racial composition might differentially moderate the link between non-normative mobility and students' achievement growth.

School racial/ethnic diversity has been consistently shown to benefit students' academic outcomes. For example, one study found that diverse school environments benefit students' reading and mathematics achievement, such that students who attended diverse schools from elementary school to high school had significantly higher reading and math grades than students who attended segregated schools throughout their academic career or switched between diverse and segregated schools (C. Wang et al., 2020). Further, a comprehensive literature review of the benefits and challenges of diversity suggests that both school and classroom diversity are associated with greater academic achievement in childhood and that high school diversity has a positive impact on college educational outcomes (Benner & Crosnoe, 2011; Tam & Bassett, 2004; Yip et al., 2019). Research on school racial composition suggests, however, that the benefits of diversity for adolescent well-being may be partly driven by same-ethnic representation, as evidence demonstrates that the benefits of school diversity were more pronounced when students had more same-ethnic peers at school (Benner & Crosnoe, 2011). Moreover, work demonstrates that having a greater proportion of same-ethnic peers is associated with greater math achievement and school attachment as well as fewer feelings of loneliness (Benner & Crosnoe, 2011; Benner & Wang, 2014; Madsen et al., 2016).

In addition to the potential main effects of diversity and same-ethnic representation on students' achievement, prominent changes in school racial composition following a school move can also be disruptive for students' academic functioning and subsequent academic trajectories. However, what is known regarding how school racial composition influences mobility experiences

is limited to a handful of studies that are rooted in the normative school transition literature. Early research explored this topic by focusing on students' racial/ethnic identity. For example, French et al. (2002), explored how decreasing representation of students' ethnic groups across the high school transition (ethnic incongruence) related to their racial/ethnic identity development and found that for African American students, incongruence with school staff was associated with an increase in group esteem, and greater incongruence with peers was associated with increased ethnic identity exploration. Since then, research has expanded to explore the links between school racial composition, student mobility, and developmental domains related to academic well-being. For example, experiencing declines in the proportion of same-ethnic peers across a school move was shown to be related to less school belonging and connectedness as well as lower grades and increased absences (Benner & Graham, 2007, 2009). Additional research has also demonstrated the complexity of conceptualizing school racial composition, having found that attending middle schools with high ethnic diversity was protective for Latino students' school belonging and academic achievement when faced with decreasing same-ethnic representation from elementary school to middle school (Morales-Chicas & Graham, 2017). Research on normative school transitions has established the influential role changing school racial composition has on transition experiences. However, further research is needed to understand whether similar effects are present in relation to non-normative mobility because non-normative mobility is unstructured and often unexpected. Therefore, the consequences of contextual changes could be greater for non-normative moves as they may be an added stressor to an already unpredictable situation. Investigating changes in school racial composition across a non-normative move is also particularly critical

given racial/ethnic disparities in non-normative mobility experiences (U.S. Government Accountability Office, 2010).

Together, these findings related to school racial diversity and the proportion of same-ethnic peers call attention to the complexity of measuring school racial composition. In relation to school mobility, the current study aimed to provide critical insights into how different conceptualizations of school racial composition can have varying implications for students' academic trajectories following a non-normative school move. I extended this work further, however, by investigating how non-normative moves impacted racial/ethnic minority students, in particular, a student population more likely to experience non-normative mobility.

### **Variation By Students' Race/Ethnicity**

In taking a race-based approach to understanding how school contextual factors impact students' academic achievement, it is also critical to consider how these associations differ by students' own race/ethnicity. Examining these racial/ethnic differences is especially important given the racial stratification systems in place in the American educational system. In the context of U.S. schools, there are persistent racialized opportunity gaps in which access to quality educational resources is often tied to race/ethnicity (Lewis & Diamond, 2015). For example, White students are often disproportionately placed in honors and advanced placement classes when compared to racial minority students, giving White students greater access to the highest quality teaching and academic resources (Tyson, 2013). The life course theory recognizes the cumulative nature of these types of advantages and disadvantages, which can translate into long-term influences on subsequent academic trajectories (Elder, 1998). Similarly, transitions and the ease with which a student navigates transitions can also cumulatively influence academic trajectories;

successful transitions can serve as a cumulative advantage, promoting later academic success, while transition challenges may bring about cumulative disadvantages. The concept of cumulative advantage/disadvantage is relevant to the study of racial differences in mobility experiences because the extent to which a non-normative move influences academic trajectories may be largely dependent on a student's experiences in a racially stratified school system. For example, for groups that have not historically experienced academic disadvantages due to their race/ethnicity (i.e., White and Asian American students), a non-normative school transition may not bring about severe consequences given these students have accumulated educational advantages across their early life course. However, for students that have experienced racial/ethnic marginalization throughout their lives, a disruptive nonnormative school transition would be an added disadvantage that may further sidetrack academic trajectories (Benner et al., 2011).

There is limited research supporting the notion of racial/ethnic differences in non-normative mobility experiences. One working paper conducted by Xu and colleagues at the Center for Analysis of Longitudinal Data in Education Research (CALDER) and the Urban Institute (2009) examined the impacts of non-normative mobility on the academic outcomes of students in North Carolina and found that non-normative mobility disrupted the math performance of Black and Latina/o/x students but not White students. Moreover, non-normative mobility appeared to improve the reading performance of White students, while having no effect on the reading performance of racial minority students (ibid). However, this research is descriptive in nature, and additional work is needed that formally tests the significant racial/ethnic differences in student outcomes following a nonnormative school move, a goal of the current study.

Additionally, there may be racial/ethnic differences in how changes in the school racial/ethnic composition moderate the association between mobility and academic achievement. For example, White students, but not racial minority students, showed higher scores on math and reading assessments when attending elementary schools with greater racial diversity as well as more same-race/ethnic peers (Benner & Crosnoe, 2011). In considering changes in school racial composition, studies have seldom investigated racial/ethnic variation in the impacts of changing school racial composition on student outcomes following a non-normative transition. Addressing this gap in the non-normative transition literature is necessary given that non-normative mobility is disproportionately experienced by racial minority students (Goldhaber et al., 2022). Understanding the racial/ethnic differences in the associations between non-normative mobility, changing school racial composition, and academic trajectories will provide a deeper understanding of how non-normative mobility impacts students of various backgrounds, which can inform efforts to promote the academic success of diverse groups of students experiencing non-normative mobility.

### **Current Study**

The existing literature on non-normative mobility showcases non-normative mobility as an individualized experience, with the impacts of non-normative mobility varying depending on contextual and individual factors. As such, to better understand how and which students are most impacted by non-normative mobility, research must move beyond documenting the association between non-normative mobility and academic achievement and consider potential contextual moderators of non-normative mobility's influence. Given the diversifying racial landscape of the U.S. student population, contextual factors related to race/ethnicity, such as school racial

composition and students' racial/ethnic background, are important to investigate as potential modifiers to non-normative mobility's impact on academic achievement. To address the need to contextualize non-normative mobility experiences while focusing on race-based contextual factors, the current study utilized data from the NWEA MAP Growth math and reading assessments to address three research questions (see conceptual model Figure 1). The first research question queried how mobile students' pre-mobility and post-mobility achievement trajectories unfolded. Given a large share of the non-normative mobility literature finds school moves to be disruptive for students' academic trajectories (e.g., Welsh, 2018), I hypothesized that students experiencing a non-normative move would display a decline in achievement immediately following the school move and would have more attenuated achievement growth following the move compared to their pre-mobility achievement trajectories. It should be noted that I focused on school moves that occur between school years (i.e., summer moves). There is evidence that most students in NWEA's database, both mobile and non-mobile, experience "summer learning loss" or a slight decline in achievement across the summer months (Atteberry & McEachin, 2021). Therefore, it is crucial to pay mind to how mobile students' trajectories mapped on to the trajectories of non-mobile students, and as part of this first research aim, I compared the academic trajectories of mobile students to non-mobile students over the same period of time. Here, I expected that students experiencing a non-normative move would have lower rates of achievement growth following the school move compared to students that did not move schools.

The second research question asked whether school racial composition across the non-normative move influenced post-mobility academic growth trajectories. More specifically, I examined how changes in the school racial composition (i.e., school racial diversity, percentage

of same-ethnic peers) between the sending and receiving school influenced students' post-mobility achievement and achievement growth over time. I also assessed whether the influence of changing school racial composition was conditioned by the composition of the sending school students attended. Given that the extant literature on non-normative mobility suggests that the impact of non-normative mobility is likely to vary when accounting for contextual factors (Hanushek et al., 2004; Schwartz et al., 2017), I expected mobile students' post-mobility achievement and achievement trajectories to vary as a function of the school racial composition changes experienced when moving schools. Non-normative mobility research has not focused on changes in racial composition across a non-normative move. However, research on normative school transitions has found that declines in the proportion of same-ethnic peers across a school move is related to poor academic adjustment and achievement (Benner & Graham, 2007, 2009). Therefore, I expected that students who experienced a decline in same-ethnic peers across a school move would have lower levels of achievement following a school move than students who experienced minimal change or an increase in same-ethnic peers following a school move. As for racial/ethnic diversity, given the extant literature which suggests that diversity is beneficial for students' academic outcomes (Wang et al., 202; Yip et al., 2019), I hypothesized that students who experienced an increase in diversity following a school move would have higher levels of academic achievement and achievement growth than students who experienced minimal change or a decrease in their school racial diversity following a school move.

However, I further hypothesized that these patterns of moderation would depend on the racial composition of the school the student attended before moving, or their starting school. For example, research suggests that having a "critical mass" of same-ethnic peers is important for

promoting academic success (Benner, 2011). Therefore, if a Black student is moving from a school that is made up of predominantly Black students to a school where there are fewer Black students but there remains a critical mass of same-ethnic peers, then this student may not experience severe consequences from this school move. However, if a Black student is attending a more ethnically diverse school where there is a critical mass of Black students and moves to a school where there are very few Black students, then this student may experience more severe consequences from this school move because they have lost their critical mass of same-ethnic peers. Due to the lack of research on this topic, this aspect of research question two remains exploratory, and hypotheses were not put forth specifying exactly how the racial composition of the starting school would influence the moderating impact of the change in school racial composition.

The final research question investigated the generalizability of the findings from research question two across race by examining whether the relations between school racial composition and students' post-mobility achievement and achievement growth varied by students' own race/ethnicity. Research question three was exploratory, as little research has investigated racial differences in the associations under study, and my central purpose was to assess the generalizability of the findings across racial/ethnic groups. Given the current study's emphasis on racially/ethnically related contextual factors, it was crucial to investigate whether White students were driving the results of the current study, especially given evidence that suggests that White students are less impacted by non-normative school moves and reap greater benefits from school diversity (Xu & D'Souza, 2009; Yip, 2019). Moreover, exploring the racial/ethnic differences in the associations between non-normative mobility, changing school racial composition, and academic trajectories can illuminate how non-normative mobility impacts students of various

backgrounds, which can inform efforts to promote the academic success of increasingly diverse groups of students.

## **Methods**

### **Participants and Procedures**

This study utilized data from NWEA's anonymized longitudinal student achievement database. NWEA's MAP Growth® assessment is a computerized adaptive test administered to school-age students across the U.S. multiple times per school year, typically in the fall and spring. For all grade levels, MAP Growth includes engaging items and interactive elements to accurately assess students. For kindergarten and 1<sup>st</sup> grade students, targeted audio supports are an additional feature that is particularly important for engaging students who are learning to read. I utilized the fall and spring test scores of students taking mathematics and reading MAP Growth assessments within a set of 70 large districts in 27 states that partner with NWEA to assess students with MAP Growth. This study followed  $N = 230,055$  Kindergarten to 2<sup>nd</sup> grade students over four school years from 2014 to 2018 (51% Male; 34% White, 19% Black, 7% Asian, 30% Latino/a/x, 10% Other). Participant demographics are presented in Table 1. This sample included those students with at least one test score (fall or spring) in each of the four school years assessed. In the current study, the pre-mobility phase was from the fall of 2014 through the spring of 2016, and the post-mobility phase was from the fall of 2016 through the spring of 2018; I focused on non-normative moves occurring the summer after the 2015-16 school year. Specifically, the current study used an accelerated longitudinal approach, combining observations from three cohorts of students; students who began Kindergarten in 2014, students who began 1<sup>st</sup> grade in 2014, and students who began 2<sup>nd</sup> grade in 2014. The data were structured in this way in order to maximize the amount of

available data while avoiding issues of attrition that occur in long-term panel studies, thus increasing the statistical power of the analyses as non-normative moves are not as common as normative moves in these data. While there may be concerns regarding the developmental differences in when a non-normative move occurs, in a working manuscript utilizing the same data, researchers did not find any notable developmental differences in when a non-normative move occurs in these early grade levels (Fernandez et al., 2022). I also controlled for students' cohort to account for potential developmental differences at the time of the move.

### **Identifying mobile students**

Schools were identified by their IDs from the National Center of Education Statistics' Common Core of Data (CCD), which also provide the grades offered within each school. These school IDs were then linked to the unique district or state ID assigned to students in the MAP Growth assessment system, which allowed for the tracking of student enrollment in schools within a district across terms and grade levels. A school move was identified by comparing whether the school ID in the fall or spring of the previous year is different from the school ID assigned to the student in any semester during the next year<sup>1</sup>. Non-normative school moves were identified based on whether the grade level at which a school move occurred was before the terminal grade of the sending school, indicating that the school move was not due to promotion to the next school level. For example, some students attend a Kindergarten through 2<sup>nd</sup> grade primary school before

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<sup>1</sup> Students were identified as making within-year school moves; however only handful of within-year moves were observed across the sample. Therefore, the analyses focused on moves that occurred during the summer break between school years, which were much more common.

transitioning to elementary school (grades 3-5). If a student attended a K-2<sup>nd</sup> grade primary school and experienced a school move in the 1<sup>st</sup> grade, then this would be considered a non-normative school move; however, if they moved after second grade, this move would be normative and thus not considered here.

## **Measures**

### ***Math and Reading Achievement***

Students' pre- and post-mobility math and reading achievement was measured using NWEA's MAP Growth<sup>®</sup> math and reading assessments. School districts use NWEA's MAP Growth assessments to monitor elementary and secondary students' reading and mathematics achievement throughout the school year. MAP Growth is a computer adaptive test that precisely measures achievement, including for students above or below grade level, and it is vertically scaled to allow for the estimation of gains across time. MAP Growth test-retest reliability was estimated by the Pearson correlation between MAP Growth RIT scores of students taking the assessment in two consecutive terms. Test-retest reliability coefficients were generally greater than .80 across subjects except at lower grade levels, such as kindergarten (test-retest reliability > .67; NWEA, 2019). MAP Growth assessments have been found to predict performance on a number of state summative assessments (NWEA, 2019). Assessment scores are known as Rasch unIT (RIT) and are a linear transformation of the logit scale units from the Rasch item response theory model. For the current analysis RIT scores were divided by ten to aid in the model estimation in Mplus. For the current study, I utilized fall and spring RIT scores across four years (2014-2018). This was a total of eight RIT scores for both math and reading (four before the non-normative move and four following it).

### ***Change in School Racial Composition***

A series of dichotomous change indicators were created to assess the extent to which a student experienced a change in the percentage of same-ethnic peers at their school and their school's racial diversity. Students could experience a positive change (i.e., move to a school with more same-ethnic peers or moved to a more diverse school), a negative change (i.e., moved to a school with fewer same-ethnic peers or to a less diverse school), or no change (i.e., little to no change in the percentage of same-ethnic peers or school diversity). Information used to measure school racial composition was derived from school variables reported by the CCD.

To calculate the percentage of same-ethnic peers in school for each student, we used students' race/ethnicity and matched this with the school demographic composition data from the CCD to determine the proportion of students at each school that matched each student's race/ethnicity. The percentage of same-ethnic peers was only calculated for White, Latino/a/x, Black, and Asian American students. School racial diversity scores were calculated using Simpson's Diversity Index, a measure of community diversity (Simpson, 1949). The formula for calculating the value of the index is:

$$D = 1 - \sum \left(\frac{n}{N}\right)^2 \quad (1)$$

In this equation,  $n$  is the number of individuals identifying as each race at the school, and  $N$  is the total number of individuals at the school. The racial/ethnic groups included in this calculation are White, Latino/a/x, Black, and Asian American. Scores for Simpson's diversity index range from zero to one, with higher scores indicating greater diversity.

The measures of school proportion of same-ethnic peers and school racial diversity were then transformed using an inverse logit transformation. This transformation weighs school composition indicators in the middle of the distribution more than indicators at the high and low extremes (see Benner & Graham 2009 for an example). After transformation, school composition difference scores were calculated by subtracting transformed sending school indicators from transformed receiving school indicators. Thus, for a student with a transformed sending school diversity score of 0.50 and a transformed receiving school diversity score of 0.25, their diversity difference score would be -0.25, indicating the student moved to a less diverse school (i.e., negative change).

Transforming the school composition indicators acknowledges that students may have identical difference scores but that difference scores will be meaningfully different for those who remain in schools that are categorically similar (e.g., having a change score of 10%, but remaining in a low diversity school) compared to those students who move schools that are categorically different in terms of demographic make-up (e.g., having a difference score of 10% but moving from a school that is considered low in diversity to a school that is high in diversity). From the difference scores, dichotomous change indicators were created to indicate whether a student experienced a negative change in context (changes 1 *SD* below the mean), little to no change in context (mean change scores up to  $\pm 1$  *SD*), or a positive change in context (changes scores 1 *SD* above the mean), consistent with prior research (Benner & Graham, 2009; French et al., 2000). Frequencies for each composition change group are presented in Table 2.

## ***Covariates***

As a part of the rostering process, student race/ethnicity and gender are reported for each student in the NWEA dataset; however, the NWEA data do not include other potentially important student-level characteristics, including child SES, home environment, home language, or pre-kindergarten educational experiences. The models for the current study integrated students' gender (1 = male, 0 = female), race/ethnicity (dummy codes for Black, Asian American, Latino/a/x, and other, with White as the omitted reference group), dichotomous indicators of the students' cohort (2<sup>nd</sup>-5<sup>th</sup> grade cohort as the omitted reference group), and dichotomous indicators of additional school moves occurring in the years before and after the target non-normative move. School-level covariates were the SES of the student population (i.e., the percent of students receiving free or reduced-price lunch) derived from school variables reported by the CCD.

## **Analysis Plan**

The data were analyzed in Mplus 8 (Muthén & Muthén, 1998–2017). For all analyses, separate models were run for reading achievement and math achievement. To address the first research aim of modeling students' pre-mobility achievement trajectories with their post-mobility achievement trajectories, I utilized piecewise latent growth curve modeling to fit two phases of achievement trajectories for mobile students (see Figure 3). Piecewise growth modeling is an analytical technique that can be used to represent trajectories across different phases of development (see Benner & Graham, 2009 for an example). In the current study, I followed kindergarten to 2<sup>nd</sup> grade students each fall and spring from 2014 to 2018 and focused on non-normative moves that occurred the summer after the 2015-16 school year. The two phases of development that were modeled were pre-mobility achievement (years 2014 to 2016) and post-

mobility achievement (years 2016 to 2018). The first phase of achievement represented students' achievement in their sending school (i.e., their pre-mobility achievement). The slope growth factor for this phase consisted of four time points (the fall of 2014 to the spring of 2016), with the intercept set at the spring of 2016 (the final time point). The second phase of achievement trajectories represented students' achievement in their receiving school (i.e., their post-mobility achievement). The slope growth factor for this phase consisted of four time points from the fall of 2016 to the spring of 2018, with the intercept set at the fall of 2016 (the first time point). The intercepts were modeled in this way to test students' immediate experiences of this non-normative transition by using the Wald chi-square test of parameter equalities; here, I determined whether the difference between the pre-mobility intercept (spring of 2016) and the post-mobility intercept (fall of 2016) was significantly different from zero. I also used Wald chi-square tests to examine whether the difference in the average slope for the pre-mobility phase and the post-mobility phase is significantly different from zero.

Due to poor model fit, I used an alternate method to fit the piecewise linear growth model in which I allowed the achievement parameters for the fall and spring of 2015 in the first phase of achievement growth and the fall and spring of 2017 in the second phase of achievement growth to be freely estimated. Typically, when conducting latent growth curve models, the parameters under study are fixed to the sample mean at each time point. However, achievement in the NWEA database tends to be non-linear over time, and, as such, freely estimating achievement at certain time points allows achievement to vary from the sample mean, which can aid in improving model fit. This resulted in an acceptable model fit ( $\chi^2 = 805.690$ , CFI = .991, RMSEA = .058 [.055-.062]

for reading and  $\chi^2 = 1119.786$ , CFI = .991, RMSEA = .063 [.060-.066] for math); however, in using this method, I was unable to test for quadratic growth due to having too few fixed parameters.

Finally, after examining the patterns of achievement for students experiencing a non-normative move, I then utilized multiple group analyses to compare the achievement trajectories of mobile students with the trajectories of non-mobile students over the targeted time period (i.e., fall of 2014 to spring of 2018). This allowed me to examine whether differences in the academic trajectories between mobile and non-mobile students were significantly different from zero, providing greater insights into the extent to which a non-normative move may influence students' academic trajectories. It should be noted that students may experience non-normative moves outside of the targeted move under study. These additional moves were controlled for in the analyses. After examining differences in trajectories between mobile and non-mobile students, subsequent analyses for research questions 2 and 3 were conducted among mobile students only to investigate the influence of changing racial/ethnic composition on mobile students' achievement trajectories.

For research question 2 (i.e., whether changes in school racial composition across a non-normative move influence post-mobility academic achievement and growth; see Figure 4), Wald chi-square test of parameter equalities determined whether the difference between the pre-mobility intercept (spring of 2016) and the post-mobility intercept (fall of 2016) was significantly different from zero across the school composition change groups. For the school composition change indicators, dummy variables captured the extent to which a student experienced a change in their school's racial diversity and proportion of same-ethnic peers (i.e., positive change, negative change, little to no change). I then incorporated the school composition change group indicators

as predictors of the slope of the post-mobility phase of the piecewise growth curve model. Here, I tested the influence of changes in both the proportion of same-ethnic peers and the school racial diversity simultaneously.

A second sub-aim of research question two was to examine whether the moderating influence of school racial composition changes was dependent on the racial composition of the sending school. To investigate this, I subsequently added the continuous measure of the racial composition of the sending school as a predictor of the post-mobility slope as well as an interaction between each school composition change indicator and the racial composition of the sending school as predictors of the post-mobility slope. Upon identifying significant interactions, simple slope analyses were conducted to determine the extent to which changes in school racial composition influence students' post-mobility achievement when the starting school racial composition was one standard deviation above or below the mean. All analysis for research question two was conducted only among White, Black, Latino/a/x and Asian American students as the same-ethnic peer composition change indicators could only be calculated for these students.

To answer research question three (i.e., examining the generalizability of the findings from research question two across race), I conducted multiple group analyses to assess whether the results for research question two vary by student's own race/ethnicity (see Figure 5). The multiple group analyses were conducted comparing the following racial groups: White, Black, Latino/a/x, and Asian American. I first analyzed the piecewise growth curve models from research question two in which all focal paths were free to vary across racial groups. I then conducted models in which all focal paths were constrained to be equal across all racial groups. I utilized chi-square test of parameter constraints with Satorra-Bentler corrections to determine whether constraining the

focal paths resulted in a poorer fitting model. If the constrained model fit the data more poorly than the unconstrained model, then paths were constrained one-at-a-time to determine the specific differences across groups.

There were instances of missing data in the current sample. Missing data were handled through full-information maximum likelihood (FIML). FIML enables all available data to be included in the analyses by fitting the covariance structure model directly to the observed and available data for each participant (Enders, 2022). Another important consideration is the nesting of students in schools. When using piecewise growth modeling to account for student mobility, the best approach is to cluster students by school feeder pattern. However, given that the current study is focused on non-normative moves and that the NWEA data spans a wide variety of districts and schools, clustering by feeder patterns would have resulted in a large number of clusters with small sample sizes. Therefore, I clustered by sending school using the CLUSTER function in Mplus. This function accounts for nesting and produces model estimations that have correctly adjusted standard errors.

## **Results**

### **Mobile Students' Achievement Trajectories**

The first research question of the current study investigated how mobile students' pre-mobility and post-mobility reading and math achievement trajectories unfolded. I hypothesized that mobile students would display a decline in achievement immediately following the school move and would have more attenuated achievement growth following the move compared to their pre-mobility achievement trajectories. Results of the unconditional growth model showed that students' scores increased from the fall of 2014 to the spring of 2016 by 9.15 and 9.97 achievement

points for reading and math, respectively, each semester (Figure 6). The average achievement score in the spring of 2016 (the semester before the non-normative school move) was 187 for reading and 192 for math. The average achievement score in the fall of 2016 (the semester post-mobility) was 186 for reading and 190 for math and increased by 5.85 points and 7.16 points for reading and math, respectively, each semester thereafter. Upon formally testing whether the difference between the pre and pos-mobility intercepts and slopes significantly differed from zero, results were in line with my hypothesis. Specifically, immediately after the non-normative move, students demonstrated a statistically significant decline in both reading ( $W = 70.20, p < .001$ ) and math ( $W = 293.72, p < .001$ ) achievement. Although the difference between pre-mobility and post-mobility intercepts were small (1.17 RIT points for reading and 2.25 for math; see Table 3), these declines represent a 13% loss in the reading gains and a 23% loss in the math gains students made the semester prior to moving schools, on average. Students also demonstrated significantly attenuated post-mobility achievement growth compared to their pre-mobility growth ( $W = 2411.77, p < .001$  and  $W = 1894.57, p < .001$ ) for reading and math, respectively.

Another component of research question one was to compare the academic trajectories of mobile students to those of non-mobile students over the same time period. I expected that students experiencing a non-normative move would have lower achievement and rates of achievement growth following the non-normative school move compared to students that did not move schools. To examine this aim, I conducted multiple group analyses between mobile and non-mobile students on a conditional piecewise growth model that incorporated phase-dependent covariates (i.e., the percentage of students receiving free or reduced-price lunch in each school, school moves that occur before and after the school move under study) and student level covariates (i.e., gender,

race, cohort). Incorporating these covariates allowed for the comparison of growth trajectories while accounting for factors that could also influence students' achievement trajectories. Results of the multiple group analyses showed significant differences between mobile and non-mobile students' achievement trajectories in reading and math and these results were partially in line with my hypothesis (see Table 4 for Satorra-Bentler corrected chi-square difference test results). First, it seems there were preexisting differences between mobile and non-mobile students' achievement, as mobile students had significantly lower pre-mobility reading achievement at the Spring of 2016 than non-mobile students ( $\beta = 11.73, p < .001$ ;  $\beta = 12.29, p < .001$  for mobile and non-mobile students respectively; see Table 5). This pattern also emerged for math achievement ( $\beta = 11.73, p < .001$ ;  $\beta = 12.82, p < .001$ ; see Table 5). Mobile students' pre-mobility growth was also slower than non-mobile students' growth over this same time period, but this difference was only significant for math achievement ( $\beta = 2.33, p < .001$ ;  $\beta = 2.43, p < .001$  for mobile and non-mobile students respectively; see Table 5). It should also be noted that achievement values were divided by ten for the analysis to aid in model estimation in Mplus. As such, the difference between mobile and non-mobile students' achievement scores at the spring of 2016 is 5.6 points for reading and 10.9 for math. The coefficients presented are also standardized and adjusted for covariates. This applies to students' post-mobility achievement and achievement growth presented below.

Immediately following the non-normative school move, mobile students showed significantly lower reading and math achievement than non-mobile students at the Fall of 2016, as predicted ( $\beta = 11.73, p < .001$ ;  $\beta = 12.29, p < .001$  see Table 6). As for post-mobility achievement growth, mobile students displayed significantly faster rates of reading achievement growth than non-mobile students ( $\beta = 1.96, p < .001$ ;  $\beta = 1.87, p < .001$  for mobile and non-mobile students,

respectively; see Table 6), which was counter to my hypothesis. However, for math achievement, mobile students remain behind non-mobile students, showing more attenuated math achievement growth following a school move compared to non-mobile students ( $\beta = 3.14, p < .001$ ;  $\beta = 3.67, p < .001$  for mobile and non-mobile students, respectively).

### **The Influence of Changes in School Racial Composition on Post-Mobility Achievement**

The second research question examined how changes in the school racial composition across the non-normative school move influenced mobile students' post-mobility achievement and achievement growth across two years. School racial composition was measured in two different ways, the proportion of same-ethnic peers and the school racial/ethnic diversity. To examine this aim, I first conducted Wald chi-square test of parameter equalities for each school composition change group (e.g., increase, decrease, or stable diversity) separately, to determine whether, within each change group, students' achievement changed from immediately before to immediately following the school move. Results showed that students who experienced no change in same-ethnic peers across a non-normative move demonstrated a significant increase in *math* achievement immediately following the school move ( $W = 11.48, p < .001$ ; see Table 7). The differences in pre- and post-mobility intercepts for math were not significantly different from zero for the other same-ethnic peer change groups (i.e., increasing, decreasing same-ethnic representation), and the differences in pre- and post-mobility intercepts for reading were not significantly different from zero within any of the same-ethnic peer change groups. Analysis across the same-ethnic peer change groups did not include students in the other racial category as they did not have information on same-ethnic peers.

For school racial/ethnic diversity, students who experienced a decrease in diversity across the non-normative move showed immediate declines in reading achievement ( $W = 4.58, p < .05$ ), but this was not observed for math ( $W = 1.11, p = .293$ ). Additionally, students who experienced no change in racial/ethnic diversity across the non-normative move showed an immediate decline in reading achievement ( $W = 6.17, p < .05$ ), which was unexpected, but a significant increase in math achievement after moving schools ( $W = 13.71, p < .001$ ). Experiencing an increase in school racial diversity across the non-normative move did not appear to have immediate influences on reading or math achievement (see Table 7).

To test for the influence of changing school composition on students' post-mobility achievement growth, I regressed each of the school composition change group indicators for the proportion of same-ethnic peers and school racial/ethnic diversity on the slope of the post-mobility phase of the growth curve model. Analyses were first conducted using no change in composition as the reference group and then using positive change in composition as the reference group to make all possible comparisons across composition groups. For reading achievement, changes in school racial composition—both school diversity and proportion of same-ethnic peers—did not have a significant impact on post-mobility achievement growth (see Table 8). For math achievement, students who experienced a decline in same-ethnic peers showed more attenuated math achievement growth than students who experienced no change in same-ethnic peers ( $\beta = -.04, p < .05$ ), in line with my hypothesis. Experiencing a decline in same-ethnic peers was not related to post-mobility math achievement growth when compared to students who experienced a positive change in same-ethnic peers ( $\beta = -.03, p = .145$ ) nor was experiencing an increase in same-ethnic peers when compared to no change ( $\beta = -.01, p = .678$ ). For school racial/ethnic diversity,

students who experienced an increase in school racial/ethnic diversity also showed more attenuated math achievement growth than students who experienced no change in their school racial/ethnic diversity ( $\beta = -.04, p < .05$ ), which was counter to my hypothesis. Experiencing a decline in school racial/ethnic diversity was not related to post-mobility math achievement growth when compared to students who experienced a positive change in diversity ( $\beta = .02, p = .422$ ) or no change in diversity ( $\beta = -.02, p = .102$ ).

An additional exploratory component of research question two was to examine whether the influence of changes in school racial composition was dependent on the racial composition of the sending school students attended. To investigate this aim, I added the continuous measure of the racial composition (racial diversity and proportion of same-ethnic peers; see Model 1 in Table 9) of the sending school as a predictor of the post-mobility slope as well as an interaction between each school composition change indicator and the racial composition of the sending school as predictors of the post-mobility slope (see Model 2 in Table 9). Results showed no significant interactions between sending school composition and change in sending school composition for reading or math achievement.

### **Variation by Students' Race/Ethnicity**

The final research question explored whether the relations between school racial composition and students' post-mobility achievement growth vary by students' own race/ethnicity. Results of the multiple group analyses with chi-square difference tests integrating Satorra-Bentler corrections revealed significant racial differences for both reading and math achievement (S-B Scaled  $\chi^2$  difference (12) = 31.63,  $p < .01$ ; S-B Scaled  $\chi^2$  difference (12) = 30.68,  $p < .01$  for reading and math respectively; see Table 10). For reading achievement, results showed racial differences

in the influence of experiencing a decline in same-ethnic peers versus no change in same-ethnic peers, experiencing a decline in same-ethnic peers versus an increase, and between experiencing a decline in diversity versus no change in diversity on students' post-mobility reading achievement growth. Specifically, White students who experience a decline in same-ethnic peers showed faster rates of reading achievement growth post school move compared to White students who experience no change in same-ethnic peers ( $\beta = .05, p < .05$ ; see Table 11). Additionally, these results are mirrored for Asian students ( $\beta = .14, p < .01$ ). For declining same-ethnic peers versus increasing, White students who experience a decline in same ethnic peers show faster rates of reading achievement growth than White students who experience an increase in same-ethnic peers ( $\beta = .07, p < .05$ ), but this association was not significant for Black, Asian, or Latino/a/x students (see Table 11). Moreover, the influence of declining racial diversity (versus no change) is also only significant for White students with White students who experience a decline in diversity across the non-normative school move showing more attenuated reading achievement growth post move than students' who experience no change in racial diversity ( $\beta = -.07, p < .01$ ).

For math achievement, results showed racial differences in the association between experiencing a decline in same-ethnic peers versus no change and students' post-mobility math achievement growth. This association was only significant for Latino/a/x students, such that experiencing a decline in same-ethnic peers across the non-normative move was linked to more attenuated math achievement growth compared to Latino/a/x students who experience no change in same-ethnic peers across the non-normative move ( $\beta = -.07, p < .01$ ; see Table 12). Experiencing a decline in same-ethnic peers as opposed to no change in same-ethnic peers was not related to post-mobility math achievement growth for White ( $\beta = .05, p = .201$ ), Black ( $\beta = -.03, p = .378$ ),

or Asian students ( $\beta = .002, p = .935$ ). Results for math achievement also showed significant racial differences for the influence of increasing same-ethnic peers (versus no change) on students' math achievement growth. This association was only significant for White students, such that experiencing an increase in same-ethnic peers was related to more attenuated math achievement growth compared to experiencing no change in same-ethnic peers ( $\beta = -.10, p < .01$ ). Lastly, results for math achievement found significant racial differences among students who experienced a decline versus an increase in same-ethnic peers. In this case, White students who experienced a decline in same-ethnic peers showed faster rates of post-mobility math achievement growth than White students who experienced an increase in same-ethnic peers ( $\beta = .12, p < .01$ ). For Latino/a/x students, however, experiencing a decline in same-ethnic peers (versus an increase) was related to more attenuated math achievement growth ( $\beta = -.09, p < .05$ ). Experiencing a decline versus increase in same-ethnic peers was not significantly associated with post-mobility math achievement growth for Black ( $\beta = -.06, p = .170$ ) or Asian students ( $\beta = .06, p = .139$ ; see Table 12).

Finally, multiple group analyses by race assessed the racial/ethnic generalizability of the interactions between school racial composition change groups and sending school racial composition (see Table 13). This analysis was conducted only among White, Black, and Latino/a/x students as attempting to conduct the multiple group analysis including Asian students resulted in errors likely due to the small sample of Asian students experiencing mobility and changes in mobility. Results of the multiple group analysis revealed no significant racial differences among the effects of the interactions between school composition change indicators and sending school

composition for reading (S-B Scaled  $\chi^2$  difference (2) = 0.14 – 3.26,  $p$  = .196 - .934) or math achievement (S-B Scaled  $\chi^2$  difference (2) = 0.21 – 5.14,  $p$  = .245 - .537; see Table 13).

## **Discussion**

Non-normative school mobility is a widely occurring event that has been shown to be consequential for students' academic achievement. However, the life course theory and the existing literature on the impacts of non-normative mobility suggest that the influence of non-normative mobility on students' achievement may vary depending on contextual and individual factors (Elder, 1998; Han et al., 2017; Vandell et al., 2021). In considering contextual and individual factors, those related to race/ethnicity are particularly relevant aspects to consider as modifiers of the influence of non-normative mobility given the increasing racial/ethnic diversity in the population of U.S. students (Frankenberg et al., 2019). The current study sought to gain a deeper understanding of how non-normative mobility impacts elementary school-age students by documenting achievement trajectories across a non-normative move and investigating how the influence of non-normative mobility is dependent on racially/ethnically relevant contextual and individual factors. Specifically, the current study examined three primary research questions. The first research question asked how mobile students' pre-and post-mobility achievement trajectories unfolded and whether these trajectories differed significantly from the trajectories of non-mobile students over the same period of time. The second research question examined whether changes in the school racial composition, as measured by school racial diversity and the proportion of same-ethnic peers, across the non-normative move influenced students' post-mobility achievement and achievement growth over time. Additionally, research question two sought to assess whether the influence of changing school racial composition was conditioned by the composition of the

sending school students attended. Lastly, research question three sought to explore whether the influence of changing school racial composition on students' post-mobility achievement growth generalized across races/ethnicities.

For research question one, I hypothesized that students who experienced a non-normative move would demonstrate an immediate decline in their academic achievement following the school move and would have more attenuated achievement growth following the school move compared to their achievement trajectories prior to the move. The results supported this hypothesis, as mobile students showed significantly lower reading and math achievement in the semester immediately following the non-normative move compared to their achievement the semester before moving. Moreover, mobile students' post-mobility reading and math achievement growth was slower than their achievement growth prior to moving.

Extending this work further, for the second component of research question one, I expected mobile students to have significantly lower post-mobility achievement and achievement growth compared to non-mobile students over the same time period, and results only partially supported my hypothesis. As expected, mobile students showed significantly lower levels of both reading and math achievement in the semester following the school move compared to non-mobile students that same semester. Additionally, mobile students showed more attenuated math achievement growth following the non-normative move compared to non-mobile students. However, unexpectedly, results showed that mobile students demonstrated faster rates of reading achievement growth following the non-normative move compared to non-mobile students. These results suggest that, for reading, mobile students are recovering from their achievement disruptions following the school move, but they struggle to catch up in math. While this result was not

hypothesized, it is consistent with research that has found that non-normative school moves were negatively related to math achievement but positively or insignificantly related to reading achievement (Xu et al., 2009). Another study has also shown evidence of students showing an increase in English language arts achievement following a non-structural move (Schwartz et al., 2017). It is possible that math achievement is more sensitive to non-normative moves because mathematics progress is thought to depend on in-school learning more so than reading or language arts (Bodovski & Farkas, 2007).

While these results are in line with research showing that students' experience disruptions in achievement growth following a non-normative school move (Grigg, 2012; Lleras & McKillip, 2017), it must be noted that the causal influence of school mobility for students' academic trajectories cannot be determined. Both mobile and non-mobile students' experienced drops in their achievement across the summer after the 2015-16 school year and literature documents a "summer learning loss" phenomenon, in which students tend to show disruptions in achievement during the summer months (Alexander et al., 2001; Atteberry & McEachin, 2021). These summer learning disruptions may be related to how students spend their time during the summer as summer learning disruptions are shown to vary by students' socioeconomic status and it is hypothesized that low-income families experience constraints in budget and time that limit parents ability to provide access to summer activities that may promote learning during the summer months (Gershenson, 2013). It is for this reason that statistical comparisons were made between mobile and non-mobile students' trajectories, and while the causal influence of mobility cannot be fully determined, these analyses bring us closer to understanding how mobile students' achievement differ from non-mobile students.

For research question two (i.e., how changes in school racial composition matter for post-mobility achievement), I hypothesized that mobile students who experienced a decline in same-ethnic peers following the non-normative move would have lower levels of achievement and slower achievement growth post-move than students who experience no change or an increase in same-ethnic peers following the school move. The results partially supported my hypothesis, as students who experienced no change in same-ethnic peers demonstrated higher math achievement immediately following the non-normative school move compared to their achievement prior to the school move, but students who experienced a positive or negative change in same-ethnic peers did not show immediate changes in their math achievement. As for post-mobility achievement growth, changes in the proportion of same-ethnic peers did not have any influence on students' post-mobility reading, but experiencing a decline in the proportion of same-ethnic peers was associated with slower math achievement growth following the non-normative school move. This finding is in line with evidence that suggests students' academics are disrupted by declining same-ethnic peers following the transition to high school (Benner & Graham, 2007, 2009).

For school racial/ethnic diversity, I expected that students who experienced an increase in racial/ethnic diversity following the school move would show higher levels of achievement and achievement growth following the school move than students who experienced a decline or no change in their school racial diversity. Results partially supported my hypothesis as students who experienced a decline in diversity showed a significant decline in reading achievement immediately following the school move. However, students who experienced an increase in school racial/ethnic diversity showed more attenuated math achievement growth compared to students who experienced no change in their school racial/ethnic diversity. While unexpected, research

suggests that the benefits from school racial/ethnic diversity are driven by having a critical mass of same-ethnic peers (Benner & Crosnoe, 2011) and it is possible that in cases where schools have high levels of racial/ethnic diversity, students may lose their critical mass of same-ethnic peers, thus negatively impacting their achievement. The current study models the influence of changes in the same-ethnic peers and school racial/ethnic diversity on student outcomes simultaneously, and the notion of the importance of a critical mass in same-ethnic peers is reflected in the current findings.

For the second component of research question two, I hypothesized that patterns of effects would depend on the racial composition of the sending school the student attended prior to moving, but specific hypotheses were not put forth regarding the extent to which the sending school composition would serve as a moderator. Results did not support my hypothesis as the influence of changing school racial composition did not appear to be moderated by sending school racial composition. The lack of significant findings may be related to the few number of students that experienced substantial changes in their school composition following the school move.

Lastly, related to the final research question (racial/ethnic differences), the influence of changing composition and sending school composition on students' post-mobility achievement growth does appear to vary by race, as predicted. Results suggest that having a critical mass of same-ethnic peers is particularly important for Latino/a/x students, who show more attenuated post-mobility math achievement growth when they experience a decline in same-ethnic peers; in contrast, White students appear to benefit from a decline in same-ethnic peers post-mobility and experience academic disruptions when experiencing an increase in same-ethnic peers or a decline in diversity. This finding for White students might indicate that greater exposure to non-White

peers can be beneficial for White students, as suggested by prior work that finds that White students tend to benefit from attending racially diverse schools (Yip et al., 2019). Asian students also appear to benefit from a decline in same-ethnic peers. The reason for this result remains unclear as few studies have examined the influence of changing school racial composition on Asian American students specifically. This result could be related to changes in other aspects of the school context, such as socioeconomic composition as mentioned previously. This finding could also be related to aspects outside of the school setting. For example, research finds greater numeric marginalization in school was linked to more frequent family cultural socialization (Y. Wang et al., 2022), which in turn is linked to various positive outcomes for youth including academic outcomes (M.-T. Wang et al., 2020). It is possible upon transferring to a school with few same-ethnic peers, increased family cultural socialization helps Asian American students thrive despite numerical marginalization.

Taken as a whole, contextualizing non-normative mobility is a critical step in advancing student mobility research; in doing so, researchers can pinpoint which students are most at risk for experiencing severe detriments from non-normative moves. The current study advances the literature on student mobility by taking an accelerated longitudinal approach to assessing the influence of non-normative mobility on students' achievement growth. Moreover, focusing on racially/ethnically relevant contextual factors is a novel contribution of the current study, as little research has investigated the role of changing school racial composition on the influence of non-normative mobility specifically. Moreover, attention to students' own race/ethnicity can help identify racial/ethnic differences in needed transition supports and aid educators in supporting students from various backgrounds in a racially/ethnically diversifying school system.

While the current study makes novel contributions to the existing mobility literature and is strengthened by its large sample, longitudinal design, and piecewise growth modeling approach, it is not without limitations. First, the NWEA data do not include important student-level characteristics that may influence students' achievement or response to mobility, such as student socioeconomic background. Mobile students tend to be disproportionately from low-income backgrounds (Grigg, 2012) and students from low-income backgrounds also tend to have lower levels of academic achievement than students from higher socioeconomic backgrounds (Reardon, 2013). However, the current study represents an important first step in unpacking how race/ethnicity-specific contextual factors matter for how students are able to navigate their non-normative school moves. Additionally, while these data are longitudinal, they are correlational, and thus no causal claims can be made. Moreover, the schools in the current sample had self-selected into administering the MAP Growth assessments, and thus the data are not nationally representative and may not be generalizable to American students overall. Future research utilizing large nationally representative data and accounting for the influence of family socioeconomic status on student outcomes can assist in further disentangling the variation in the impact of non-normative mobility.

### **Conclusion**

The results of the current study document disruptions in students' achievement growth across a non-normative move but suggest that the extent to which students' trajectories are disrupted is dependent on changes in the school racial composition across the school move, with changes in proportion of same-ethnic peers being particularly influential on students' post-mobility achievement growth. The current study further expands on the extant literature surrounding student

mobility and changing contexts by exploring whether the influence of changes in school racial composition was dependent on sending school racial composition, and results provide evidence supporting this notion. Moreover, the relations between changing composition and students' post-mobility achievement growth appeared to vary across race, with Latino/a/x students' being particularly sensitive to the consequences of declining same-ethnic peers across a non-normative move, and White students appearing to benefit from declining same-ethnic peers. Additionally, Asian students attending school with few same-ethnic peers seem to experience academic consequences when experiencing any pattern of change in same-ethnic peers (increase or decrease). Together, these findings shed light on the importance of contextualizing students' mobility experiences and placing attention on both structural and individual-level factors that may influence students' academic responses to non-normative school moves. The insights gained by investigating modifiers of students' mobility experiences can assist in informing interventions to support mobile students, and focusing on race/ethnicity-related factors is particularly important in an education system with a diverse racial/ethnic landscape.

Table 1. Participant Demographics

| Reading Sample                                                           | Full Sample<br>(N = 189,885) |      | Mobile Students<br>(N = 12,918) |      | Non-mobile<br>Students<br>(N = 176,961) |      |
|--------------------------------------------------------------------------|------------------------------|------|---------------------------------|------|-----------------------------------------|------|
|                                                                          | N                            | %    | N                               | %    | N                                       | %    |
| <b>Race/ethnicity</b>                                                    |                              |      |                                 |      |                                         |      |
| White                                                                    | 68317                        | 36   | 3362                            | 26.0 | 64954                                   | 36.7 |
| Black                                                                    | 36606                        | 19.3 | 3970                            | 30.7 | 32636                                   | 18.4 |
| Asian American                                                           | 12511                        | 6.6  | 645                             | 5.0  | 11865                                   | 6.7  |
| Latino/a/x                                                               | 52524                        | 27.7 | 3463                            | 26.8 | 49058                                   | 27.7 |
| Other                                                                    | 19927                        | 10.5 | 1478                            | 11.4 | 18448                                   | 10.4 |
| <b>Gender</b>                                                            |                              |      |                                 |      |                                         |      |
| Female                                                                   | 93410                        | 49.2 | 6204                            | 48.0 | 87203                                   | 49.3 |
| Male                                                                     | 96475                        | 50.8 | 6714                            | 52.0 | 89758                                   | 50.7 |
| <b>School Mobility</b>                                                   |                              |      |                                 |      |                                         |      |
| Experienced mobility<br>the summer after the<br>2015-2016 school year    | 12918                        | 6.8  | --                              | --   | --                                      | --   |
| Math Sample                                                              | Full Sample<br>(N = 230,005) |      | Mobile Students<br>(N = 15,465) |      | Non-mobile<br>Students<br>(N = 214,582) |      |
|                                                                          | N                            | %    | N                               | %    | N                                       | %    |
| <b>Race/ethnicity</b>                                                    |                              |      |                                 |      |                                         |      |
| White                                                                    | 78308                        | 34   | 3732                            | 24.1 | 74575                                   | 34.8 |
| Black                                                                    | 43437                        | 18.9 | 4593                            | 29.7 | 38843                                   | 18.1 |
| Asian American                                                           | 17078                        | 7.4  | 974                             | 6.3  | 16103                                   | 7.5  |
| Latino/a/x                                                               | 69298                        | 30.1 | 4555                            | 29.5 | 64740                                   | 30.2 |
| Other                                                                    | 21934                        | 9.5  | 1611                            | 10.4 | 20321                                   | 9.5  |
| <b>Gender</b>                                                            |                              |      |                                 |      |                                         |      |
| Female                                                                   | 113109                       | 49.2 | 7438                            | 48.1 | 105668                                  | 49.2 |
| Male                                                                     | 116946                       | 50.8 | 8027                            | 51.9 | 108914                                  | 50.8 |
| <b>School Mobility</b>                                                   |                              |      |                                 |      |                                         |      |
| Experienced mobility<br>the summer after the<br>2015-2016 school<br>year | 15465                        | 6.7  | --                              | --   | --                                      | --   |

Note. Total possible N = 189,885 for reading and 230,055 for math

Table 2. Frequency of Composition Change Groups Among Mobile Students

|                                    | Reading Sample |      | Math Sample |       |
|------------------------------------|----------------|------|-------------|-------|
|                                    | <i>N</i>       | %    | <i>N</i>    | %     |
| <b>Change in Same-ethnic Peers</b> |                |      |             |       |
| Negative change                    | 1587           | 13.9 | 1921        | 13.87 |
| Positive change                    | 1529           | 13.4 | 1823        | 13.16 |
| No change                          | 8319           | 72.8 | 10104       | 72.96 |
| <b>Change in Diversity</b>         |                |      |             |       |
| Negative change                    | 1662           | 12.9 | 1945        | 12.6  |
| Positive change                    | 1841           | 14.3 | 2182        | 14.1  |
| No change                          | 9410           | 72.8 | 11332       | 73.3  |

*Note.* Total possible mobile student *N* = 12,918 for reading and 15,465 for math

Table 3. Summary of Unconditional Growth Models for Reading and Math Achievement

|                      | Model Fit |                    | Wald Test |                 | Sending School |       | Receiving School |       |
|----------------------|-----------|--------------------|-----------|-----------------|----------------|-------|------------------|-------|
|                      | CFI       | RMSEA (CI)         | <i>W</i>  | <i>p</i> -value | Intercept      | Slope | Intercept        | Slope |
| <b>Reading</b>       | .99       | .06 (0.055-0.062)  |           |                 | 186.88         | 9.15  | 185.71           | 5.85  |
| Intercept difference |           |                    | 70.20     | .000            |                |       |                  |       |
| Slope difference     |           |                    | 2411.77   | .000            |                |       |                  |       |
| <b>Math</b>          | .99       | .06 (0.060 -0.066) |           |                 | 191.77         | 9.97  | 189.52           | 7.16  |
| Intercept difference |           |                    | 293.72    | .000            |                |       |                  |       |
| Slope difference     |           |                    | 1894.57   | .000            |                |       |                  |       |

*Note.* Intercept is spring of 2016 in the sending school [phase one] and fall of 2016 in the receiving school [phase two]. Total possible mobile student *N* = 12,918 for reading and 15,465 for math. CI = confidence interval. All intercept and slope values significant at  $p < .001$ .

Table 4. Variation In Pre- and Post-Mobility Achievement Trajectories by Students' Mobility Status

|                                                       | <b>S-B Scaled <math>\chi^2</math><br/>difference</b> | <b>df</b> | <b>p-value</b> |
|-------------------------------------------------------|------------------------------------------------------|-----------|----------------|
| <b>Multiple Group: Mobile vs Non-Mobile Students</b>  |                                                      |           |                |
| <b>Reading</b>                                        |                                                      |           |                |
| <b>Fully constrained: fixed intercepts and slopes</b> | <b>300.76</b>                                        | <b>4</b>  | <b>0.000</b>   |
| <b>Intercept 1 fixed</b>                              | <b>203.84</b>                                        | <b>1</b>  | <b>0.000</b>   |
| Slope 1 fixed                                         | 1.13                                                 | 1         | 0.287          |
| <b>Intercept 2 fixed</b>                              | <b>245.51</b>                                        | <b>1</b>  | <b>0.000</b>   |
| <b>Slope 2 fixed</b>                                  | <b>11.36</b>                                         | <b>1</b>  | <b>0.001</b>   |
| <b>Math</b>                                           |                                                      |           |                |
| <b>Fully constrained: fixed intercepts and slopes</b> | <b>188.75</b>                                        | <b>4</b>  | <b>0.000</b>   |
| <b>Intercept 1 fixed</b>                              | <b>127.07</b>                                        | <b>1</b>  | <b>0.000</b>   |
| <b>Slope 1 fixed</b>                                  | <b>17.43</b>                                         | <b>1</b>  | <b>0.000</b>   |
| <b>Intercept 2 fixed</b>                              | <b>131.35</b>                                        | <b>1</b>  | <b>0.000</b>   |
| <b>Slope 2 fixed</b>                                  | <b>9.87</b>                                          | <b>1</b>  | <b>0.002</b>   |

Note: Significant Satorra-Bentler scaled chi-square difference test results ( $p < .05$ ) are bolded. Comparison model is the fully free model for all difference tests.

Table 5. Comparing Mobile and Non-mobile Students' Conditional Pre-Mobility Reading and Math Achievement Growth

|                   | Non-movers                              |                        | Movers                                  |                        |
|-------------------|-----------------------------------------|------------------------|-----------------------------------------|------------------------|
|                   | Pre-mobility Intercept<br>(Spring 2016) | Pre-mobility<br>Slope  | Pre-mobility Intercept<br>(Spring 2016) | Pre-mobility Slope     |
| <b>Reading</b>    |                                         |                        |                                         |                        |
| Intercept         | <b>12.29 (0.05)***</b>                  | <b>2.68 (0.03)***</b>  | <b>11.73 (0.09)***</b>                  | <b>2.61 (0.08)***</b>  |
| Prior school move | <b>-0.01 (0.00)**</b>                   | -0.01 (0.01)           | -0.01 (0.01)                            | 0.00 (0.01)            |
| Later school move | --                                      | --                     | --                                      | --                     |
| Send school %FRPL | <b>-0.23 (0.01)***</b>                  | 0.00 (0.01)            | <b>-0.05 (0.01)***</b>                  | <b>0.07 (0.02)***</b>  |
| Rec School %FRPL  | --                                      | --                     | --                                      | --                     |
| Male              | <b>-0.08 (0.00)***</b>                  | <b>0.02 (0.00)***</b>  | <b>-0.1 (0.01)***</b>                   | 0.01 (0.01)            |
| Black             | <b>-0.15 (0.01)***</b>                  | <b>-0.11 (0.01)***</b> | <b>-0.21 (0.01)***</b>                  | <b>-0.18 (0.02)***</b> |
| Asian             | <b>0.02 (0.01)***</b>                   | <b>0.01 (0.01)</b>     | <b>0.06 (0.01)***</b>                   | 0.01 (0.01)            |
| Latino/a/x        | <b>-0.19 (0.01)***</b>                  | -0.03<br>(0.01)0.001   | <b>-0.22 (0.01)***</b>                  | <b>-0.09 (0.02)***</b> |
| Other             | <b>-0.07 (0.01)***</b>                  | <b>-0.01 (0.01)</b>    | <b>-0.1 (0.02)***</b>                   | -0.04 (0.02)           |
| K-3rd cohort      | <b>-0.51 (0.01)***</b>                  | <b>0.57 (0.01)***</b>  | <b>-0.53 (0.01)***</b>                  | <b>0.47 (0.02)***</b>  |
| 1st-4th cohort    | <b>-0.25 (0.00)***</b>                  | <b>0.23 (0.01)***</b>  | <b>-0.25 (0.01)***</b>                  | <b>0.17 (0.02)***</b>  |
| R <sup>2</sup>    | <b>0.39 (0.01)***</b>                   | <b>0.28 (0.01)***</b>  | <b>0.32 (0.01)***</b>                   | <b>0.21 (0.02)***</b>  |
| <b>Math</b>       |                                         |                        |                                         |                        |
| Intercept         | <b>12.82 (0.06)***</b>                  | <b>2.43 (0.04)***</b>  | <b>11.73 (0.12)***</b>                  | <b>2.33 (0.07)***</b>  |
| Prior school move | <b>-0.01 (0.00)***</b>                  | -0.01 (0.01)           | <b>-0.02 (0.00)***</b>                  | -0.01 (0.01)           |
| Later school move | --                                      | --                     | --                                      | --                     |
| Send school %FRPL | <b>-0.19 (0.01)***</b>                  | <b>0.12 (0.01)***</b>  | -0.01 (0.01)                            | <b>0.17 (0.02)***</b>  |
| Rec school %FRPL  | --                                      | --                     | --                                      | --                     |
| Male              | <b>0.03 (0.00)***</b>                   | <b>0.07 (0.00)***</b>  | 0.00 (0.01)                             | <b>0.06 (0.01)***</b>  |
| Black             | <b>-0.19 (0.01)***</b>                  | <b>-0.13 (0.01)***</b> | <b>-0.27 (0.01)***</b>                  | <b>-0.18 (0.02)***</b> |
| Asian             | <b>0.05 (0.01)***</b>                   | <b>0.03 (0.01)***</b>  | <b>0.11 (0.01)***</b>                   | 0.02 (0.01)            |
| Latino/a/x        | <b>-0.2 (0.01)***</b>                   | <b>-0.02 (0.01)*</b>   | <b>-0.24 (0.01)***</b>                  | <b>-0.05 (0.02)**</b>  |
| Other             | <b>-0.07 (0.01)***</b>                  | <b>-0.01 (0.01)</b>    | <b>-0.09 (0.01)***</b>                  | -0.02 (0.02)           |
| K-3rd cohort      | <b>-0.57 (0.00)***</b>                  | <b>0.69 (0.01)***</b>  | <b>-0.59 (0.01)***</b>                  | <b>0.65 (0.02)***</b>  |
| 1st-4th cohort    | <b>-0.25 (0.01)***</b>                  | <b>0.34 (0.01)***</b>  | <b>-0.28 (0.01)***</b>                  | <b>0.34 (0.02)***</b>  |
| R <sup>2</sup>    | <b>0.43 (0.01)***</b>                   | <b>0.44 (0.01)***</b>  | <b>0.4 (0.01)***</b>                    | <b>0.42 (0.02)***</b>  |

Note. Send = Sending, Rec = Receiving, FRPL = Free or reduced-price lunch. Standardized coefficients adjusted for covariates are presented. Achievement values were divided by 10 for analysis purposes. Significant standardized coefficients are bolded.  $N = 12,918$  and  $176,961$  for mobile and nonmobile students, respectively, in the reading models and  $15,465$  and  $214,582$  for mobile and nonmobile students, respectively, in the math models.

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

Table 6. Comparing Mobile and Non-mobile Students' Conditional Post-Mobility Reading and Math Achievement Growth

|                   | <b>Non-movers</b>                      |                        | <b>Movers</b>                          |                        |
|-------------------|----------------------------------------|------------------------|----------------------------------------|------------------------|
|                   | Post-mobility Intercept<br>(Fall 2016) | Post-mobility<br>Slope | Post-mobility Intercept<br>(Fall 2016) | Post-mobility Slope    |
| <b>Reading</b>    |                                        |                        |                                        |                        |
| Intercept         | <b>11.6 (0.04)***</b>                  | <b>1.87 (0.03)***</b>  | <b>11.02 (0.09)***</b>                 | <b>1.96 (0.08)***</b>  |
| Prior school move | --                                     | --                     | --                                     | --                     |
| Later school move | <b>0.00 (0.00)*</b>                    | <b>-0.02 (0.01)**</b>  | <b>-0.02 (0.01)***</b>                 | 0.00 (0.02)            |
| Send school %FRPL | --                                     | --                     | --                                     | --                     |
| Rec School %FRPL  | <b>-0.23 (0.01)***</b>                 | <b>0.07 (0.01)***</b>  | <b>-0.05 (0.01)***</b>                 | 0.01 (0.02)            |
| Male              | <b>-0.08 (0.00)***</b>                 | <b>0.04 (0.00)***</b>  | <b>-0.11 (0.01)***</b>                 | <b>0.04 (0.02)**</b>   |
| Black             | <b>-0.12 (0.01)***</b>                 | <b>-0.05 (0.01)***</b> | <b>-0.19 (0.02)***</b>                 | <b>-0.06 (0.02)*</b>   |
| Asian             | <b>0.05 (0.01)***</b>                  | <b>-0.03 (0.01)***</b> | <b>0.08 (0.01)***</b>                  | -0.02 (0.02)           |
| Latino/a/x        | <b>-0.18 (0.01)***</b>                 | <b>0.03 (0.01)***</b>  | <b>-0.21 (0.01)***</b>                 | <b>0.06 (0.02)*</b>    |
| Other             | <b>-0.07 (0.01)***</b>                 | 0.00 (0.01)            | <b>-0.09 (0.02)***</b>                 | -0.01 (0.02)           |
| K-3rd cohort      | <b>-0.52 (0.01)***</b>                 | <b>0.55 (0.01)***</b>  | <b>-0.52 (0.01)***</b>                 | <b>0.5 (0.02)***</b>   |
| 1st-4th cohort    | <b>-0.24 (0.00)***</b>                 | <b>0.27 (0.01)***</b>  | <b>-0.23 (0.01)***</b>                 | <b>0.23 (0.02)***</b>  |
| R <sup>2</sup>    | <b>0.38 (0.01)***</b>                  | <b>0.28 (0.01)***</b>  | <b>0.31 (0.01)***</b>                  | <b>0.22 (0.02)***</b>  |
| <b>Math</b>       |                                        |                        |                                        |                        |
| Intercept         | <b>12.94 (0.05)***</b>                 | <b>3.67 (0.05)***</b>  | <b>11.81 (0.12)***</b>                 | <b>3.14 (0.1)***</b>   |
| Prior school move | --                                     | --                     | --                                     | --                     |
| Later school move | 0.00 (0.00)                            | <b>-0.03 (0.01)***</b> | -0.01 (0.00)                           | -0.02 (0.01)           |
| Send school %FRPL | --                                     | --                     | --                                     | --                     |
| Rec school %FRPL  | <b>-0.23 (0.01)***</b>                 | <b>-0.04 (0.01)**</b>  | <b>-0.05 (0.01)***</b>                 | <b>0.04 (0.02)*</b>    |
| Male              | <b>0.02 (0.00)***</b>                  | <b>0.06 (0.00)***</b>  | -0.01 (0.01)                           | <b>0.04 (0.01)**</b>   |
| Black             | <b>-0.15 (0.01)***</b>                 | <b>-0.15 (0.01)***</b> | <b>-0.22 (0.01)***</b>                 | <b>-0.2 (0.02)***</b>  |
| Asian             | <b>0.08 (0.01)***</b>                  | <b>0.06 (0.01)***</b>  | <b>0.13 (0.01)***</b>                  | <b>0.09 (0.02)***</b>  |
| Latino/a/x        | <b>-0.17 (0.01)***</b>                 | <b>-0.06 (0.01)***</b> | <b>-0.2 (0.01)***</b>                  | <b>-0.08 (0.02)***</b> |
| Other             | <b>-0.06 (0.01)***</b>                 | <b>-0.04 (0.01)***</b> | <b>-0.08 (0.01)***</b>                 | <b>-0.05 (0.02)**</b>  |
| K-3rd cohort      | <b>-0.6 (0.01)***</b>                  | <b>0.32 (0.01)***</b>  | <b>-0.61 (0.01)***</b>                 | <b>0.33 (0.02)***</b>  |
| 1st-4th cohort    | <b>-0.34 (0.00)***</b>                 | <b>0.27 (0.01)***</b>  | <b>-0.34 (0.01)***</b>                 | <b>0.24 (0.02)***</b>  |
| R <sup>2</sup>    | <b>0.47 (0.01)***</b>                  | <b>0.14 (0.01)***</b>  | <b>0.43 (0.01)***</b>                  | <b>0.14 (0.01)***</b>  |

Note. Send = Sending, Rec = Receiving, FRPL = Free or reduced-price lunch. Standardized coefficients adjusted for covariates are presented. Achievement values were divided by 10 for analysis purposes. Significant standardized coefficients are bolded. N = 12,918 and 176,961 for mobile and nonmobile students, respectively, in the reading models and 15,465 and 214,582 for mobile and nonmobile students, respectively, in the math models.

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

Table 7. Wald Test of the Difference Between the Pre-Mobility and Post-Mobility Intercepts Across School Composition Change Groups

|                             | Wald Test    |                 | Sending School | Receiving School |
|-----------------------------|--------------|-----------------|----------------|------------------|
|                             | <i>W</i>     | <i>p</i> -value | Inter          | Inter            |
| <b>Reading</b>              |              |                 |                |                  |
| Increase in same-eth peers  | 0.18         | 0.673           | 116.73         | 108.41           |
| Decrease in same-eth peers  | 2.28         | 0.131           | 117.37         | 109.48           |
| No change in same-eth peers | 3.04         | 0.081           | 118.12         | 110.84           |
| Increase in diversity       | 0.10         | 0.753           | 117.04         | 111.50           |
| Decrease in diversity       | <b>4.58</b>  | <b>0.032</b>    | <b>118.93</b>  | <b>109.88</b>    |
| No change in diversity      | <b>6.17</b>  | <b>0.013</b>    | <b>117.21</b>  | <b>110.05</b>    |
| <b>Math</b>                 |              |                 |                |                  |
| Increase in same-eth peers  | 0.36         | 0.550           | 119.29         | 121.88           |
| Decrease in same-eth peers  | 0.01         | 0.916           | 119.22         | 122.92           |
| No change in same-eth peers | <b>11.48</b> | <b>0.000</b>    | <b>116.74</b>  | <b>117.18</b>    |
| Increase in diversity       | 0.10         | 0.755           | 122.75         | 126.63           |
| Decrease in diversity       | 1.11         | 0.293           | 123.99         | 123.46           |
| No change in diversity      | <b>13.71</b> | <b>0.000</b>    | <b>115.49</b>  | <b>116.06</b>    |

*Note.* Inter = Intercept; Significant Wald tests are bolded. *N* = 12,918 for reading models and 15,465 for math models. Standardized intercept values adjusted for covariates are presented.

Table 8. Estimates of Change in School Racial Composition on Students' Post-Mobility Achievement Growth

|                                        | <b>Reading</b>        | <b>Math</b>            |
|----------------------------------------|-----------------------|------------------------|
| Post-mobility slope                    | <b>1.95 (0.10)***</b> | <b>3.16 (0.11)***</b>  |
| Decrease in same-eth peers             | 0.00 (0.02)           | <b>-0.04 (0.02)*</b>   |
| Decrease in same-eth peers vs Increase | 0.00 (0.02)           | -0.03 (0.02)           |
| Increase in same-eth peers             | 0.00 (0.01)           | -0.01 (0.02)           |
| Decrease in diversity                  | -0.01 (0.01)          | -0.02 (0.01)           |
| Decrease in diversity vs Increase      | -0.02 (0.02)          | 0.02 (0.02)            |
| Increase in diversity                  | 0.01 (0.01)           | <b>-0.04 (0.02)*</b>   |
| Later school move                      | 0.00 (0.02)           | -0.02 (0.02)           |
| Receiving School %FRPL                 | 0.02 (0.02)           | <b>0.06 (0.02)**</b>   |
| Male                                   | <b>0.04 (0.02)*</b>   | <b>0.04 (0.01)*</b>    |
| Black                                  | <b>-0.07 (0.02)**</b> | <b>-0.21 (0.02)***</b> |
| Asian                                  | -0.02 (0.02)          | <b>0.09 (0.02)***</b>  |
| Latino/a/x                             | <b>0.05 (0.02)*</b>   | <b>-0.09 (0.02)***</b> |
| K-3rd cohort                           | <b>0.50 (0.02)***</b> | <b>0.34 (0.02)***</b>  |
| 1st-4th cohort                         | <b>0.23 (0.02)***</b> | <b>0.24 (0.02)***</b>  |
| $R^2$                                  | <b>0.22 (0.02)***</b> | <b>0.16 (0.02)***</b>  |

*Note.* Same-eth = percentage of same-ethnic peers. Standardized coefficients adjusted for covariates are presented. Achievement values were divided by 10 for analysis purposes. Significant standardized coefficients are bolded. . Estimates are from models in which no change in school composition is the reference group unless otherwise specified.  $R^2$  estimates are identical for no change group comparison model and positive change group comparison model  $N = 12,918$  for reading models and 15,465 for math models.

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

Table 9. Sending School Composition as a Moderator of the Link Between Changing Racial Composition and Student Achievement

|                                                | Reading      |               | Math                 |              |
|------------------------------------------------|--------------|---------------|----------------------|--------------|
|                                                | Model 1      | Model 2       | Model 1              | Model 2      |
|                                                | $\beta$ (SE) | $\beta$ (SE)  | $\beta$ (SE)         | $\beta$ (SE) |
| <b>No change as reference</b>                  |              |               |                      |              |
| Decrease in same-eth peers                     | 0.00 (0.02)  | 0.00 (0.02)   | <b>-0.03 (0.02)*</b> | -0.03 (0.03) |
| Increase in same-eth peers                     | 0.00 (0.01)  | 0.03 (0.02)   | -0.01 (0.02)         | 0.00 (0.02)  |
| Decrease in diversity                          | -0.01 (0.01) | 0.00 (0.02)   | -0.02 (0.02)         | -0.02 (0.02) |
| Increase in diversity                          | 0.00 (0.02)  | 0.01 (0.02)   | <b>-0.04 (0.02)*</b> | -0.04 (0.03) |
| Send school same-eth peers                     | 0.00 (0.02)  | -0.01 (0.02)  | -0.01 (0.02)         | -0.02 (0.02) |
| Send school diversity                          | -0.01 (0.02) | -0.02 (0.02)  | -0.01 (0.02)         | -0.01 (0.02) |
| Decrease in same-eth X send school same-eth    |              | 0.00 (0.025)  |                      | 0.00 (0.03)  |
| Increase in same-eth X send school same-eth    |              | 0.04 (0.02)   |                      | 0.01 (0.02)  |
| Decrease in diversity X send school diversity  |              | -0.02 (0.02)  |                      | 0.00 (0.03)  |
| Increase in diversity X send school diversity  |              | 0.02 (0.02)   |                      | 0.00 (0.03)  |
| R <sup>2</sup>                                 | 0.22***      | 0.22***       | .16***               | 0.22***      |
| <b>Positive change as reference</b>            |              |               |                      |              |
| Decrease in same-eth peers                     | 0.00 (0.02)  | -0.03 (0.03)  | -0.03 (0.02)         | -0.03 (0.03) |
| No change in same-eth peers                    | 0.00 (0.02)  | -0.04 (0.03)  | 0.01 (0.02)          | 0.00 (0.03)  |
| Decrease in diversity                          | -0.01 (0.02) | -0.01 (0.03)  | 0.02 (0.02)          | 0.01 (0.04)  |
| No change in diversity                         | 0.00 (0.02)  | -0.02 (0.03)  | <b>0.05 (0.02)*</b>  | 0.05 (0.04)  |
| Send school same-eth peers                     | 0.00 (0.02)  | 0.12 (0.07)   | -0.01 (0.02)         | 0.02 (0.08)  |
| Send school diversity                          | -0.01 (0.02) | 0.02 (0.05)   | -0.01 (0.02)         | -0.01 (0.09) |
| Decrease in same-eth X send school same-eth    |              | -0.04 (0.04)  |                      | -0.01 (0.04) |
| No change in same-eth X send school same-eth   |              | -0.12 (0.071) |                      | -0.03 (0.08) |
| Decrease in diversity X send school diversity  |              | -0.03 (0.03)  |                      | 0.00 (0.03)  |
| No change in diversity X send school diversity |              | -0.04 (0.05)  |                      | 0.00 (0.07)  |
| R <sup>2</sup>                                 | 0.22***      | 0.22***       | .16***               | 0.22***      |

Note. Same-eth = percentage of same-ethnic peers. Standardized coefficients adjusted for covariates are presented. Achievement values were divided by 10 for analysis purposes. Significant standardized coefficients are bolded. .  $N = 12,918$  for reading models and  $15,465$  for math models.

\*  $p < .05$ . \*\*\*  $p < .001$ .

Table 10. Variation in the Influence of School Composition Change on Post-Mobility Achievement Growth by Race

|                                                      | <b>S-B Scaled<br/><math>\chi^2</math><br/>difference</b> | <b>df</b> | <b>p-<br/>value</b> |
|------------------------------------------------------|----------------------------------------------------------|-----------|---------------------|
| <b>Multiple Group: Race</b>                          |                                                          |           |                     |
| <b>Reading</b>                                       |                                                          |           |                     |
| <b>Fully constrained</b>                             | <b>31.63</b>                                             | <b>12</b> | <b>0.002</b>        |
| <b>Decline in same-ethnic peers</b>                  | <b>12.70</b>                                             | <b>3</b>  | <b>0.005</b>        |
| Increase in same-ethnic peers                        | 3.23                                                     | 3         | 0.357               |
| <b>Decline in diversity</b>                          | <b>9.61</b>                                              | <b>3</b>  | <b>0.022</b>        |
| Increase in diversity                                | 1.74                                                     | 3         | 0.627               |
| <b>Fully constrained (positive change reference)</b> | <b>31.626</b>                                            | <b>12</b> | <b>0.002</b>        |
| <b>Decline in same-ethnic peers vs increase</b>      | <b>8.370</b>                                             | <b>3</b>  | <b>0.039</b>        |
| Decline in diversity vs increase                     | 7.298                                                    | 3         | 0.063               |
| <b>Math</b>                                          |                                                          |           |                     |
| <b>Fully constrained</b>                             | <b>30.68</b>                                             | <b>12</b> | <b>0.002</b>        |
| <b>Decline in same-ethnic peers</b>                  | <b>8.36</b>                                              | <b>3</b>  | <b>0.039</b>        |
| <b>Increase in same-ethnic peers</b>                 | <b>11.93</b>                                             | <b>3</b>  | <b>0.008</b>        |
| Decline in diversity                                 | 2.14                                                     | 3         | 0.543               |
| Increase in diversity                                | 6.64                                                     | 3         | 0.084               |
| <b>Fully constrained (positive change reference)</b> | <b>30.68</b>                                             | <b>12</b> | <b>0.002</b>        |
| <b>Decline in same-ethnic peers vs increase</b>      | <b>21.62</b>                                             | <b>3</b>  | <b>0.000</b>        |
| Decline in diversity vs increase                     | 1.83                                                     | 3         | 0.608               |

*Note.* Significant Satorra-Bentler scaled chi-square difference test results ( $p < .05$ ) are bolded. Comparison model is the fully free model for all difference tests. Reference group for analysis in no change in school composition unless otherwise specified.  $N = 12,918$  for reading models and 15,465 for math models.

Table 11. Estimates of Change in School Racial Composition on Students' Post-Mobility Reading Achievement Growth by Race

|                                         | White                 | Black                 | Asian                 | Latino/a/x            |
|-----------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Post-mobility slope                     | <b>1.99 (0.14)***</b> | <b>2.01 (0.2)***</b>  | <b>1.78 (0.38)***</b> | <b>2.07 (0.14)***</b> |
| Decrease in same-eth peers              | <b>0.05 (0.02)*</b>   | -0.03 (0.03)          | <b>0.14 (0.04)**</b>  | -0.01 (0.02)          |
| Decrease in same-eth peers vs. Increase | <b>0.07 (0.03)*</b>   | -0.03 (0.04)          | 0.09 (0.05)           | -0.01 (0.04)          |
| Increase in same-eth peers              | -0.03 (0.03)          | 0.00 (0.03)           | 0.07 (0.05)           | 0.01 (0.02)           |
| Decrease in diversity                   | <b>-0.07 (0.02)**</b> | 0.02 (0.03)           | 0.06 (0.05)           | 0.00 (0.02)           |
| Decrease in diversity vs Increase       | <b>-0.07 (0.03)*</b>  | 0.02 (0.04)           | 0.12 (0.08)           | -0.02 (0.03)          |
| Increase in diversity                   | 0.00 (0.02)           | 0.00 (0.03)           | -0.05 (0.06)          | 0.02 (0.02)           |
| Later school move                       | -0.01 (0.03)          | 0.01 (0.03)           | <b>0.19 (0.08)*</b>   | -0.02 (0.03)          |
| Receiving School %FRPL                  | -0.03 (0.04)          | 0.03 (0.03)           | <b>0.22 (0.08)**</b>  | -0.01 (0.03)          |
| Male                                    | 0.04 (0.03)           | <b>0.07 (0.03)*</b>   | 0.07 (0.06)           | 0.02 (0.03)           |
| K-3rd cohort                            | <b>0.51 (0.04)***</b> | <b>0.51 (0.06)***</b> | <b>0.62 (0.1)***</b>  | <b>0.49 (0.03)***</b> |
| 1st-4th cohort                          | <b>0.24 (0.04)***</b> | <b>0.24 (0.04)***</b> | <b>0.26 (0.07)***</b> | <b>0.21 (0.03)***</b> |
| $R^2$                                   | <b>0.22***</b>        | <b>0.22***</b>        | <b>0.46**</b>         | <b>0.20***</b>        |

Note. Same-eth = percentage of same-ethnic peers. Standardized coefficients adjusted for covariates are presented. Achievement values were divided by 10 for analysis purposes. Significant standardized coefficients are bolded. . Estimates are from models in which no change in school composition is the reference group unless otherwise specified.  $R^2$  estimates are identical for the no change comparison and positive change comparison models.  $N = 12,918$  for reading models and 15,465 for math models.

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

Table 12. Estimates of Change in School Racial Composition on Students' Post-Mobility Math Achievement Growth by Race

|                                            | White                 | Black                 | Asian                | Latino/a/x            |
|--------------------------------------------|-----------------------|-----------------------|----------------------|-----------------------|
| Post-mobility slope                        | <b>3.71 (0.26)***</b> | <b>2.56 (0.19)***</b> | <b>3.58 (0.3)***</b> | <b>2.93 (0.17)***</b> |
| Decrease in same-eth peers                 | 0.05 (0.04)           | -0.03 (0.03)          | 0.00 (0.02)          | <b>-0.07 (0.03)**</b> |
| Decrease in same-eth peers vs.<br>Increase | <b>0.12 (0.04)**</b>  | -0.06 (0.04)          | 0.06 (0.04)          | <b>-0.09 (0.04)*</b>  |
| Increase in same-eth peers                 | <b>-0.10 (0.03)**</b> | 0.03 (0.03)           | -0.08 (0.05)         | 0.02 (0.03)           |
| Decrease in diversity                      | -0.04 (0.03)          | -0.03 (0.03)          | -0.04 (0.03)         | 0.01 (0.02)           |
| Decrease in diversity vs<br>Increase       | 0.04 (0.05)           | 0.00 (0.04)           | 0.07 (0.05)          | 0.01 (0.03)           |
| Increase in diversity                      | <b>-0.08 (0.03)*</b>  | -0.04 (0.03)          | <b>-0.09 (0.04)*</b> | 0.00 (0.03)           |
| Later school move                          | -0.04 (0.03)          | 0.01 (0.03)           | -0.02 (0.05)         | -0.03 (0.03)          |
| Receiving School %FRPL                     | -0.02 (0.04)          | <b>0.08 (0.03)**</b>  | <b>0.10 (0.05)*</b>  | 0.04 (0.03)           |
| Male                                       | 0.02 (0.03)           | 0.05 (0.03)           | -0.03 (0.05)         | <b>0.05 (0.02)*</b>   |
| K-3rd cohort                               | <b>0.31 (0.04)***</b> | <b>0.42 (0.04)***</b> | 0.00 (0.06)          | <b>0.38 (0.03)***</b> |
| 1st-4th cohort                             | <b>0.16 (0.03)***</b> | <b>0.31 (0.03)***</b> | 0.08 (0.05)          | <b>0.30 (0.03)***</b> |
| $R^2$                                      | <b>0.10***</b>        | <b>0.18***</b>        | <b>0.03*</b>         | <b>0.15***</b>        |

*Note.* Same-eth = percentage of same-ethnic peers. Standardized coefficients adjusted for covariates are presented. Achievement values were divided by 10 for analysis purposes. Significant standardized coefficients are bolded. . Estimates are from models in which no change in school composition is the reference group unless otherwise specified.  $R^2$  estimates are identical for the no change comparison and positive change comparison models.  $N = 12,918$  for reading models and 15,465 for math models.

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

Table 13. Variation in the Moderating Role of Sending School Composition on the Link Between School Composition Change and Post-Mobility Achievement Growth by Race

|                                                         | <b>S-B Scaled</b> |           |                |
|---------------------------------------------------------|-------------------|-----------|----------------|
|                                                         | $\chi^2$          |           |                |
|                                                         | <b>difference</b> | <b>df</b> | <b>p-value</b> |
| <b>Multiple Group: Race</b>                             |                   |           |                |
| <b>Reading</b>                                          |                   |           |                |
| <b>Fully constrained</b>                                | <b>31.81</b>      | <b>20</b> | <b>0.045</b>   |
| Sending school same-eth peers                           | 3.26              | 2         | 0.196          |
| Sending school diversity                                | 0.76              | 2         | 0.683          |
| Decline in same-eth peers X send school same-eth peers  | 1.12              | 2         | 0.571          |
| Increase in same-eth peers X send school same-eth peers | 0.14              | 2         | 0.934          |
| Decline in diversity X send school diversity            | 1.77              | 2         | 0.413          |
| Increase in diversity X send school diversity           | 2.17              | 2         | 0.337          |
| <b>Fully constrained (positive change reference)</b>    | <b>31.81</b>      | <b>20</b> | <b>0.045</b>   |
| Decline in same-eth peers X send school same-eth peers  | 0.82              | 2         | 0.663          |
| Decline in diversity X send school diversity            | 0.52              | 2         | 0.773          |
| <b>Math</b>                                             |                   |           |                |
| <b>Fully constrained</b>                                | <b>33.14</b>      | <b>20</b> | <b>0.033</b>   |
| Sending school same-eth peers                           | 5.14              | 2         | 0.077          |
| Sending school diversity                                | 1.16              | 2         | 0.561          |
| Decline in same-eth peers X send school same-eth peers  | 0.21              | 2         | 0.901          |
| Increase in same-eth peers X send school same-eth peers | 1.27              | 2         | 0.530          |
| Decline in diversity X send school diversity            | 1.30              | 2         | 0.522          |
| Increase in diversity X send school diversity           | 1.03              | 2         | 0.598          |
| <b>Fully constrained (positive change reference)</b>    | <b>33.14</b>      | <b>20</b> | <b>0.033</b>   |
| Decline in same-eth peers X send school same-eth peers  | 0.50              | 2         | 0.778          |
| Decline in diversity X send school diversity            | 1.46              | 2         | 0.482          |

Note. Significant Satorra-Bentler scaled chi-square difference test results ( $p < .05$ ) are bolded. Comparison model is the fully free model for all difference tests. Reference group for analysis in no change in school composition unless otherwise specified.  $N = 12,918$  for reading models and 15,465 for math models.

Figure 3. Analysis Model for Research Question 1

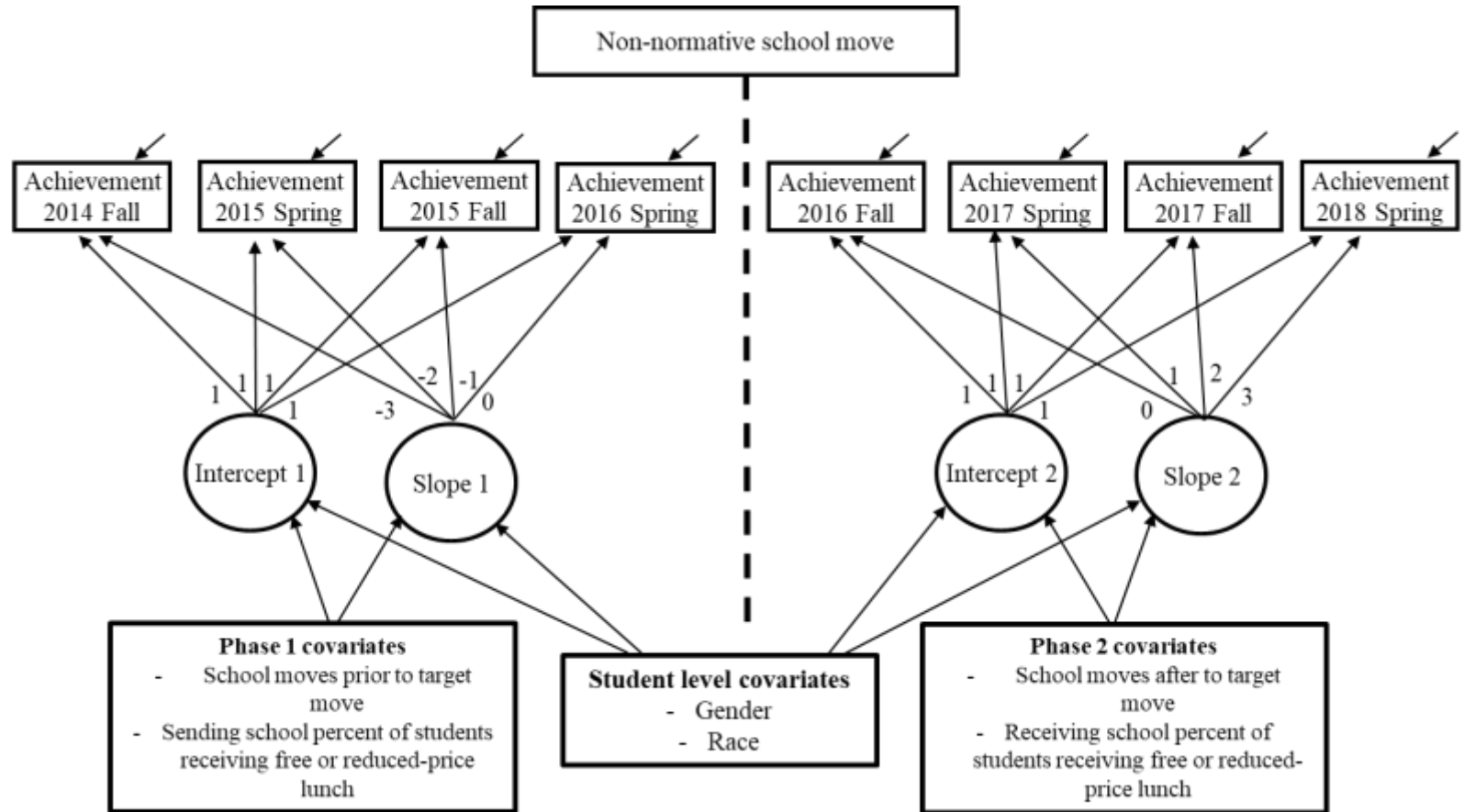


Figure 4. Analysis Model for Research Question 2

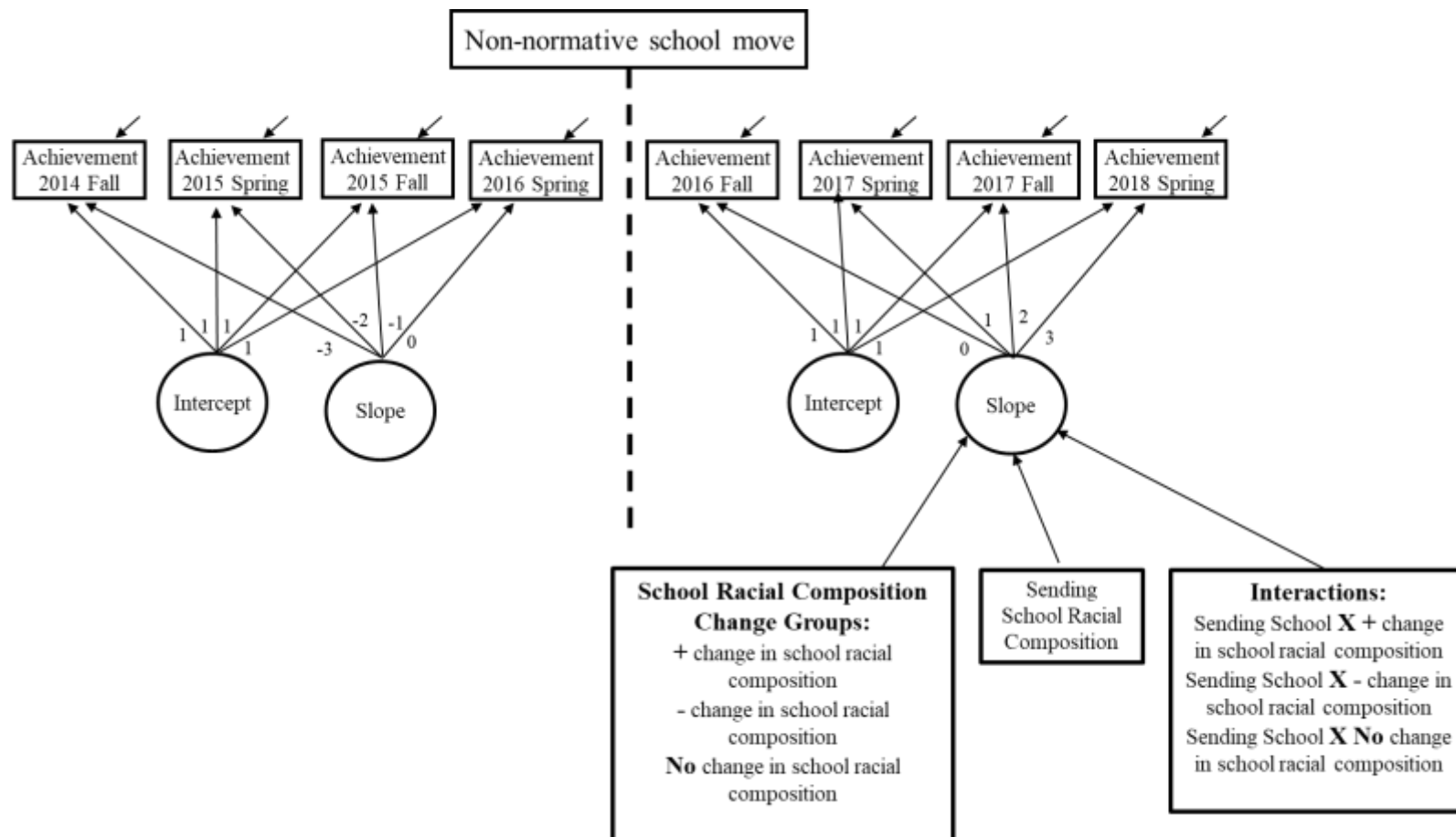


Figure 5. Analysis Model for Research Question 3

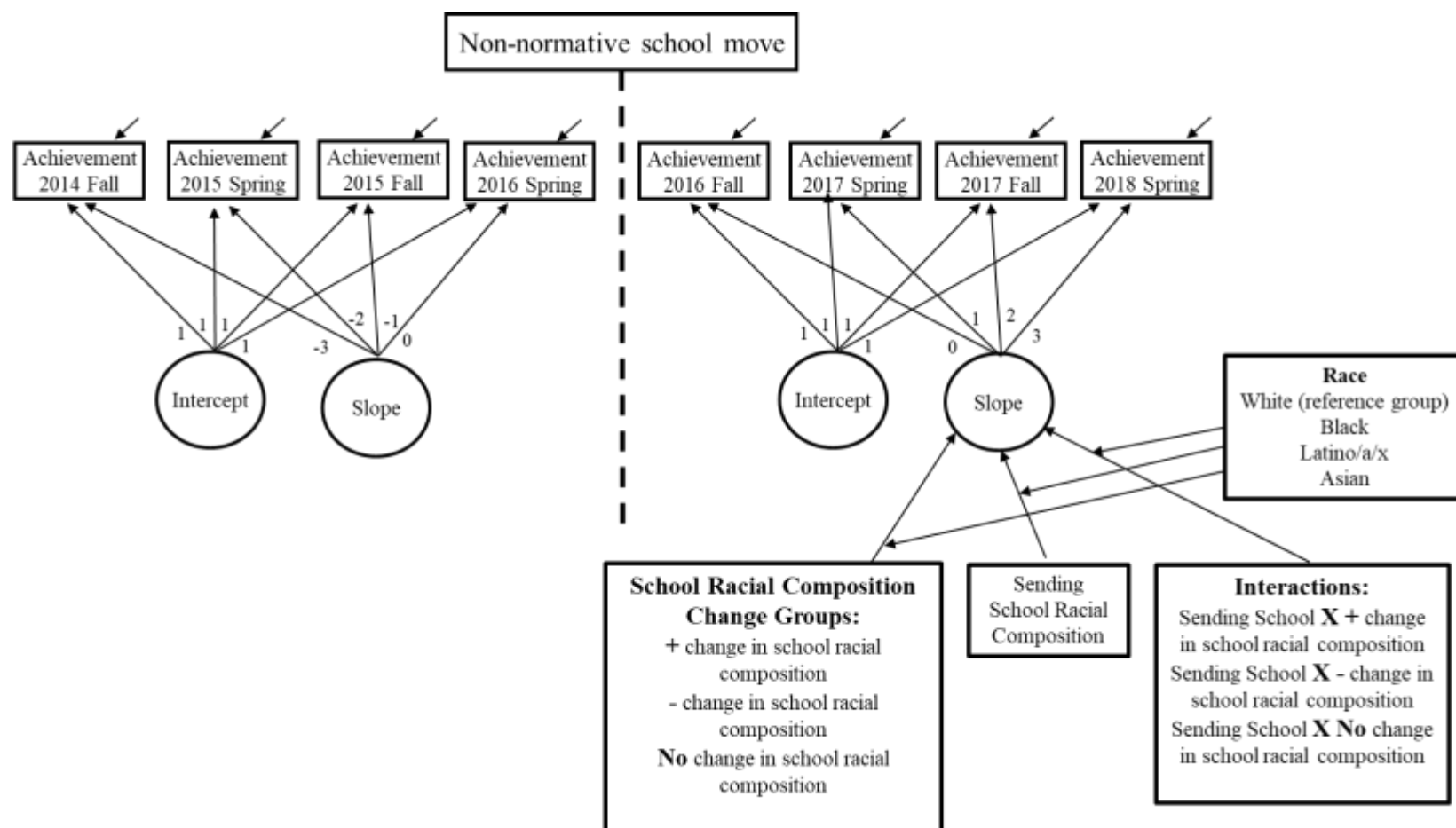
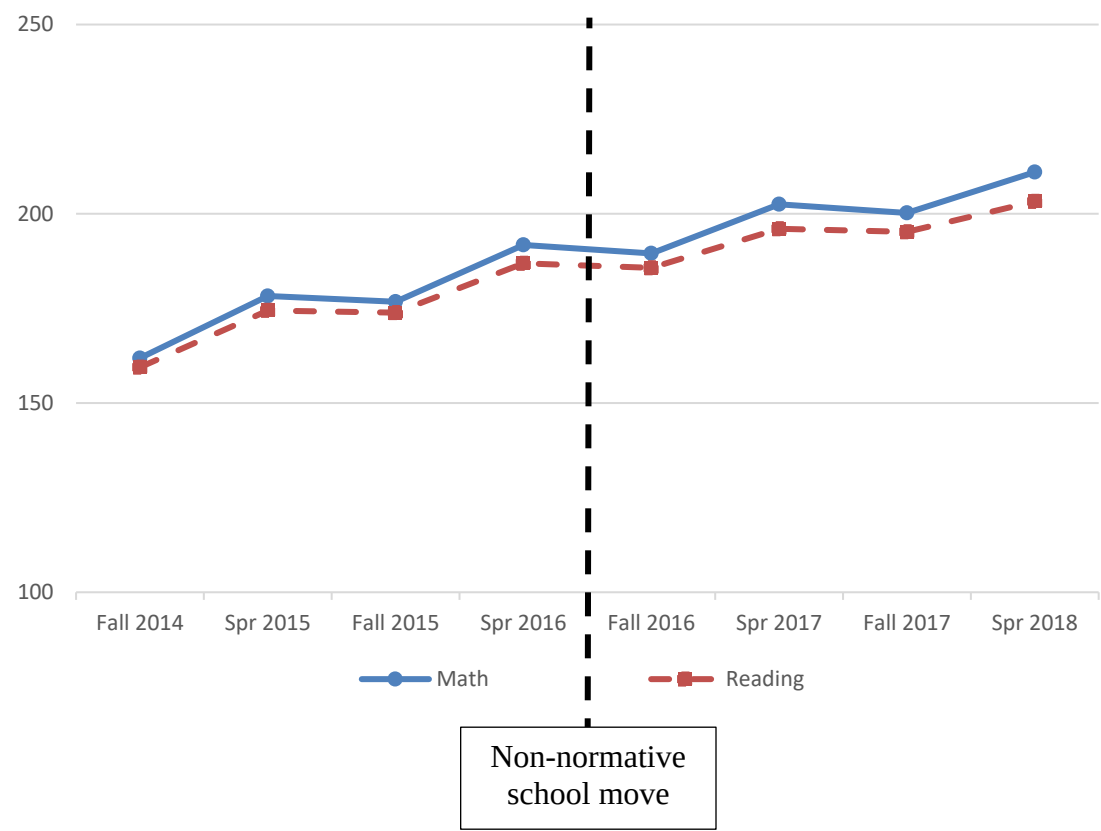


Figure 6. Unconditional reading and math achievement growth across a non-normative school move



### **CHAPTER 3: A RACE-BASED APPROACH TO EXAMINING THE TRANSITION TO HIGH SCHOOL**

The structure of the U.S. education system often requires students to make normative school transitions as they move from elementary to middle school and then again from middle school to high school. The existing literature on normative school transitions suggests that many students experience academic challenges during these transition periods (see literature review: Evans et al., 2018), which results in academic disruptions that can persist over time (Felmlee et al., 2018; Neild et al., 2008). The middle school to high school transition may be particularly challenging for adolescents, as moving to high school often means moving into a school with larger and more diverse student bodies as well as more challenging coursework (French et al., 2000; Weiss & Bearman, 2007). However, as school transition research has progressed, scholars have identified variations in transition experiences that are dependent on school and student characteristics (Akos et al., 2015; Benner & Graham, 2009). The life course theory offers a comprehensive theoretical framework to explain the lasting impact school transitions can have on students' academic trajectories, emphasizing how early transitions can serve as turning points that influence later trajectories (Elder & Shanahan, 2006). Moreover, the life course theory acknowledges the variability in transition experiences, suggesting that contextual factors play an important role in influencing individuals' responses to transition points (Benner, 2011).

School racial climate is one such contextual factor that has shown to be influential for students' academic well-being (Mattison & Aber, 2007). In relation to school

transitions, changes in perceptions of school racial climate across the middle to high school transition may be a key determinant of variation in transition experiences. The transition to high school necessitates a change in the school environment, an important sociocultural context in adolescents' lives, and life course theory suggests that navigating a school transition may become more challenging when changes in the school environment become more pronounced (Benner, 2011; Elder, 1998). Prior research has investigated how changes in structural aspects of the school context (i.e., school racial composition) influence transition experiences (Benner & Graham, 2009; French et al., 2000), but research has seldom investigated the influence of changes in racially/ethnically-related interpersonal aspects of the school context, such as school racial climate.

The current study aimed to investigate factors leading to variation in transition experiences by taking both person- and variable-centered approaches to examine overall patterns of students' academic achievement and attendance trajectories across the transition to high school, to identify subpopulation variation in these patterns, and to investigate how changes in the school racial climate across the middle to high school transition influence students' trajectories following the high school transition.

### **The High School Transition and Student's Academics**

In the U.S., most students make at least one physical school transition as they progress through the K-12 education system, and typically, students make transitions from elementary to middle school and then from middle school to high school. Much of the research on normative transitions through the schooling system has focused on the

elementary to middle school transition (Akos et al., 2015; Welsh, 2017). However, research on the middle school to high school transition is growing as scholars recognize the distinct complexities of the transition to high school (Benner, 2011). The move from middle school to high school is a particularly notable transition as it typically involves stark changes in students' school environments. High schools often have much larger and more diverse student bodies than middle schools, and the academic workload and rigor also increases substantially during this transition (Cohen & Smerdon, 2009; Evans et al., 2018). Aside from these environmental changes, the high school transition also occurs during a period of physical, psychological, and social developmental changes in adolescence (Felmlee et al., 2018).

The contextual and developmental changes that occur during the high school transition may challenge students as they adjust to their new schools. Indeed, much of the existing literature on these normative transitions generally suggests that, despite being commonplace, these transitions are disruptive for students' academic achievement and negatively impact academic-related behaviors, such as school attendance. For example, several studies have documented disruptions in students' grades following the transition (Alspaugh, 1998; Benner & Graham, 2009; Felmlee et al., 2018; Isakson & Jarvis, 1999) as well as disruptions in school attendance (Benner & Wang, 2014; Roeser et al., 1999) and other measures of academic well-being such as school involvement (Barber & Olsen, 2004; Seidman et al., 1996). Research also finds that academic difficulties in the 9<sup>th</sup> grade are linked to later drop out (Neild et al., 2008). However, there are also several studies that

have documented heterogeneous patterns in students' academic adjustment following the transition to high school, which are tied to demographic characteristics and prior achievement. For example, Sutton and colleagues (2018) examined whether students' academic achievement during the transition to high school varied by race, gender, and middle school academic standing. They found that White and Black male students exhibited greater academic disruptions upon entering high school when compared to their female counterparts and that the extent to which students were impacted by the high school transition was dependent on their middle school achievement. Another study found that the impact of entering high school is more severe for students with below-median test scores in 6<sup>th</sup> grade (Schwerdt & West, 2013).

Informed by documented variation in transition experiences, researchers have moved to person-centered approaches to examining school transitions, such as latent profile or latent class analysis, to better understand these distinctions in experiences. For example, Ding (2008) observed four distinct profiles of academic performance in math and English across the high school transition, with one group showing declining math achievement through the first year of high school, the second group showing improved math performance across the high school transition but a decline after one year in high school, and the final two groups displaying unstable math performance across the high school transition. Similar patterns were also observed for English performance. Different patterns of academic achievement trajectories were also observed among students making the transition to high school in China, with researchers finding three distinct profiles of

academic achievement in the year following the high school transition (Liu & Lu, 2011). Specifically, one group showed declining academic achievement across the first year of high school, the second group showed increasing academic achievement across the first year of high school, and the final group maintained their academic achievement level during the first year of high school.

In a more recent study, Benner and Wang (2014) expanded this work using school attendance and noted four distinct middle school *and* high school attendance trajectories. Specifically, with regards to high school attendance trajectories, one group maintained high attendance levels across high school, another group exhibited high attendance at the beginning of high school but declining attendance across high school, the third group displayed initially average but declining attendance across high school, and the final group showed initially low and declining attendance across high school. Moreover, there was evidence of students shifting attendance classes from middle school to high school such that students who exhibited poorer attendance during the high school transition were more likely to move to a lower attendance class from middle school to high school. School demographic characteristics (e.g., school size, school diversity) were also shown to predict shifting attendance trajectories from middle school to high school with school racial diversity serving as a particularly meaningful predictor.

Together, these findings demonstrate the wide variation in students' responses to the high school transition. Understanding individual differences in transition experiences and identifying factors that can potentially ease the transition to high school is critical because

the high school transition marks an important stage in which students begin to make crucial decisions regarding their academic futures (i.e., whether or not to attend college). As such, academic disruptions during this transition period may have lasting consequences for students' future academic achievement and attainment throughout high school and beyond, consistent with the tenet of disrupted trajectories from life course theory (Elder, 1998). The current study contributes to the ongoing research regarding the high school transition by replicating and extending the work of Benner and Graham (2009), which placed the high school transition in a larger developmental context by considering academic trajectories across both middle and high school. Much of the research on the middle school to high school transition continues to focus on outcomes immediately following the transition, whereas the current dissertation aimed to examine the patterns of students' trajectories in the two years before and after the transition. The current study also expanded on the research of Benner and Wang (2014) by examining both mean trajectories and distinct subpopulations of students who may display unique attendance *and* achievement trajectories before and after the high school transition. Furthermore, although attention has been placed on how shifting school demographics influence students' transition experiences, one factor that has received little attention in current transition literature is how changes in the *interpersonal* aspects of the school context might influence students' academic trajectories. School racial climate is one such interpersonal factor that has remained understudied but is increasingly relevant to students' school experiences as the

racial demographic of school-aged children in the U.S. has become more diverse (Frankenberg et al., 2019).

### **School Racial Climate as a Moderator**

The life course theory emphasizes the critical role sociocultural contexts play in human development (Benner, 2011; Elder, 1998). For adolescents experiencing the transition to high school, the school setting is a highly relevant sociocultural context that changes as students move from smaller learning environments of their middle schools to larger learning communities in high school with more students and new teachers. The school context and the changes that occur in this important sociocultural setting during the transition to high school have been shown to influence the extent to which students successfully navigate the high school transition. For example, increasing school-level SES and racial/ethnic diversity from middle school to high school has been linked to lower grades after the high school transition, and increasing school size across the high school transition has been associated with lower feelings of belonging in school and lower grades after the transition (Benner & Graham, 2009). Another study found that higher levels of perceived school environment regulation (i.e., greater teacher monitoring and school rules enforcement) during the high school transition was related to greater participation in school activities after the transition (Barber & Olsen, 2004). One characteristic of the school context that may be particularly important to students' academic adjustment after the transition to high school is the school climate and more specifically, the school racial

climate, which remains an understudied aspect of the school context in existing transition research.

General school climate and its influence on student outcomes has been widely studied. A positive school climate encompasses expectations and norms that make students feel socially and emotionally accepted and physically safe in school. Literature reviews have shown that positive school climate is linked to greater academic achievement, engagement, and academic motivation across schooling levels (Thapa et al., 2013; Wang & Degol, 2016). However, as the racial/ethnic demographics of school-aged children and adolescents have increased in diversity over the past decade (NCES, 2021), focusing on characteristics of the school climate that provide support to students across races/ethnicities is also crucial for optimizing the academic outcomes of youth from various backgrounds.

School *racial* climate can be defined as “perceptions of interracial interactions and the socialization around race and culture in a school” (Byrd, 2017, p. 700); this may include perceptions of equal status, support for positive interracial interactions, and the promotion of learning about different cultural groups in the classroom. Research has found school racial climate to be highly influential for students’ academic well-being. For example, perceptions of positive school racial climate have been shown to be associated with higher student achievement and fewer discipline problems (Mattison & Aber, 2007) as well as higher school engagement (Griffin et al., 2020) and greater academic self-esteem (Golden et al., 2018). In addition, other studies have found that perceptions of schoolwide prejudice were negatively associated with grades in school (Benner, Crosnoe, & Eccles, 2015) and

perceiving positive attitudes about race from school personnel was associated with higher academic intrinsic motivation (Byrd & Chavous, 2011). Positive school racial climate was also shown to be associated with academic achievement and college preparation (Thapa et al., 2013; Wang & Degol, 2016).

From the existing literature, it is clear that school racial climate is influential for students' academic well-being. However, school transitions often necessitate changes in the racial/ethnic composition of teachers and student body, and these structural changes may translate into differences in the school racial climate between middle school and high school. Yet little is known about how these changes matter for how students are able to navigate the high school transition. The life course theory suggests that pre-and post-transition context congruence influences the ease with which students adjust after a school transition (Elder, 1998)—that is, the more similar the characteristics of the middle school and high school context are to each other, the easier it may be for students to adjust to the high school transition. A handful of studies have examined this hypothesis and have provided initial evidence that contextual incongruence across a school transition does indeed influence students' post-transition academic and social well-being. These studies, however, have largely focused on structural characteristics of the school, such as racial/ethnic and socioeconomic composition (Benner & Graham, 2009; French et al., 2000; Morales-Chicas & Graham, 2017), finding that greater incongruence between middle school and high school structural characteristics was generally linked to greater disruptions in students' academics after the high school transition. While these structural factors of the

school context are important to consider, these macro-level characteristics likely trickle down to influence micro-level processes or the interpersonal interactions students experience within schools as well. It is therefore equally important to examine how changes in micro-level school characteristics, such as school racial climate, might influence the impact of the middle school to high school transition, a central focus of the current study.

### **Current Study**

The current study aimed to contribute to the literature on the middle school to high school transition by capturing academic trajectories in multiple ways and unpacking the role of school racial climate in predicting students' academic trajectories across the high school transition. Specifically, the current study utilized survey and school records data from an ongoing, longitudinal project conducted in the Southern U.S. to address four research questions. The first research question examined how students' school performance and attendance trajectories unfold from middle school to high school. The purpose of this aim was to replicate findings from the work of Benner and Graham (2009) and Benner and Wang (2014) and establish the mean trajectories of students' school performance and attendance from middle to high school. Prior research tracking students' academics across the transition to high school generally finds academic disruptions as students transition from middle school to high school (ibid); therefore, I expected that students would experience a decline in school performance and attendance immediately after the transition to high school and that these disruptions will persist through subsequent high school years. However, I also hypothesized that these mean level patterns would mask

subpopulation variation in students' academic trajectories, leading to research question two.

This second research question investigated whether there were subpopulations of students who exhibited distinct school performance or attendance trajectories across middle and high school. Examining subpopulations of middle school academic trajectories was largely exploratory, as little research has investigated distinct academic trajectories during this developmental period. One study has examined students' middle school attendance trajectories (Benner & Wang, 2014), and based on this prior work, I expected the following four distinct classes were most likely to emerge: a consistently low attendance class, a consistently average attendance class, a consistently high attendance class, and a high but decreasing attendance class. I further expected similar attendance trajectory classes to emerge in high school, consistent with Benner and Wang's study (2014). For students' school performance trajectories, research regarding students' high school trajectories or trajectories *across* the high school transition provides evidence for at least three different classes of school performance during the transition to high school, and I expected these three classes were most likely to emerge for both middle school and high school achievement trajectories: a high-decreasing class, a consistently high achievement class, and an improving academic achievement trajectory class.

The third research question investigated how perceptions of school racial climate in high school and the difference in school racial climate perceptions between middle school and high school predict immediate changes in school performance and attendance across

the high school transition. Given the evidence for the positive influence of school racial climate for students' academics (Byrd & Chavous, 2011), I predicted that students who had more positive perceptions of their high school racial climate would exhibit less academic disruption immediately following the high school transition than students with less positive perceptions of their high school racial climate. Moreover, I expected that students who experienced improving perceptions of their school racial climate from middle school to high school would exhibit less academic disruption immediately following the high school transition than students who reported worsening perceptions of their school racial climate from middle school to high school.

The fourth and final research question examined how perceptions of school racial climate predict distinct school performance and attendance trajectories observed in the profile analyses. This research question was examined through two sub-aims. The first sub-aim assessed how perceptions of high school racial climate and the difference in perceptions of school racial climate between middle school and high school predicted class membership of high school achievement and attendance trajectories. The existing research suggests that school racial climate has a positive influence on students' academic outcomes (Griffin et al., 2020; Wang & Degol, 2016), therefore, I expected that more positive perceptions of high school racial climate would be linked to students' membership in higher performing or improving performance trajectory classes. I also expected that students with improved perceptions of school racial climate between middle school and high school would be more likely to be classified into high-performing or improving

performance trajectory classes than students with worsening perceptions of school racial climate across the high school transition.

The second sub aim of research question four examined how the difference in perceptions of school racial climate between middle school and high school predicts *shifts* in school performance and attendance trajectory classes across the high school transition. Here, I hypothesized that students who reported improved perceptions of school racial climate from middle school to high school would maintain or improve their achievement and attendance trajectories from middle school to high school, whereas students who reported worsened perceptions of school racial climate between middle school and high school would experience declines in their school performance and attendance trajectories from middle school to high school. Through these research aims, the current study aimed to provide a deeper understanding of the variation in students' transition experiences and contribute knowledge on the role school racial climate plays in influencing the impact of the transition to high school.

## **Methods**

### **Participants and Procedures**

The proposed research utilized data from an ongoing longitudinal cohort project in the Southern U.S. entitled Preventing Inequalities in School Climate and Educational Success (Project PISCES). These data included survey data in which students report on their perceptions of their schools' racial climate in 8<sup>th</sup> grade (at the end of middle school) and in 9<sup>th</sup> grade (at the end of the first year of high school) as well as school records of

students' fall and spring grades from 7<sup>th</sup> grade through 10<sup>th</sup> grade and annual attendance records from 6<sup>th</sup> grade through 11<sup>th</sup> grade provided by participating school districts, reflecting the manner by which school districts report grades and attendance.

The original sample of participants ( $N = 1,010$ ) were first recruited in 8<sup>th</sup> grade from 13 middle schools (10 public or charter, 3 private). All 8<sup>th</sup> grade students from the targeted middle schools were recruited in school during advisory periods, and 43% of students returned parent consent forms. By consenting into the study, parents and students allowed researchers to obtain school records data for student participants from 6<sup>th</sup> to 12<sup>th</sup> grades; therefore, students' school records data begins in the 6<sup>th</sup> grade before students were enrolled in the study. Roughly three-quarters of the students in the sample were White (40%) or Latinx (34%). The remainder of the sample was Asian American (8%), African American (6%), or biracial or another race/ethnic group (13%). The mean highest level of education received by the adolescents' parents was an associate degree. Almost half of the students qualified for free or reduced-priced lunch at some point during the study period (49.7%).

Recruitment was divided into two cohorts: the first cohort began in the 2016-17 school year ( $n = 463$ ), and cohort 2 began in the 2017-18 school year ( $n = 547$ ). Surveys were administered during the advisory period (a 30-minute non-elective period) or at another time of the school's choosing. Students who did not have parental consent or student assent were given a packet of word and number games; the games packet was of similar length to the survey to help protect the identities of those students with versus

without consent/assent. Participants were compensated \$20 upon completion of the survey. All procedures were reviewed and approved by the author's Institutional Review Board. Students with parental consent and student assent to participate in the longitudinal component of Project PISCES ( $N = 852$ ) were contacted to complete follow-up surveys when they transitioned to high school in 9<sup>th</sup> grade, and each subsequent year throughout high school (10<sup>th</sup> grade - 12<sup>th</sup> grade). Consented students were given the option to complete follow-up surveys online via the Qualtrics survey platform or over the phone. Students who had not completed the survey after 6 weeks were mailed paper surveys to complete. Participants were compensated \$25 upon completion of each follow-up survey.

The final analytic sample includes students with survey data from 8<sup>th</sup> grade and 9<sup>th</sup> grade ( $N = 729$ ) but excluded students that did not make a school transition between 8<sup>th</sup> grade and 9<sup>th</sup> grade ( $N = 21$ ) and students that attended private school in both 8<sup>th</sup> grade and 9<sup>th</sup> grade ( $N = 4$ ). Additionally, seven students had no district records of their grades or attendance. This brings the final analytic sample to 697 students (47% Male, 40% White, 6% Black, 33% Latino, 8% Asian American, 13% other/biracial in the attendance analytic sample). Additionally, 40% of the analytic sample qualified for free or reduced-price lunch at least one school year during the study period. Participant demographics for the analytic sample are presented in Table 14.

## **Measures**

The key measures for the current study include students' school performance, rates of attendance, and student perceptions of school climate. Descriptives for key study variables can be found in Table 15.

### ***School Performance***

Students' school performance was measured by students' grades in core and elective courses drawn from students' school records. For each course, grades ranged from 0 to 100, and a composite achievement score for each semester (Fall and Spring) was created by calculating the mean grade earned across the core and elective courses the student was enrolled in that semester. Students' grades were measured in both fall and spring from 7<sup>th</sup> grade through 10<sup>th</sup> grade, with four performance data points representing students' middle school performance (7<sup>th</sup> and 8<sup>th</sup> grades) and four performance data points for students' high school performance (9<sup>th</sup> and 10<sup>th</sup> grades).

### ***Attendance***

School attendance data were drawn from students' school records. School records provide the total days of attendance and absences for the entire school year, not semesterly attendance. Yearly attendance and absences were recorded from 6<sup>th</sup> grade to 11<sup>th</sup> grade for each student, that is three measures of attendance for middle school and three measures of attendance for high school. The percentage of days attended was calculated by dividing the total days attended by the sum of days attended and days absent and then multiplying this value by 100.

### ***School Racial Climate***

School racial climate was measured in 8<sup>th</sup> and 9<sup>th</sup> grades using seven student-reported items (Bellmore et al., 2012; Green et al., 1988). For each item (e.g., “My school recognizes holidays of different ethnic groups”, “Students are able to make friends with kids from different ethnic groups”), participants provided a rating from 0 (No way) to 4 (For sure yes) to denote the extent to which each statement applied to themselves and their school. A composite score was created by calculating the mean of the seven items ( $\alpha = .64$  for 8<sup>th</sup> grade,  $\alpha = .64$  for 9<sup>th</sup> grade) in which higher scores indicate a more positive interracial climate. School racial climate difference scores were then calculated by subtracting middle school (8<sup>th</sup> grade) racial climate scores from high school (9<sup>th</sup> grade) racial climate indicators. From the difference scores, dichotomous change indicators were created to indicate whether a student experienced a negative change in climate perceptions (changes 1 SD below the mean), little to no change in climate perceptions (mean change scores up to  $\pm 1$  SD), or a positive change in climate perceptions (changes scores 1 SD above the mean), consistent with prior research (Benner & Graham, 2009; French et al., 2000).

### ***Covariates***

Student-level covariates included students’ gender (1 = *female*, 0 = *male*), race (dummy codes for White, African American/Black, Latino, Asian American, and biracial/other with White as the omitted racial/ethnic group), study cohort (1 = *cohort 1*, 0 = *cohort 2*), whether the student repeated a grade level, and school mobility outside of the high school transition. Students’ economic background was also included as a covariate

and determined by school records data indicating whether the student qualified for free or reduced-price lunch (1= *Student is socioeconomically disadvantaged*, 0 = *Student is not socioeconomically disadvantaged*). Students' race and gender utilized data from all survey waves as well as district records to reduce the amount of missing data. School-level covariates included school racial/ethnic diversity and the SES of the student population (i.e., the percent of students receiving free or reduced-price lunch) drawn from district records. School racial diversity scores were calculated using Simpson's Diversity Index, a measure of community diversity (Simpson, 1949). The formula for calculating the value of the diversity index is:

$$D = 1 - \sum \left(\frac{n}{N}\right)^2$$

In this equation,  $n$  is the number of individuals identifying as each race at the school, and  $N$  is the total number of individuals at the school. The racial/ethnic groups included in this calculation are White, Latino/a/x, Black, and Asian American. Scores for Simpson's diversity index range from zero to one, with higher scores indicating greater diversity.

### **Analysis Plan**

The data were analyzed using piecewise growth modeling and growth mixture modeling in Mplus 8 (Muthén & Muthén, 1998–2017). To address the first research aim of modeling students' school performance and attendance trajectories across the middle school to high school transition, I used piecewise latent growth curve modeling to fit

separate achievement and attendance trajectories for middle school and high school (see Figure 7). To model school performance trajectories, I examined students' grades each fall and spring from 7<sup>th</sup> grade through 10<sup>th</sup> grade. The first phase of achievement represented students' middle school achievement. The slope growth factor for this phase consisted of four time points (the fall of 7<sup>th</sup> grade to the spring of 8<sup>th</sup> grade), with the intercept set at the spring of 8<sup>th</sup> grade (the final time point). The second phase of achievement trajectories represented students' high school achievement. The slope growth factor for this phase consisted of four time points from the fall of 9<sup>th</sup> grade to the spring of 10<sup>th</sup> grade, with the intercept being set at the fall of 9<sup>th</sup> grade (the first time point). To examine whether students experienced non-linear changes in their achievement over time, I planned to compare the model fit for a linear growth model and a model which included quadratic terms in both phases; however, modeling non-linear change in students' school performance resulted in unresolvable errors, and I therefore proceeded with the linear model for the analysis of subsequent research questions.

After modeling the growth curves for each phase, I used Wald chi-square test of parameter equalities to determine whether the difference between the middle school intercept and the high school intercept was significantly different from zero; this allowed me to determine whether students experienced an immediate disruption in their academics following the high school transition. Wald chi-square tests were also used to examine whether the difference in the average slope for the middle school phase and the high school phase was significantly different from zero. The same methods were applied to model

students' attendance trajectories; however, students' attendance was measured annually from 6<sup>th</sup> grade through 11<sup>th</sup> grade. The slope growth factor for the middle school phase of students' attendance trajectories consisted of three time points (6<sup>th</sup> grade through 8<sup>th</sup> grade) with the intercept set at 8<sup>th</sup> grade (the final time point). The slope growth factor for the high school phase of students' attendance trajectories also consisted of three time points from 9<sup>th</sup> grade through 11<sup>th</sup> grade. Having only three time points in each phase precluded me from including a quadratic growth term.

To identify subpopulations of students who exhibited distinct achievement or attendance trajectories across the transition to high school (research aim 2; see Figure 8), I conducted a series of growth mixture models for middle school trajectories and high school trajectories in which I increased the number of potential achievement and attendance trajectory classes and used best practices for class enumeration (Nylund, Asparouhov, & Muthén, 2007), which involved assessing results from a loglikelihood-based tests (i.e., Lo-Mendel-Rubin (LMR) test) and two Information Criteria (i.e., Bayesian information criterion (BIC) and adjusted BIC (ABIC)). This approach also typically utilizes bootstrap likelihood ratio test (BLRT), but this test is unavailable when using the cluster function in Mplus.

The third aim investigated the impact of perceptions of school racial climate and changes in perceptions of school racial climate on adolescents' achievement and attendance immediately following the high school transition (see Figure 9). These tests required a multiple step process. First, perceptions of high school racial climate were incorporated as

a predictor of the school performance and attendance growth curve model intercepts at the middle school phase (8<sup>th</sup> grade) and the high school phase (9<sup>th</sup> grade; free model). Then I conducted a model in which the influence of school climate effects was held constant across the transition (fixed model). A chi-square difference test with Satorra-Bentler corrections was conducted to determine whether this constraint caused a significant decline in model fit, which would suggest that perceived high school racial climate significantly influenced students' immediate transition experiences. The same was done to test the influence of the *change* in school climate perceptions between middle school and high school on adolescents' achievement and attendance immediately following the high school transition.

Analyses for the fourth and final research question investigating the role of school racial climate in predicting high school academic trajectory classes and shifts in academic trajectory classes from middle school to high school was conducted in two parts (see Figure 10). First, to address how students' perceptions of their school's racial climate predicted high school performance and attendance trajectory classes, I planned to incorporate students' perceptions of their high school racial climate and the difference in their perceptions of school racial climate between middle school and high school as predictors of high school achievement and attendance trajectory class membership. This was to be done using the automated BCH 3-step approach in Mplus, which is a statistical method for integrating predictors in mixture models. The automated BCH approach (Asparouhov & Muthen, 2021; Bakk & Vermunt, 2016) involves first conducting an unconditional mixture

model. Second, individuals are assigned to trajectory classes and the classification errors are calculated for each individual. The final step involves integrating the assigned trajectory class scores into the model with the school racial climate variables as predictors of class membership using the individual error rates as weights. The advantage of this approach is that it is more resistant to changes in class membership from step 1 to step 2 than other methods (i.e., ML three-step approach; (Nylund-Gibson et al., 2019). As will be discussed to follow, the results of the growth mixture models suggested a one class solution for students' attendance trajectories fit the data best. Therefore, as an alternative to investigating the influence of school racial climate on students' high school attendance trajectories, I incorporated students' perceptions of their high school racial climate and the difference in their perceptions of school racial climate between middle school and high school (as measured by dichotomous change indicators) as predictors of students' attendance slopes, with separate models for each predictor (high school racial climate and change in racial climate).

The second part of research aim four was to assess how change in school racial climate predicted *shifts* in attendance and achievement trajectories from middle school to high school. To achieve this, I planned to expand on the achievement and attendance growth mixture models conducted for research question two and add a latent transition feature (GMM-LTA). The GMM-LTA model determined the extent to which students remained in similar trajectory classes from middle school to high school or shifted to a new class across the high school transition. Specifically, I planned to include two latent class

variables simultaneously in the GMM-LTAs; one latent class variable captured classes in the middle school phase and the other latent class variable captured classes at the high school phase. The high school latent class variable was regressed on the middle school latent class variable to determine the latent transition probabilities of transitioning to a different class from middle school to high school. Upon identifying the transition classes for each student, I then examined whether perceptions of high school racial climate and the difference in school racial climate perceptions from middle school to high school predicted students' transition class probability.

For students' attendance trajectories, in lieu of the GMM-LTA, due to the result of a single class solution and consistent with analyses for attendance trajectories in research question three, I examined whether change in school racial climate predicted a significant difference between students' middle school and high school attendance slopes. Specifically, I incorporated the difference in students' school racial climate perceptions from middle school to high as a predictor of the attendance growth curve model slopes for the middle school phase and the high school phase, with separate models for high school racial climate and change in racial climate perceptions. Then two models were tested: a model in which the influence of school climate was free to vary across the two slopes and a model in which the influence of school climate was held constant. A chi-square difference test with Satorra-Bentler corrections was conducted to determine whether this constraint caused a significant decline in model fit, which would suggest that perceived school racial climate significantly influenced students' trajectories.

For the current study, full-information maximum likelihood (FIML) was used to handle missing data. FIML enables all available data to be included in the analyses by fitting the covariance structure model directly to the observed and available data for each participant (Enders, 2022). Students are also nested in both middle schools and high schools, and the most appropriate method for accounting for the dual nesting of students in middle and high schools is to cluster students by school feeder pattern, as doing so takes into account the specific middle school and high school students attend. The CLUSTER function in Mplus was used to account for the nesting of students in feeder patterns, which produced model estimations that had correctly adjusted standard errors.

## **Results**

### **School Performance and Attendance Trajectories Across the High School Transition**

The first research question of the current study aimed to examine how students' school performance and attendance trajectories unfolded from middle school to high school. I hypothesized that students would experience a decline in school performance and attendance immediately after the transition to high school and that these disruptions would persist through subsequent high school years. Results of the unconditional growth model for grades in school showed that the average school performance score in the spring of 8th grade (end of middle school) was 91, and these scores remained relatively stable across 7<sup>th</sup> and 8<sup>th</sup> grades ( $b = .30, p = .081$ ; see Figure 11a). The average school performance score in the fall of 9<sup>th</sup> grade (beginning of high school) was 88 and decreased by 0.43 points each semester ( $p < .001$ ). Upon formally testing whether the difference between the middle

school and high school intercepts and slopes significantly differed from zero, results were in line with my hypotheses (see Table 16). Across the transition to high school (i.e., from Spring 8<sup>th</sup> to Fall 9<sup>th</sup>), students demonstrated a statistically significant decline in school performance ( $W = 33.83, p < .001$ ). Students' performance trajectories in middle versus high school also differed significantly, with students demonstrating stable performance trajectories across middle school, on average, but significantly declining school performance trajectories across high school ( $W = 10.68, p < .001$ ).

For attendance, the average percentage of total school days attended in 8th grade (end of middle school) was 96.7%, and student attendance declined by .30 percentage points each semester ( $p < .05$ ; see Figure 11b). The average percentage of total school days attended in 9<sup>th</sup> grade (beginning of high school) was 95.9%, and attendance remained relatively stable across 9<sup>th</sup> and 11<sup>th</sup> grades ( $b = - 2.10, p = .143$ ). Across the high school transition (from 8<sup>th</sup> grade to 9<sup>th</sup> grade), students exhibited a marginally significant decline in attendance ( $W = 3.55, p = .060$ ; see Table 2). Additionally, the difference between middle school and high school attendance slopes was not statistically significant ( $W = 1.79, p = .180$ ).

### **Unique Trajectories of School Performance and Attendance**

The second research question investigated whether there were subpopulations of students who exhibited distinct school performance or attendance trajectories across middle and high school. While I expected multiple classes to emerge for both the performance and attendance models, results of the GMM revealed a multiple class solution

for students' school performance only (see Table 17). Specifically, upon examining the multiple fit indices presented in Table 17, the 3-class solution was selected for both middle school and high school trajectories. While the LMR and VLMR tests indicated that the  $k$  model did not fit the data significantly better than  $k-1$  model for any of the model comparisons (e.g., 1 versus 2, 2 versus 3), the BIC and ABIC declined across the fit classes, leveling off between the 3- and the 4-class models for both middle school and high school trajectories, suggesting the 3-class model was the best fit for both the middle school and high school trajectory data (see Figure 12a for middle school and 12b for high school). The BIC and ABIC were more heavily relied on for class enumeration as Nylund and colleagues (2007) suggest that the BIC and ABIC are the preferred statistical indicator for class enumeration along with the BLRT. A more recent study also supports the use of the BIC and ABIC in class enumeration of growth mixture models (Kim, 2014).

Trajectories for the 3-class middle school trajectories are presented in Figure 13a. The first class, which I labeled stable-high, in which 80.3% of the sample maintained a high-level of attendance across middle school. The second class, labeled high-declining, contained 13% of the sample and was characterized by students with initially high but declining school performance. The third class was labeled as average-increasing and contained 6.7% of the sample with students showing average initial school performance that increased across middle school. Similar patterns of trajectory classes emerged for students' high school trajectories, however, the sample size of each class differed from the middle school trajectory classes. For high school trajectory classes, the stable-high class

contained 82.5% of the sample, the high-declining class contained 4.1% of the sample, and the average-increasing class contained 13.4% of the sample (see Figure 13b).

Growth mixture models between one and four classes were fit for students' middle school and high school attendance trajectories (see Table 18). For both sets of attendance trajectory analyses, the LMR and VLMR tests indicated that the  $k$  models did not fit the data significantly better than  $k-1$  models for any of the model comparisons (e.g., 1 versus 2, 2 versus 3). Moreover, the BIC and ABIC declined across the four models, and there was not strong evidence of the BIC and ABIC leveling off (see Figures 14a and b). Finally, the sample sizes of the estimated classes were too small to provide strong evidence of substantively meaningful classes, and thus I concluded that the 1-class model fit the attendance data best for both the middle and high school trajectories.

### **School Racial Climate and Students' Immediate Transition Experiences**

Research question three aimed to investigate the impact of perceptions of school racial climate and changes in perceptions of school racial climate on adolescents' school performance and attendance immediately across the high school transition (i.e., from 8<sup>th</sup> to 9<sup>th</sup> grades). Beginning with the influence of school racial climate on students' school performance, results indicated that high school racial climate did not have a significant influence on students' school performance across the immediate transition to high school (S-B Scaled  $\chi^2$  difference (1) = 1.36,  $p$  = .243). Likewise, the change in school racial climate from middle school to high school (modeled as the negative change group and the positive change group with the no change group as the omitted reference group) also did

not impact students' performance across the immediate transition to high school (S-B Scaled  $\chi^2$  difference (2) = 0.02,  $p = .988$ ).

For students' attendance, high school racial climate did not have a significant influence on students' attendance across the transition to high school (S-B Scaled  $\chi^2$  difference (1) = 0.28,  $p = .594$ ), but change in the school racial climate from middle school to high school did influence students' immediate attendance across the transition to high school (S-B Scaled  $\chi^2$  difference (2) = 6.47,  $p < .05$ ). Specifically, those students who reported declines in school racial climate from middle to high school unexpectedly experienced increases in attendance rates, whereas students who reported no change in school racial climate perceptions showed slight declines in attendance rates from 8<sup>th</sup> grade to 9<sup>th</sup> grade (Scaled  $\chi^2$  difference (1) = 11.09,  $p < .001$ ) as did students who reported improved perceptions of racial climate (S-B Scaled  $\chi^2$  difference (1) = 16.91,  $p < .001$ ; see Figure 15). The influence of change in school racial climate on attendance was not significant when comparing students' who experienced improved racial climate perception to those who experienced no change in racial climate perceptions from 8<sup>th</sup> grade to 9<sup>th</sup> grade (Scaled  $\chi^2$  difference (1) = .002,  $p = .967$ ).

### **School Racial Climate and Trajectory Class Membership**

The fourth and final research question examined how perceptions of school racial climate predicted distinct school performance and attendance trajectories observed in the GMM analyses. This research question was examined through two sub-aims. The first sub-aim assessed how perceptions of high school racial climate and the difference in

perceptions of school racial climate between middle school and high school predicted class membership of high school achievement and attendance trajectories. As mentioned previously, results of the growth mixture model only revealed a multiple class solution for students' school performance trajectories. As such, the automated BCH 3-step approach in Mplus was conducted only for students' school performance trajectories.

For students' school performance trajectories, results showed that high school racial climate was related to students' school performance trajectory class, such more positive perceptions of school racial climate were associated with greater likelihood of being in the stable-high versus average-increasing class ( $\chi^2 = 6.74, p < .01$ , see Table 19), with the mean school racial climate score being 2.94 among students in the stable-high class and 2.74 among students in the average-increasing class. For change in racial climate perceptions from middle school to high school, there was a marginal influence on students' high school trajectory class, such that experiencing worsened perceptions of school racial climate across the high school transition was related to greater likelihood of being in the stable-high versus the high-declining class ( $\chi^2 = 3.61, p = .057$  see Table 20), as the mean for the negative change in climate indicator was greater for students in the stable-high class ( $M = .14$ ) than the high-declining class ( $M = .03$ ). No other significant class differences emerged for students who experienced no change in racial climate perceptions or students who experienced improved climate perceptions.

For students' attendance trajectories, given the single-class model, an alternative approach was taken for research question 4 in which I regressed changes in perceptions of

racial climate on students' high school attendance slopes. Results showed that racial climate in 9<sup>th</sup> grade did not significantly influence the change in students' attendance across high school ( $\beta = 0.05, p = .219$ , see Table 21). Change in school racial climate from middle to high school, however, was significantly related to students' high school attendance trajectories, such that students' who experienced improved perceptions of school racial climate between middle school and high school had more attenuated attendance declines compared to students that experienced no change in school racial climate ( $\beta = 0.06, p < .05$ ; see Table 22). Change in school racial climate from middle school to high school was not significantly related to changes in students' attendance across high school when comparing students who experienced worse perceptions of school racial climate with those who experienced no change or improved perceptions ( $\beta = 0.01, p = .751$  and  $\beta = -.04, p = .405$  for the no change comparison and improved perceptions comparison, respectively).

The second part of research aim four was to assess how change in school racial climate predicted *shifts* in school performance and attendance trajectories from middle school to high school. For students' school performance, I first expanded on the school performance growth mixture models conducted for research question two and added a latent transition feature (GMM-LTA). Results of the GMM-LTA placed students in nine different transition classes based on the three middle school performance trajectory classes and the three high school performance trajectory classes. As shown in Figures 16 a,b,c, and Table 23, the largest transition class (77% of the sample; see Figure 16a) exhibited stable and high school performance across both middle and high school. There were then students

that exhibited stable and high school performance in middle school followed by average increasing performance in high school (3.9%). The next observed transitions class consisted of approximately 1% of the sample and this class was characterized by stable and high school performance in middle school and high declining performance in high school. The next set of classes are characterized by students with high but declining school performance in middle school followed by stable-high performance in high school (4.5%), average and increasing performance in high school (5.8%; see Figure 16b). A transition class also emerged in which students displayed high but declining achievement in both middle school and high school (0.6%). Another small proportion of students made up a transition class characterized by average and increasing performance in middle school and stable and high performance in high school (0.7%; see Figure 16c). Approximately 5% of the sample made up a transition class in which students held average increasing school performance in both middle school and high school. Lastly, 1.3% of the sample was classified as having average but increasing school performance in middle school followed by high but declining performance in high school.

Upon examining the sample sizes for each of the high school transition classes, it was determined that most transition classes had sample sizes that were too small to make reasonable determinations as to whether changes in school racial climate would predict students' placement in one class over another (see Table 23 for class frequencies). As exceptions, the stable-high class included 77% of the sample, and two other classes reflected students who had high but declining performance in middle school, and then

stable-high performance (4.5%) or average but increasing performance (5.8%) in high school. I combined the latter two classes into a single class to represent students who struggled academically in middle school but improved in high school. I then conducted a logistic regression to determine if the school racial climate change groups predicted students' placement in the consistently stable-high transition class versus the high school improvement class. Results of the logistic regression revealed no evidence that school racial climate predicted students' belonging in either class (see Table 24).

For students' attendance trajectories, analyses mirrored the methodology utilized for research question three wherein I examined whether the change in school racial climate across the immediate transition to high school predicted differences in the slopes for attendance for middle versus high school. Here, the dichotomous change indicators for perceptions of school racial climate were incorporated as predictors of the attendance growth curve model slopes for the middle school phase and the high school phase. Results showed that change in the school racial climate from middle school to high school did not influence the change in students' school performance trajectories in middle school versus high school (S-B Scaled  $\chi^2$  difference (2) = 3.52,  $p$  = 0.172).

## **Discussion**

Normative school transitions are a regular occurrence in U.S. school systems, with students making structured school moves from elementary to middle school and then middle school to high school. The latter is considered a particularly challenging transition for adolescents as the high school transition typically entails larger and more diverse

student bodies, more challenging course work, and impending decisions about the future (French et al., 2000; Weiss & Bearman, 2007). However, the extant research and life course theory suggest that there may be variation in students' transition experiences depending on school contextual factors (Benner, 2011; Elder & Shanahan, 2006). School racial climate is one such factor that may be particularly influential for students' transition experiences as school racial climate has shown to be related to students' academic well-being. The current study aimed to expand on the current high school transition literature by taking both person and variable-centered approaches to examine mean-level patterns of students' school performance and attendance trajectories across the transition to high school. Moreover, the current study investigated how changes in the school racial climate from middle school to high school influenced students' trajectories across the transition. Specifically, the current study addressed four research questions.

### **Students' School Performance and Attendance Trajectories**

The first research question examined how students' school performance and attendance trajectories unfold from middle school to high school, and I hypothesized that students would experience a decline in school performance and attendance immediately after the transition to high school and that these disruptions would persist through subsequent high school years. Results partially supported my hypothesis, with students showing a decline in school performance (as assessed by grades in school) immediately after the transition to high school and persistent disruption in school performance through the 10<sup>th</sup> grade. This result for school performance was consistent with prior work that

suggests students' school performance is negatively impacted across the transition to high school (Benner & Graham, 2009; Felmlee et al., 2018). Attendance, however, did not change significantly either across the immediate transition to high school or across the first two years of high school. This result is counter to research finding significant attendance disruptions across the transition to high school (Benner and Wang, 2014). It is possible the findings of the current do not map on to prior research because of differences in sample characteristics. Benner and Wang (2014) utilized a large sample of students from a large district in a central city, and evidence suggests that absenteeism may be more prevalent in such contexts (Gottfried, 2019), whereas the current study utilized a smaller sample of students from schools in both urban and more suburban areas.

### **Identifying Subpopulations with Shared School Performance and Attendance Trajectories**

The second research question investigated whether there were subpopulations of students who exhibited distinct school performance or attendance trajectories across middle and high school, and I expected subpopulations of students with distinct school performance and attendance trajectories to emerge: a high-decreasing class performance class, a stable-high performance class, and an improving school performance trajectory class. Results revealed three distinct school performance trajectories, and the pattern of these trajectories was similar to my hypotheses. Specifically, I identified a stable-high class, a high-decreasing class, and an average-increasing class for both middle school and high school. Little research has utilized person-centered approaches to study students'

school performance trajectories across the transition to high school, but results of the current study are in line with prior research taking this approach (Ding, 2008; Liu & Lu, 2011). The emergence of multiple school performance trajectories highlights the importance of considering individual variation in students' performance trajectories both across school transitions and during prior and subsequent school years. This is particularly relevant to school districts aiming to assess overall school performance because focusing on mean-level performance outcomes may conceal subpopulations of students. If a school appears to be performing well at the mean-level, there may be smaller populations of students struggling to maintain performance that are not accounted for and thus do not receive potential resources needed to succeed academically.

For students' attendance trajectories, I expected four distinct classes to emerge in middle school and high school: a consistently low attendance class, a consistently average attendance class, a consistently high attendance class, and a high but decreasing attendance class. Results for students' attendance trajectories, however, did not provide strong evidence of subpopulation variation. This is counter to research that found evidence of a multiple-class solution for students' attendance trajectories (Benner and Wang, 2014). As mentioned previously, it is possible the lack of variation suggested by the current study may be due to the characteristics of the sample and the context in which the studies took place. Moreover, the average attendance rates for the current study's participants remained relatively high throughout the years under study. The difference in results between the current study and Benner and Wang (2014), brings up an important point of the influence

of urbanicity on students' attendance trajectories across school transitions. Future research should attempt to replicate findings that suggest the high school transition is disruptive for students' attendance in urban school districts, where school absences are more common, but also explore potential variation in transition influence by urbanicity.

### **School racial climate and students' immediate transition experiences**

Research question three examined the influence of students' perceptions of school racial climate and changes in perceptions of school racial climate for their school performance and attendance immediately across the high school transition (i.e., from 8<sup>th</sup> to 9<sup>th</sup> grades). I hypothesized that students who had more positive perceptions of their high school racial climate would exhibit less academic disruption immediately following the high school transition than students with less positive perceptions of their high school racial climate. I further expected that students who experienced improved in their perceptions of their school racial climate from middle school to high school would exhibit less academic disruption immediately following the high school transition than students who reported declining perceptions of their school racial climate from middle school to high school. Results did not support my hypotheses, as neither high school racial climate nor change in perceptions of high school racial climate significantly influenced students' school performance immediately following the high school transition. Further, while change in school racial climate perceptions did influence students' attendance from 8<sup>th</sup> grade to 9<sup>th</sup> grade, findings suggested a different pattern of effects than hypothesized—students who reported poorer perceptions of school racial climate in high school compared to middle

school experienced increased attendance rates, whereas students who experienced no change or positive changes in school racial climate perceptions showed slight declines in attendance. This unexpected result could potentially be explained by research that suggests some students may increase their efforts to do well academically when faced with stereotype threat as a way of combating and coping with stereotypes (Harper, 2015; Morgan & Mehta, 2004).

### **School Racial Climate and High School Trajectories**

I then examined how perceptions of racial climate in 9<sup>th</sup> grade and *changes* in school racial climate perceptions from middle school to high school predicted students' high school performance and attendance trajectories. I expected that more positive perceptions of high school racial climate would be linked to higher performing or improving performance trajectories. For school performance, results partially supported my hypothesis, as more positive perceptions of school racial climate in 9<sup>th</sup> grade was associated with greater likelihood of being in the stable-high school performance trajectory class versus the average-increasing class in high school. This is in line with research that suggests that school racial climate is beneficial for students' academics (Golden et al., 2018), and this result for the current study suggests that positive perceptions of school racial climate at the start of high school may help students feel comfortable and safe in their new schools, enabling them to begin high school on a strong academic footing.

For students' attendance trajectories, perceptions of racial climate in 9<sup>th</sup> grade was not related to changes in students' attendance across high school, but experiencing

improved perceptions of school racial climate across the middle school to high school transition was associated with more attenuated attendance declines across high school when compared to students' who experienced no change in school racial climate, which is consistent with prior work highlighting the promotive impact that positive racial climate perceptions can have (Griffin et al., 2020). However, given that the unconditional growth model for high school attendance suggested that students' attendance remained relatively stable across high school (i.e., non-significant high school attendance slope), future work is needed to replicate the findings reported here.

### **School Racial Climate and *Shifts* in Trajectories Across the High School Transition**

Lastly, the current study assessed how change in perceptions of school racial climate from middle school to high school predicted *shifts* in performance and attendance trajectories from middle school to high school. For school performance, I hypothesized that students who reported improved perceptions of school racial climate from middle school to high school would maintain or improve their achievement and attendance trajectories from middle school to high school, whereas students who reported worsened perceptions of school racial climate between middle school and high school would experience declines in their school performance and attendance trajectories from middle school to high school. Results for school performance, however, did not support my hypotheses, as the latent transition analysis showed that three-quarters of students were classified as consistently stable-high in both middle school to high school and the only other sizeable classes entailed high-declining performance in middle school followed by either stable-high or average but

increasing performance in high school. Further, change in school racial climate was unrelated to class membership. The emergence of transition classes is a notable finding, as little research has utilized latent transition analysis to further examine subpopulations of students with distinct school performance trajectories across the transition to high school. The lack of evidence regarding change in school racial climate's influence on shifts in students' school performance trajectories across the transition, however, was unexpected given the strong evidence of school racial climates' influence on students' academic performance (M.-T. Wang & Degol, 2016), and both the theoretical support and empirical evidence suggest that changes in important sociocultural contexts are influential on students' transition experiences (Benner, 2011; Elder, 1998). For the current study, the transition classes I examined were each characterized by high or improving school performance in high school, and thus it is possible that school racial climate may not be influential on the transition classes identified in the current study. Future research with larger samples may yield more variability in shifts in school performance trajectories across middle and high school, which would enable a more complete examination of how school racial climate matters for different latent transition classes. For example, those with stable-high middle school achievement but declining high school achievement might be more likely to report poorer school racial climate across the transition, as prior research suggests experiences of discrimination in high school, a marker of poor racial climate, are linked with poorer academic outcomes (Benner & Graham, 2011; Fernandez & Benner, 2022).

### **Strengths, Limitations, and Future Directions**

The current study makes notable contributions to the ongoing school transition research, by utilizing a racially/ethnically and socioeconomically diverse sample and person-centered approaches to gain a better understanding of the variation in students' transition experiences. This study is also one of the first to examine the influence of interpersonal aspects of the school context on students' academic behaviors across the transition. However, there are limitations of the current study to note. First, while the current study utilizes longitudinal data, results are correlational, thus no causal claims can be made. The current study also relies on a subjective measure of school racial climate that depends on students' self-reports. It is recognized that self-report data are susceptible to respondent bias (Cooper et al., 2012); however, to assuage these biases, students were given their surveys to be completed in the privacy of their homes to ensure privacy of survey completion. Moreover, the racial climate measure utilized in the current study focuses on perceptions of school norms that support multiculturalism and whether the participant engages in intergroup interactions. It is possible that other interpersonal processes that reflect school racial climate, such as the frequency of racial/ethnic discrimination or perceptions of racial fairness, may be more illuminating (Mattison & Aber, 2007; M.-T. Wang & Degol, 2016). Future qualitative work on the influence of school racial climate on students' transition experiences would be highly beneficial to understanding students' experiences and the contextual factors that may play a role in improving or hindering their academic growth across a school transition.

Despite these limitations, the current study makes several contributions to the high school transition literature and contains strengths in its methodology. First, the current study examines both the immediate and long-term influence of the high school transition and school racial climate on students' academic trajectories, which provides insights into the lasting or potentially delayed impacts of the transition to high school and how school racial climate may serve to place students on a path of academic success or struggles. Moreover, through the use of growth mixture modeling and latent transition analysis, the current study aimed to uncover subpopulations of students with distinct performance trajectories. Person-centered approaches are crucial to the study of students' academic success, as district decision making with regard to school closings or intervention implementation is often based on student performance at the school level (de la Torre & Gwynne, 2009; Rennie Center for Education Research & Policy, 2020). Therefore, paying careful attention to variation in student trajectories ensures subpopulations of students do not get left behind. In addition, most studies that have focused on the contextual moderators of students' transition experiences have focused on structural school characteristics, such as school racial/ethnic or socioeconomic composition (Benner & Graham, 2009; French et al., 2000; Morales-Chicas & Graham, 2017). The current study expands on this work by focusing on an interpersonal process within the school setting—school racial climate. Lastly, the current study aimed to not only expand on existing transition research, but also replicate findings on students' attendance trajectories across the transition. Replication of research is critical for advancing scientific knowledge and assessing the generalizability of

study findings to other populations (Schmidt, 2009). Findings from the current study serve to illuminate avenues for supporting students' during the transition to high school.

### **Conclusion**

Study 2 aimed to provide a nuanced understanding of the influence the high school transition has on students' academics by identifying subpopulations of students with distinct academic trajectories before and after the high school transition and examining the role of changing perceptions of school racial climate on students' transition experiences. Results suggest there is variation in how students respond to the high school transition with the identification of three distinct school performance trajectories. I observed evidence of school racial climate's influence on students' trajectories across the transition and in some cases, in patterns that were unexpected. Regardless, the current study is a critical first step in exploring the influence of school racial climate on students' transition experiences, and future research is needed that examines the role of school racial climate in supporting students during times of school transitions. Taking a person-centered approach to studying transition experiences is critical for identifying which students experience lasting consequences from the high school transition versus which students navigate the high school transition with ease. Moreover, understanding school racial climate and its association with students' transition experiences is critical for supporting students during a critical transition point given the rapidly changing racial/ethnic landscape of the U.S. school system.

Table 14. Participant Demographics

|                                               | <i>N</i> | %    |
|-----------------------------------------------|----------|------|
| <b>Race/ethnicity</b>                         |          |      |
| African American/Black                        | 43       | 6.2  |
| Latina/o/x                                    | 233      | 33.4 |
| Asian American                                | 55       | 7.9  |
| White                                         | 277      | 39.7 |
| Biracial/other                                | 89       | 12.8 |
| <b>Gender</b>                                 |          |      |
| Male                                          | 324      | 46.9 |
| Female                                        | 367      | 53.1 |
| <b>Receipt of Free or Reduced-Price Lunch</b> |          |      |
| Did not qualify free or reduced-price lunch   | 422      | 60.5 |
| Qualified for free or reduced-price lunch     | 275      | 39.5 |

*Note.* Total possible *N* is 697.

Table 15. Descriptives For Independent and Dependent Variables Under Study

|                            | <i>N</i> | <i>M</i> | <i>SD</i> | <i>%</i> |
|----------------------------|----------|----------|-----------|----------|
| Grades 7th fall            | 635      | 90.46    | 6.85      |          |
| Grades 7th spring          | 646      | 90.30    | 6.93      |          |
| Grades 8th fall            | 683      | 91.21    | 6.06      |          |
| Grades 8th spring          | 687      | 91.09    | 5.95      |          |
| Grades 9th fall            | 586      | 87.83    | 7.56      |          |
| Grades 9th spring          | 588      | 86.96    | 8.79      |          |
| Grades 10th fall           | 547      | 87.42    | 7.25      |          |
| Grades 10th spring         | 417      | 87.31    | 8.31      |          |
| Attendance 6th             | 565      | 97.01    | 3.66      |          |
| Attendance 7th             | 647      | 96.96    | 3.94      |          |
| Attendance 8th             | 692      | 96.47    | 4.24      |          |
| Attendance 9th             | 611      | 95.98    | 5.71      |          |
| Attendance 10th            | 561      | 96.49    | 6.97      |          |
| Attendance 11th            | 523      | 92.39    | 16.57     |          |
| Negative change in climate | 82       |          |           | 12.2     |
| No change in climate       | 493      |          |           | 73.5     |
| Positive change in climate | 96       |          |           | 14.3     |

*Note.* Total possible *N* = 697.

Table 16. Summary of Unconditional Growth Models for School Performance and Attendance

|                      | Model Fit |                    | Wald Test |                 | Middle School |       | High School |       |
|----------------------|-----------|--------------------|-----------|-----------------|---------------|-------|-------------|-------|
|                      | CFI       | RMSEA              | <i>W</i>  | <i>p</i> -value | Inter         | Slope | Inter       | Slope |
| <b>Grades</b>        | .96       | .07 (0.057-0.084)  |           |                 | 91.11         | 0.30  | 87.84       | -0.43 |
| Intercept difference |           |                    | 33.83     | .000            |               |       |             |       |
| Slope difference     |           |                    | 10.68     | .001            |               |       |             |       |
| <b>Attendance</b>    | .98       | .05 (0.019 -0.071) |           |                 | 96.66         | -0.30 | 95.92       | -2.12 |
| Intercept difference |           |                    | 3.55      | .060            |               |       |             |       |
| Slope difference     |           |                    | 1.79      | .180            |               |       |             |       |

*Note.* Inter = intercept (8<sup>th</sup> grade in middle school and 9<sup>th</sup> grade in high school). Parameters for 7<sup>th</sup> grade attendance and 10<sup>th</sup> grade attendance were freely estimated to improve model fit. Variances for 6<sup>th</sup> grade, 9<sup>th</sup> grade, and 11<sup>th</sup> grade attendance and 8<sup>th</sup> grade spring and 9<sup>th</sup> grad fall school performance were set to 0.

Table 17. Summary of Growth Mixture Model Results for School Performance

| <b>Middle School</b> | <b>1 class</b> | <b>2 class</b> | <b>3 class</b> | <b>4 class</b> |
|----------------------|----------------|----------------|----------------|----------------|
| Loglikelihood        | -1093.098      | -1024.618      | -936.537       | -903.551       |
| # parameters         | 8              | 11             | 14             | 17             |
| BIC                  | 2238.513       | 2121.171       | 1964.629       | 1918.275       |
| ABIC                 | 2213.111       | 2086.244       | 1920.177       | 1864.297       |
| LMR p-value          | --             | 0.4117         | 0.4319         | 0.4317         |
| VLMR p-value         | --             | 0.4083         | 0.4295         | 0.4296         |
| Entropy              | --             | 0.85           | 0.86           | 0.86           |
| Distribution         | 100            | 88-12          | 82-12-6        | 67-22-4-6      |
| <b>High School</b>   | <b>1 class</b> | <b>2 class</b> | <b>3 class</b> | <b>4 class</b> |
| Loglikelihood        | -1446.981      | -1369.097      | -1316.176      | -1296.544      |
| # parameters         | 8              | 10             | 13             | 16             |
| BIC                  | 2945.124       | 2802.146       | 2715.491       | 2695.412       |
| ABIC                 | 2919.726       | 2770.399       | 2674.22        | 2644.616       |
| LMR p-value          |                | 0.1179         | 0.4397         | 0.4919         |
| VLMR p-value         |                | 0.1108         | 0.4299         | 0.4865         |
| Entropy              |                | 95             | 89             | 85             |
| Distribution         | 100            | 95-4.5         | 82-13-4        | 78-12-7-2.8    |

*Note.* BIC = Bayesian Information Criterion. ABIC - Adjusted Bayesian Information Criterion. LMR = Lo-Mendell Rubin test. VLMR = Vuong-Lo-Medell Rubin test.

Table 18. Summary of Growth Mixture Model Results for Attendance

| <b>Middle School</b> | <b>1 class</b> | <b>2 class</b> | <b>3 class</b> | <b>4 class</b> |
|----------------------|----------------|----------------|----------------|----------------|
| Loglikelihood        | -558.925       | -365.542       | -249.37        | -178.413       |
| # parameters         | 8              | 11             | 14             | 17             |
| BIC                  | 1170.178       | 803.036        | 590.315        | 468.023        |
| ABIC                 | 1144.776       | 768.109        | 545.863        | 414.045        |
| LMR <i>p</i> -value  | --             | 0.2002         | 0.2074         | 0.6341         |
| VLMR <i>p</i> -value | --             | 0.1951         | 0.2016         | 0.634          |
| Entropy              | --             | 1              | 0.99           | 0.96           |
| Distribution         | 100            | 99-.9          | 96-3.1-0.7-    | 93-3.6-3.1-.5  |
| <b>High School</b>   | <b>1 class</b> | <b>2 class</b> | <b>3 class</b> | <b>4 class</b> |
| Loglikelihood        | -1888.293      | -1529.934      | -1338.843      | -1205.3        |
| # parameters         | 7              | 121            | 135            | 16             |
| BIC                  | 3821.561       | 3124.117       | 2761.21        | 2513.398       |
| ABIC                 | 3799.337       | 3092.369       | 2719.937       | 2462.601       |
| LMR <i>p</i> -value  |                | 0.1689         | 0.005          | 0.1958         |
| VLMR <i>p</i> -value |                | 0.1673         | 0.01           | 0.1919         |
| Entropy              |                | 97             | 97             | 97             |
| Distribution         | 100            | 93-6.8         | 94-4.2-2.1     | 92-2.4-2.1-3.6 |

*Note.* BIC = Bayesian Information Criterion. ABIC - Adjusted Bayesian Information Criterion. LMR = Lo-Mendell Rubin test. VLMR = Vuong-Lo-Medell Rubin test.

Table 19. High School Racial Climate as a Predictor of High School Performance Trajectory Classes

| <b>Class comparisons</b>               | <b>Chi-Square</b> | <b>P-Value</b> |
|----------------------------------------|-------------------|----------------|
| Average-increase vs High-decline       | 0.13              | 0.717          |
| <b>Stable-high vs Average-increase</b> | <b>6.74</b>       | <b>0.009</b>   |
| Stable-high vs High-decline            | 3.34              | 0.068          |

*Note.* Avg-increase = Average-increasing class, High-decline = High declining class. Bolded values indicate significant Chi-Square difference test.

Table 20. Change in School Racial Climate as a Predictor of High School Performance Trajectory Classes

| <b>Class comparisons</b>                       | <b>Chi-Square</b> | <b>P-Value</b> |
|------------------------------------------------|-------------------|----------------|
| <b>Worsened school climate perceptions</b>     |                   |                |
| Average- increase vs High-decline              | 1.46              | 0.227          |
| Stable-high vs Average- increase               | 1.52              | 0.217          |
| <b>Stable-high vs High-decline</b>             | <b>3.61</b>       | <b>0.057</b>   |
| <b>Improved school climate perceptions</b>     |                   |                |
| Average- increase vs High-decline              | 0.42              | 0.516          |
| Stable-high vs Average- increase               | 0.83              | 0.362          |
| Stable-high vs High-decline                    | 0.02              | 0.878          |
| <b>No change in school climate perceptions</b> |                   |                |
| Average- increase vs High-decline              | 1.81              | 0.179          |
| Stable-high vs Average- increase               | 0.11              | 0.743          |
| Stable-high vs High-decline                    | 1.77              | 0.183          |

*Note.* Avg-increase = Average-increasing class, High-decline = High declining class. Bolded values indicate significant Chi-Square difference test.

Table 21. 9<sup>th</sup> Grade School Racial Climate as a Predictor of the High School Attendance Slope

|                                           | <b>β (SE)</b>          |
|-------------------------------------------|------------------------|
| <b>High school slope</b>                  | <b>-2.42 (0.31)***</b> |
| 9th grade school racial climate           | 0.05 (0.04)            |
| <b>High school racial diversity index</b> | <b>0.58 (0.1)***</b>   |
| High school % FRPL                        | -0.12 (0.09)           |
| Additional school move after 9th grade    | 0.01 (0.11)            |
| Repeated grade level in high school       | -0.04 (0.03)           |
| Female                                    | 0.00 (0.02)            |
| Black                                     | -0.03 (0.02)           |
| Latino/a/x                                | -0.03 (0.02)           |
| <b>Asian</b>                              | <b>-0.05 (0.02)*</b>   |
| Other                                     | -0.03 (0.02)           |
| Cohort                                    | 0.09 (0.06)            |
| Economically Disadvantaged                | 0.03 (0.03)            |
| <b>R-squared</b>                          | <b>0.47 (0.13)***</b>  |

*Note.* Attendance values were divided by 10 for analysis.

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

Table 22. Change In School Racial Climate as A Predictor of The High School Attendance Slope

|                                                          | <b>Change in climate</b> |
|----------------------------------------------------------|--------------------------|
| <b>High school slope</b>                                 | <b>-2.18 (0.28)***</b>   |
| Worsened school climate perceptions vs. no change        | 0.01 (0.039)             |
| Worsened school climate perceptions vs improved          | -0.04 (0.049)            |
| <b>Improved school climate perceptions vs. no change</b> | <b>0.06 (0.025)*</b>     |
| <b>High school racial diversity index</b>                | <b>0.59 (0.1)***</b>     |
| High school % FRPL                                       | -0.12 (0.09)             |
| Additional school move after 9th grade                   | 0.00 (0.098)             |
| Repeated grade level in high school                      | -0.04 (0.035)            |
| Female                                                   | 0.00 (0.023)             |
| Black                                                    | -0.03 (0.021)            |
| Latino/a/x                                               | -0.03 (0.021)            |
| <b>Asian</b>                                             | <b>-0.05 (0.023)*</b>    |
| Other                                                    | -0.03 (0.022)            |
| Cohort                                                   | 0.08 (0.063)             |
| Economically Disadvantaged                               | 0.03 (0.024)             |
| <b>R-squared</b>                                         | <b>0.47 (0.12)***</b>    |

*Note.* Attendance values were divided by 10 for analysis. Estimates are from models in which no change in school climate is the reference group unless otherwise specified.

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

Table 23. Distribution of Student School Performance Transition Classes

|                                        | Frequency | Percent |
|----------------------------------------|-----------|---------|
| Consistently stable-high               | 537       | 77.16   |
| Stable-high ms - avg. increasing hs    | 27        | 3.88    |
| Stable-high ms - high declining hs     | 8         | 1.15    |
| High declining ms - stable high hs     | 31        | 4.45    |
| High declining ms - avg. increasing hs | 40        | 5.75    |
| High declining ms and hs               | 4         | 0.57    |
| Avg. increasing ms - stable high hs    | 5         | 0.72    |
| Avg. increasing ms and hs              | 35        | 5.03    |
| Avg. increasing ms - high declining hs | 9         | 1.29    |

*Note.* Avg. = Average; ms = middle school; hs = high school.

Table 24. Logistic Regression Predicting School Performance Transition Class Membership by Change in School Racial Climate Perceptions

| <b>Predictor</b>                                 | <b>OR</b> | <b>CI</b>   | <b><i>p</i>-values</b> |
|--------------------------------------------------|-----------|-------------|------------------------|
| Worsened school climate perceptions vs no change | 1.31      | 0.686-2.489 | 0.416                  |
| Worsened school climate perceptions vs improved  | 1.59      | 0.686-3.684 | 0.279                  |
| Improved school climate perceptions vs no change | 0.82      | 0.413-1.635 | 0.577                  |

*Note.* Examining the odds of being in the Consistently Stable-High class versus either the Average-decreasing in middle school and either stable-high or increasing in high school. OR = odds ratio; CI = confidence interval. Estimates are from models in which no change in school climate is the reference group unless otherwise specified. Monte-Carlo integration required with this model.

Figure 7. Analysis Model for Research Question 1

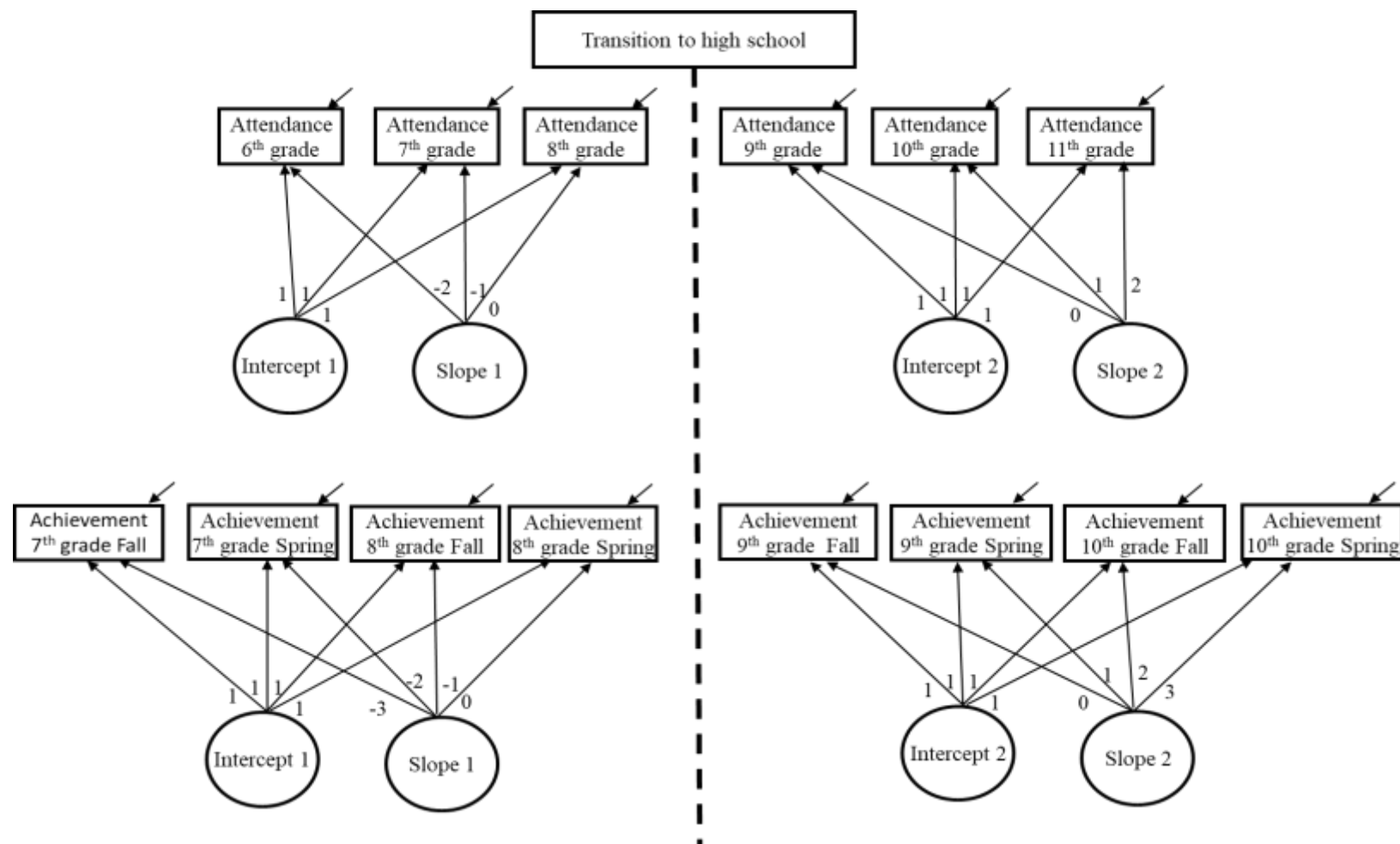


Figure 8. Analysis Model Example for Research Question 2

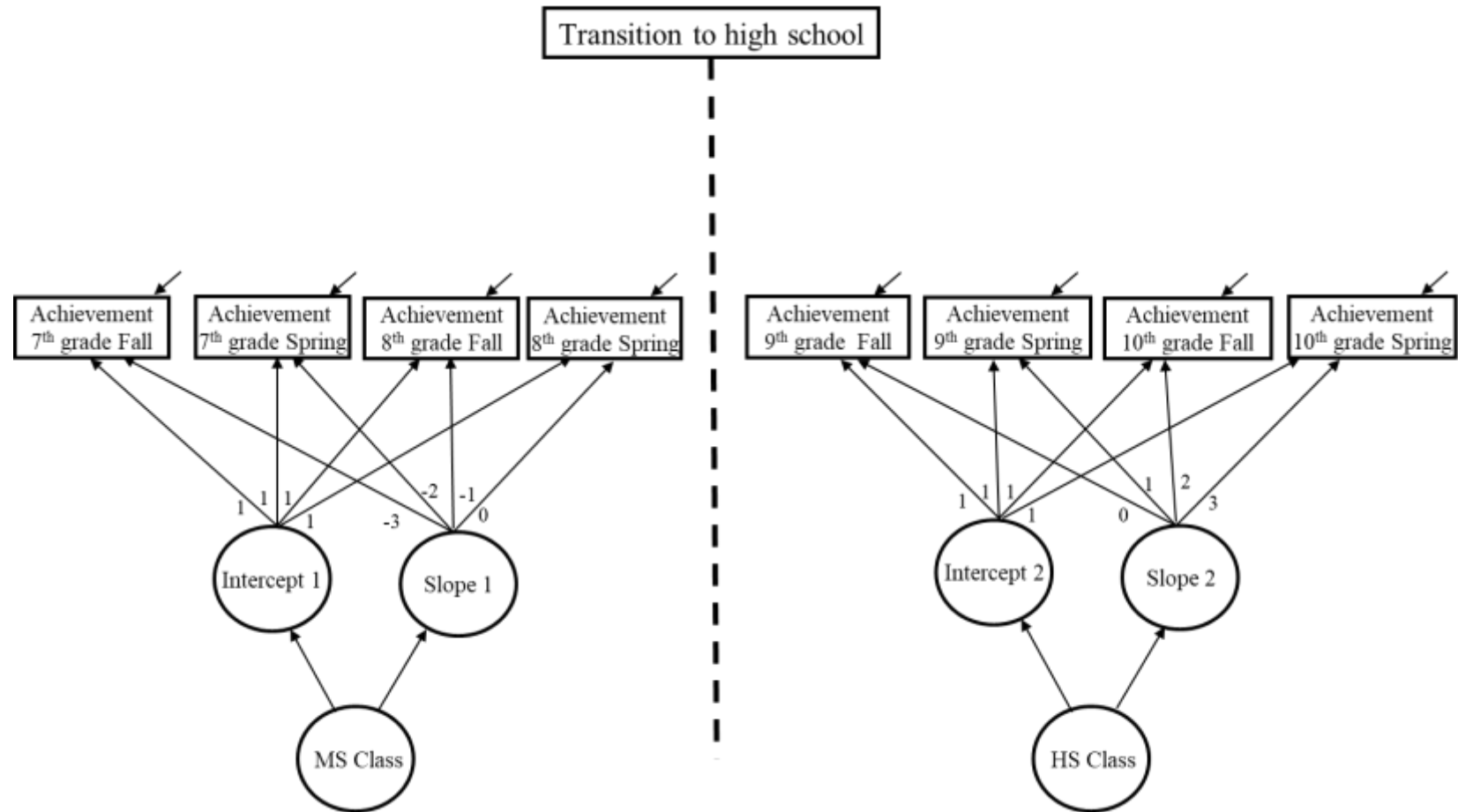


Figure 9. Analysis Model Example for Research Question 3

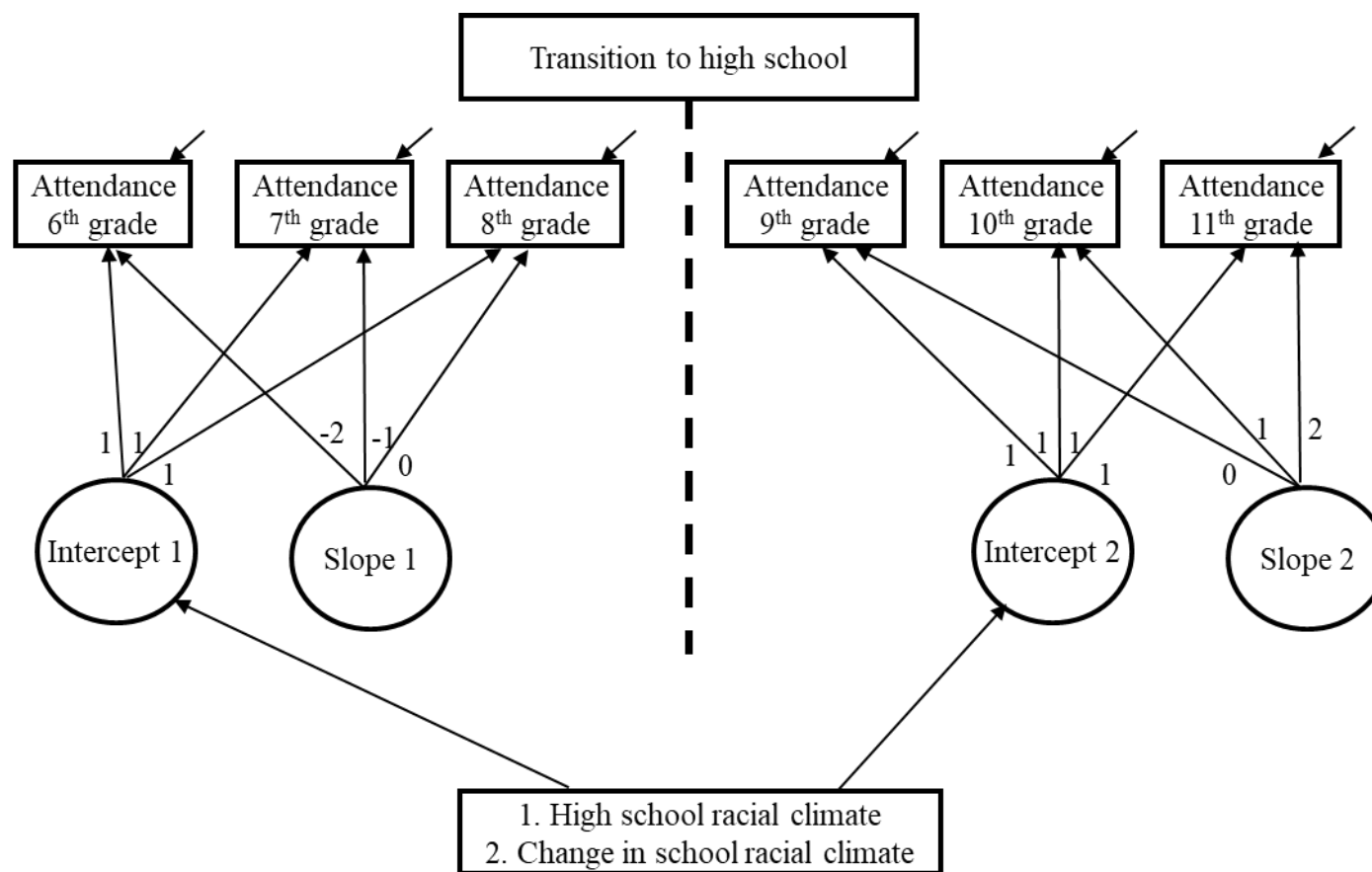


Figure 10. Analysis Model Example for Research Question 4

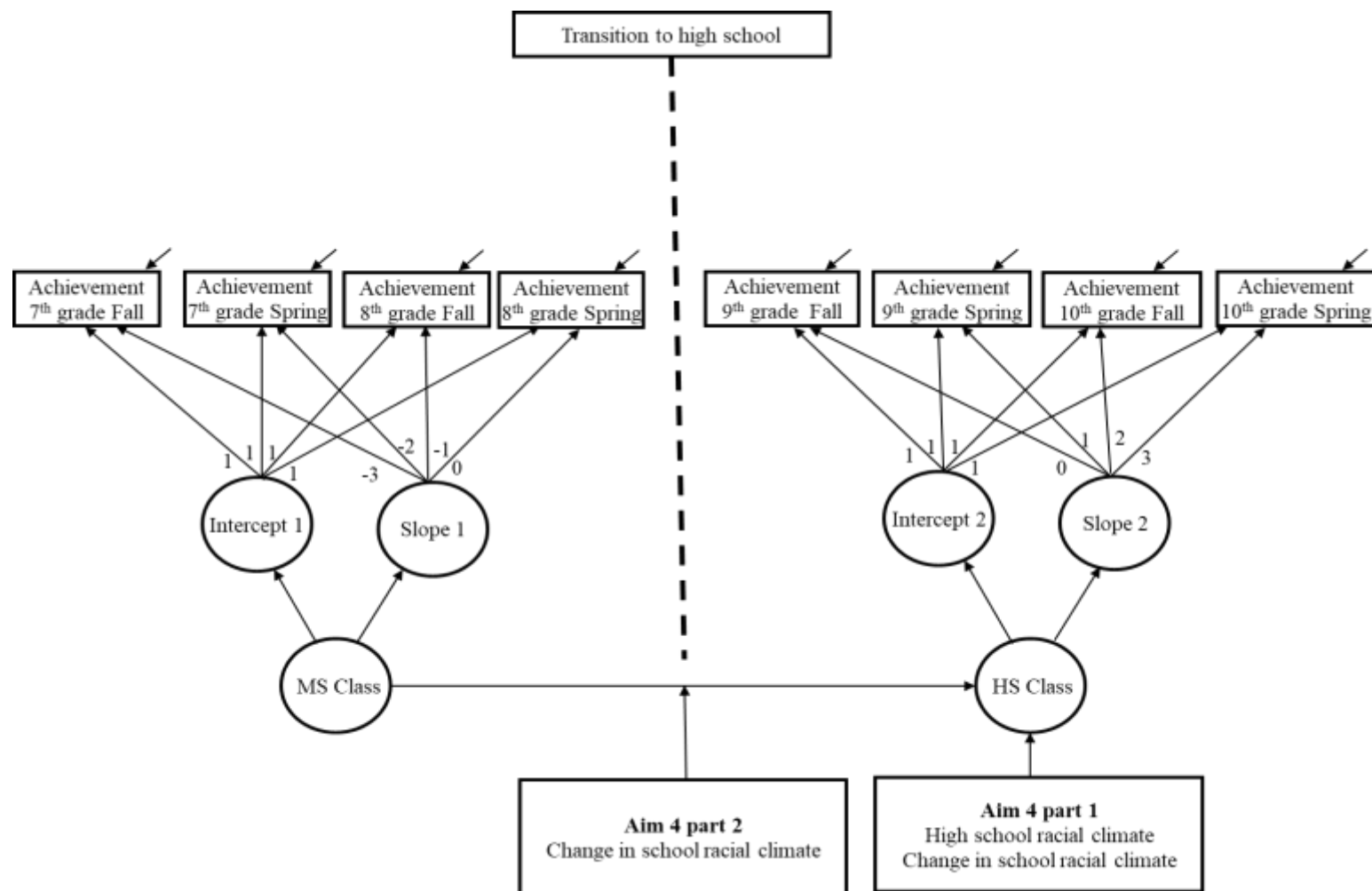


Figure 11. Unconditional School Performance and Attendance Trajectories Across the High School Transition

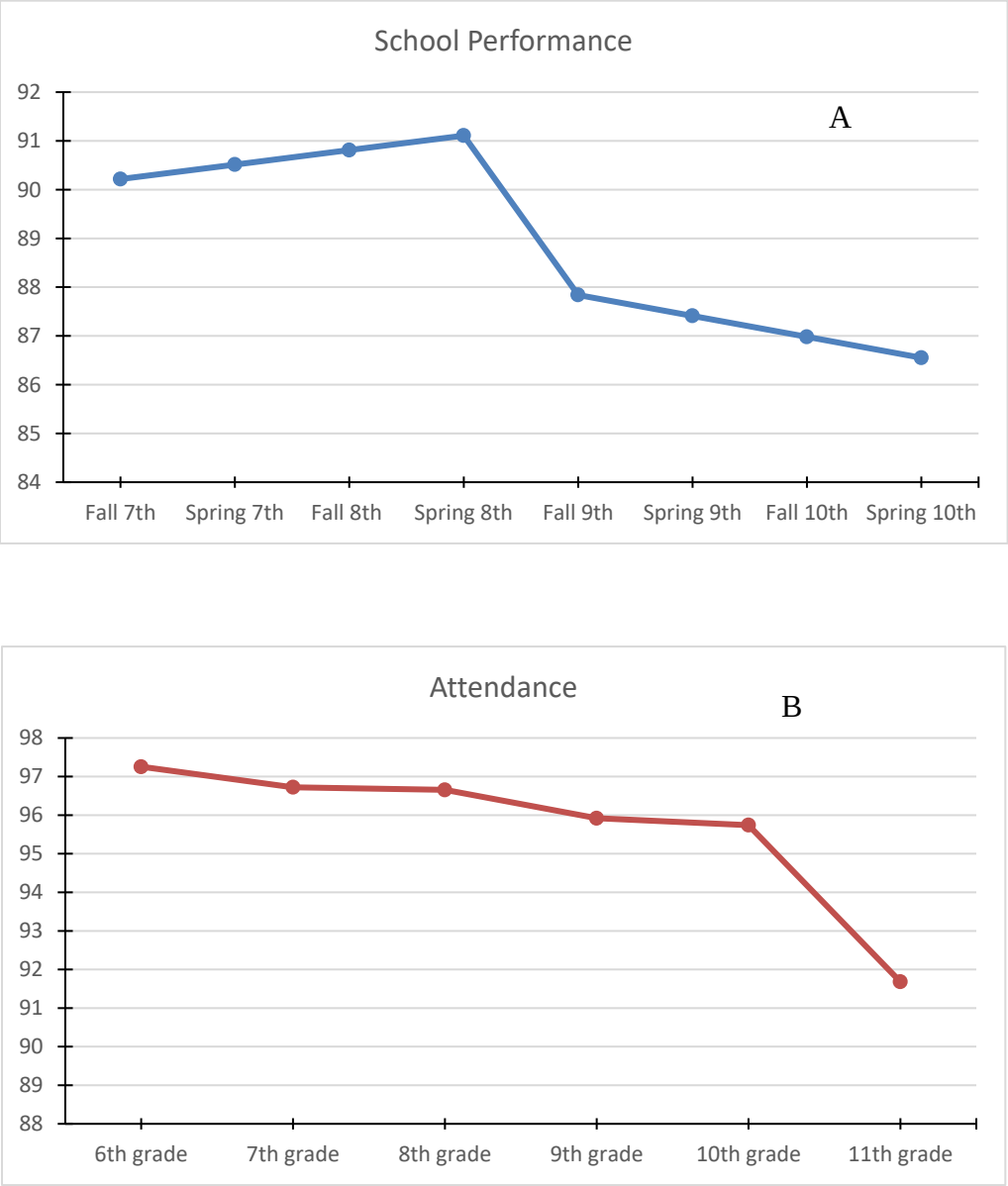


Figure 12a. BIC and ABIC Values Across GMM Class Solutions Utilized for Class Enumeration of Middle School Performance Trajectories

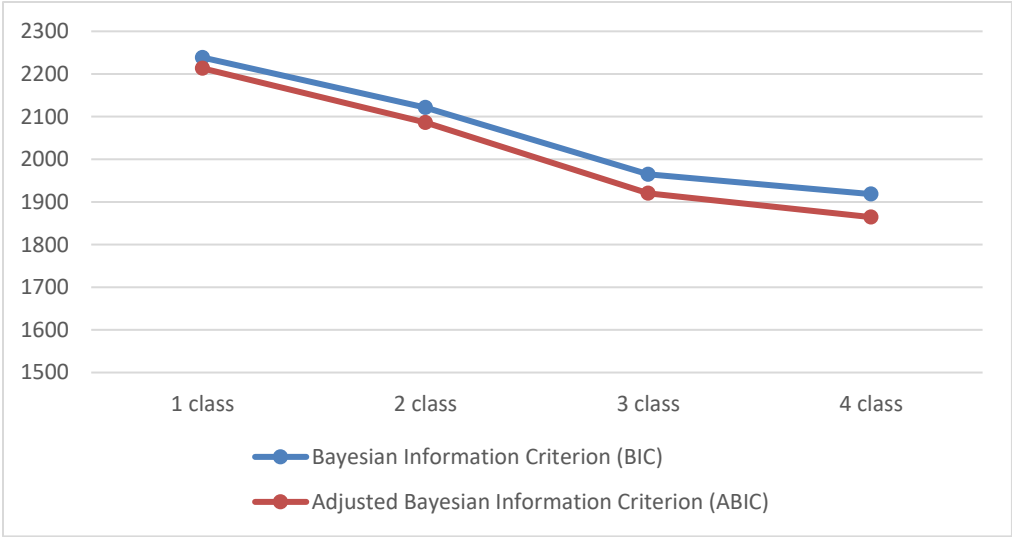


Figure 12b. BIC and ABIC Values Across GMM Class Solutions Utilized for Class Enumeration of High School Performance Trajectories

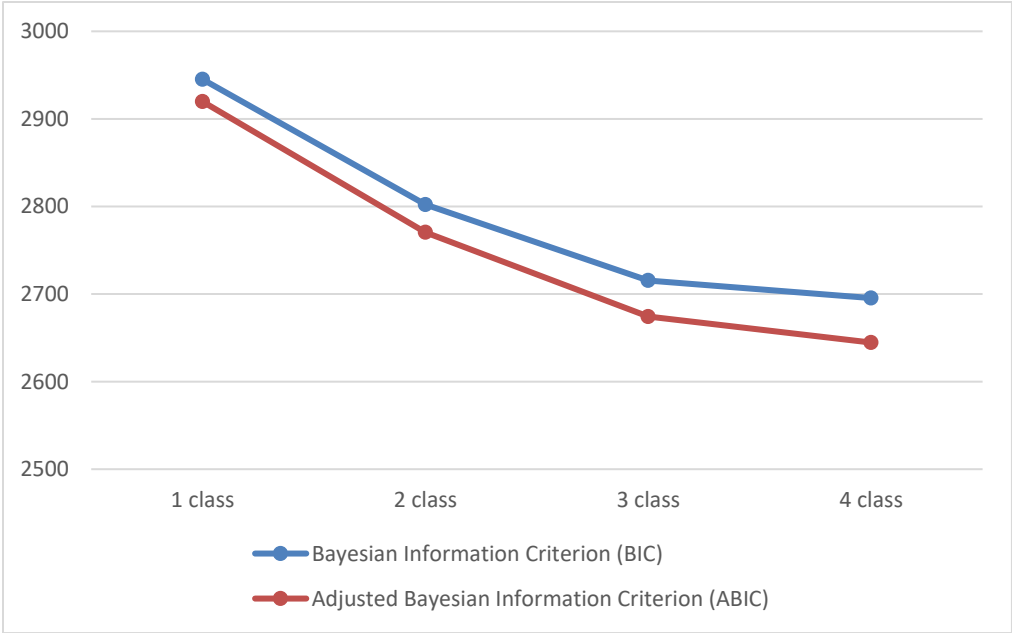


Figure 13a. Growth Mixture Model Results for Students’ Middle School Performance Trajectories

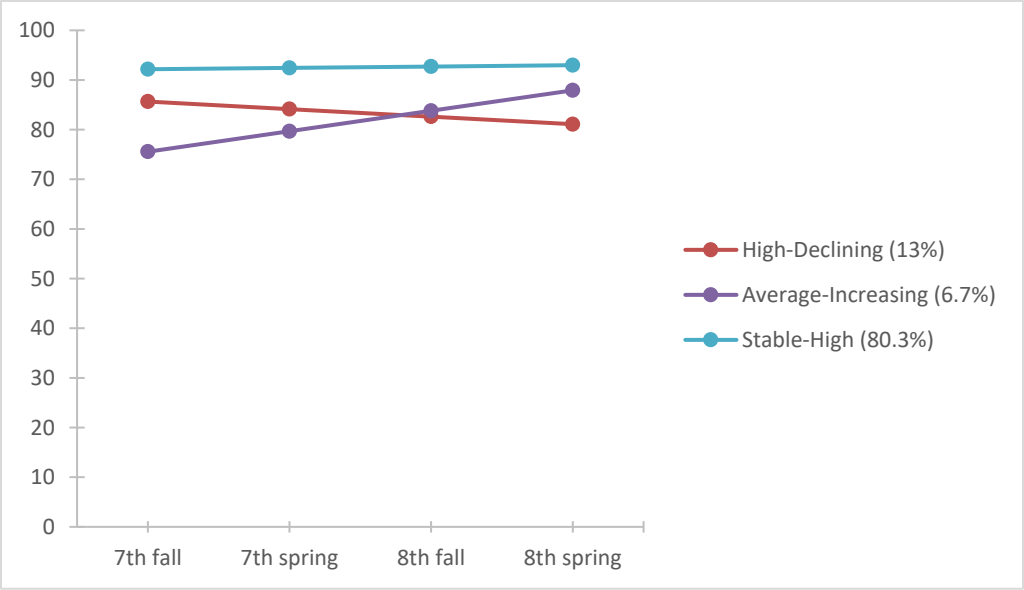


Figure 13b. Growth Mixture Model Results for Students' High School Performance Trajectories

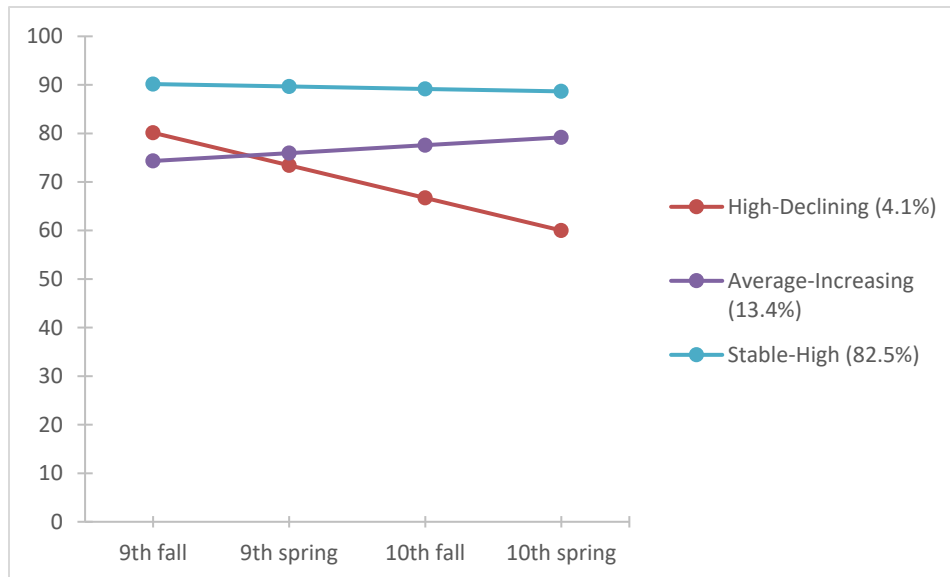


Figure 14a. BIC and ABIC Values Across GMM Class Solutions Utilized for Class Enumeration of Middle School Attendance Trajectories

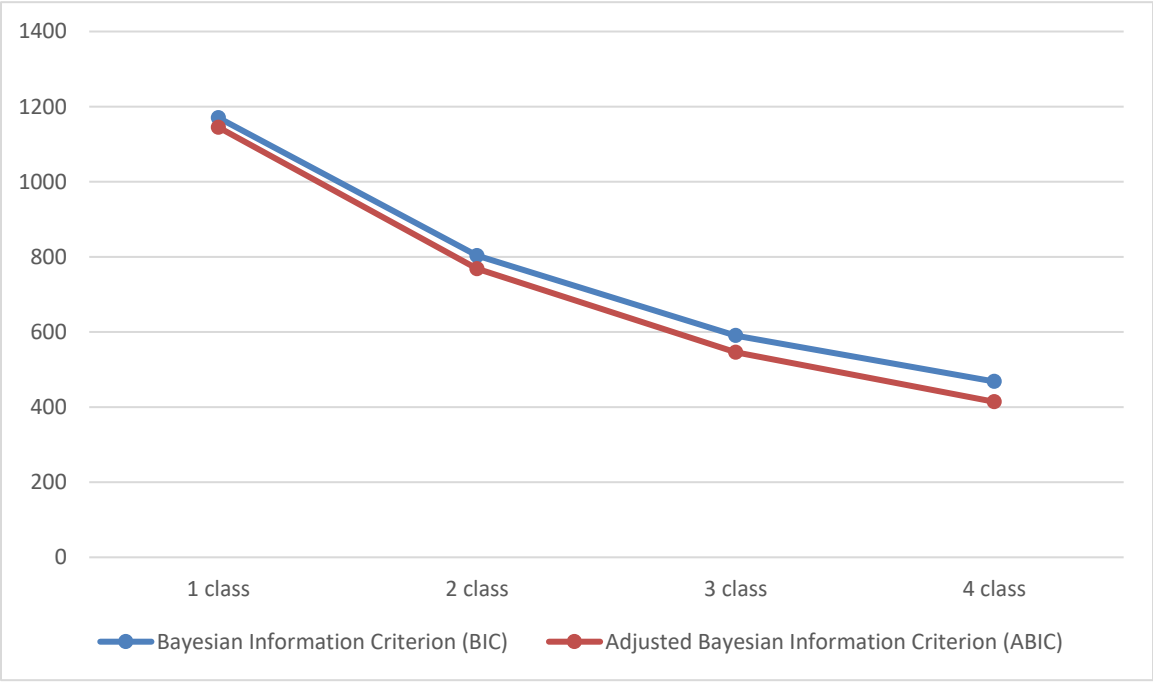


Figure 14b. BIC and ABIC Values Across GMM Class Solutions Utilized for Class Enumeration of High School Attendance Trajectories

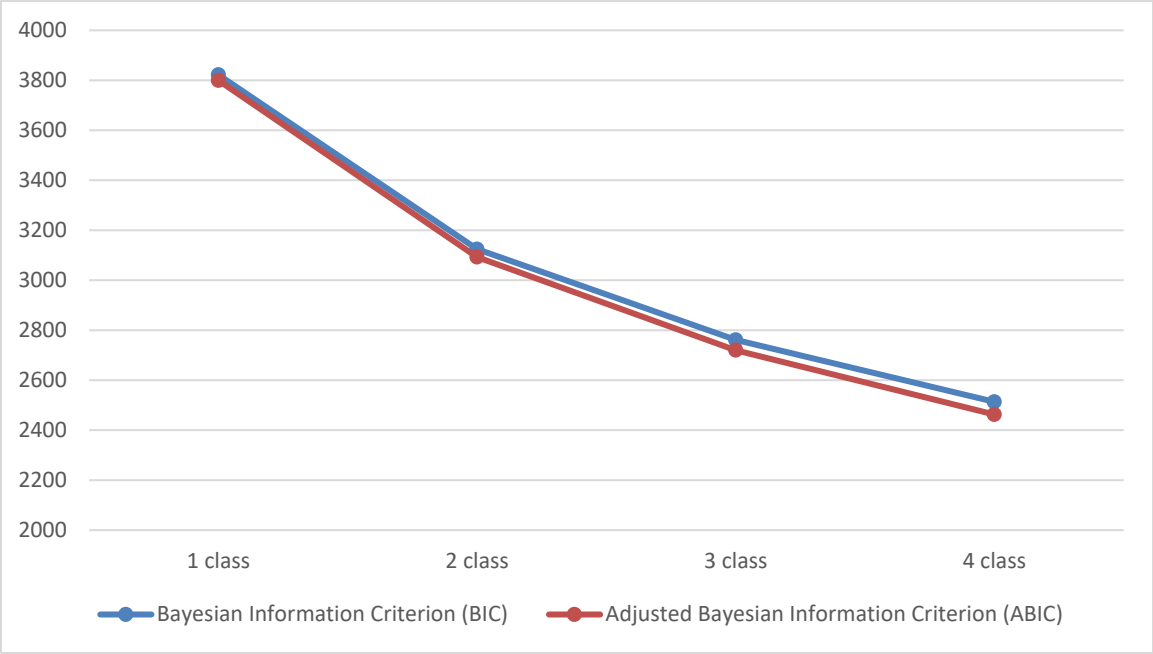


Figure 15. Students' 8<sup>th</sup> And 9<sup>th</sup> Grade Attendance Means by School Racial Climate Change Group

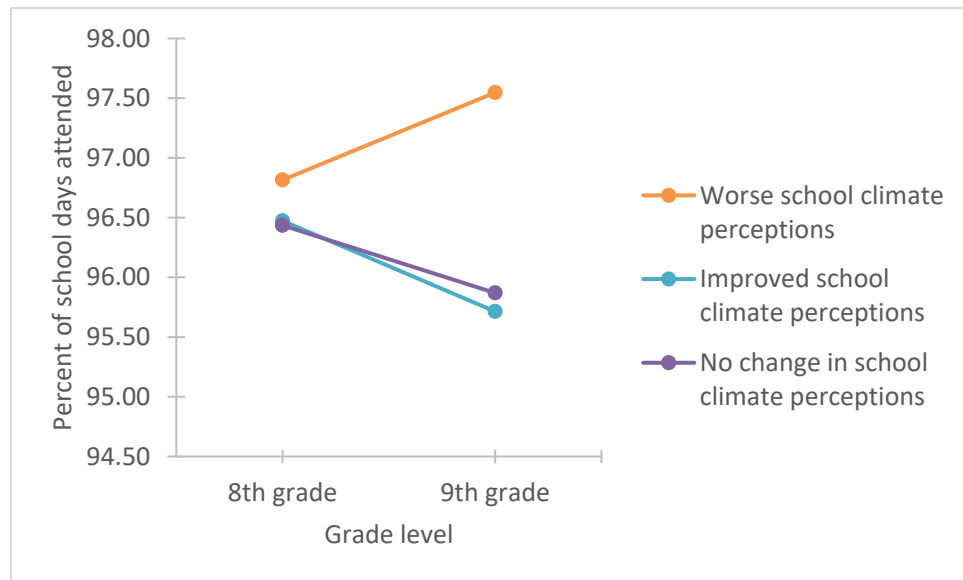
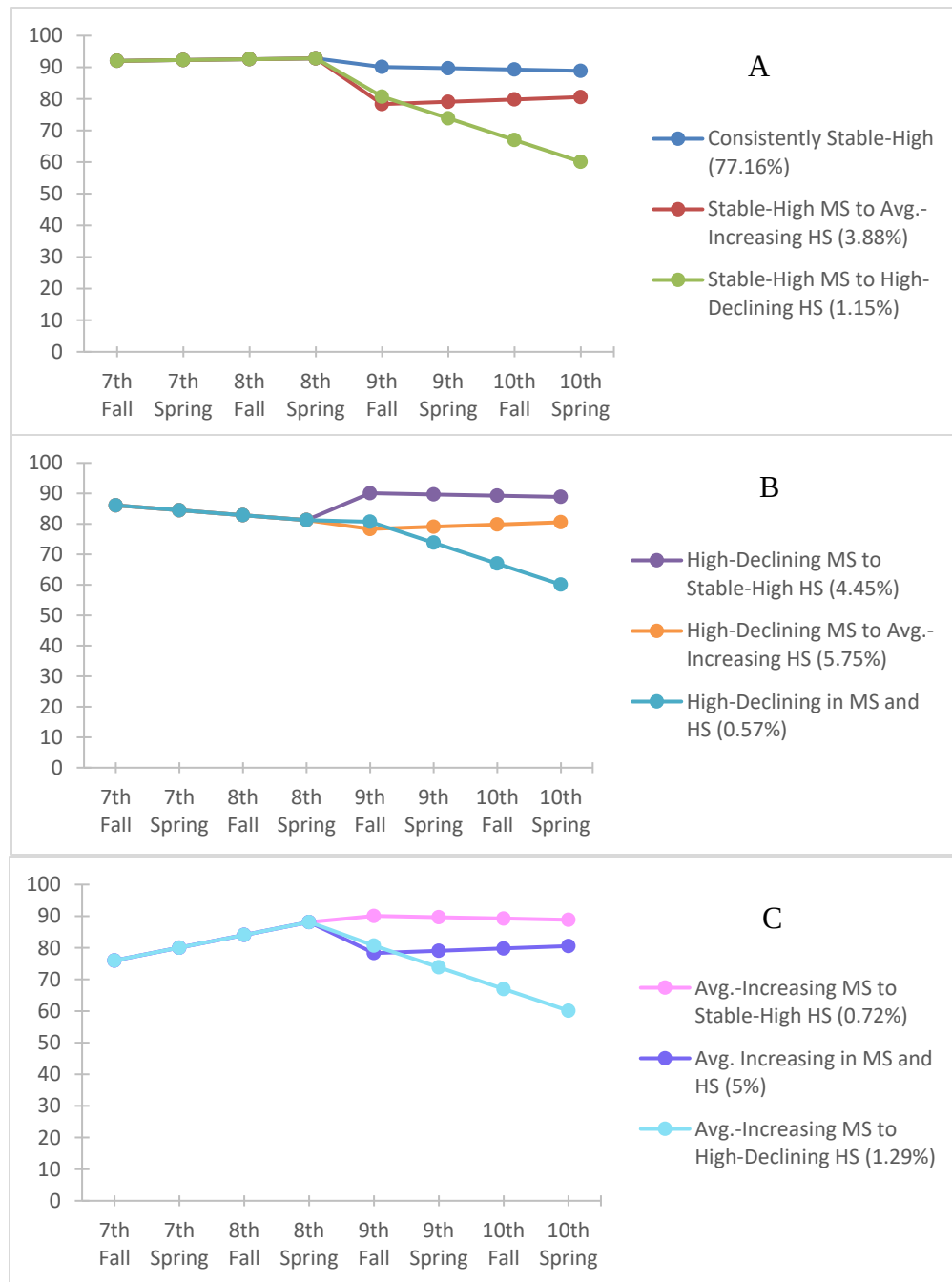


Figure 16. Growth Mixture Model-Latent Transition Analysis Results for School Performance Trajectories



Note. Latent transition analysis was conducted in a single model; trajectories are presented in three separate figures for clarity.

## **General Discussion**

For decades, U.S. researchers and policymakers have taken keen interest in documenting and understanding school mobility and its influence on students' educational outcomes (Mehana & Reynolds, 2004; Reynolds et al., 2009; Welsh, 2017). However, there are many confounding student and contextual characteristics related to both the initiation of student mobility as well as students' educational outcomes that make studying the impact of school mobility on students' academic outcomes complex. The current dissertation sought to disentangle potential sources of variation in students' mobility experiences by investigating how changes in both structural and interpersonal aspects of the school context across a school move influenced students' academic trajectories across the transition. Given the increasing racial/ethnic diversity of America's school-aged children (Frankenberg et al., 2019; NCES; 2021), the current dissertation focused specifically on race/ethnicity-related aspects of the school context, which can provide insights into the unique transition needs of different students and different schools and enable schools to provide the best supports possible to mobile students in a diversifying school system.

More specifically, Study 1 focused on how changes in structural aspects of the school context (i.e., school racial/ethnic diversity, the percentage of same-ethnic peers) influenced students' math and reading trajectories across a non-normative school move occurring in elementary school and whether this varied by students' own

race/ethnicity. Study 1 utilized a large dataset from the NWEA Map Growth math and reading assessments and found that students experienced disruptions in their achievement growth across the non-normative move and that the extent of these disruptions was influenced by changes in the school racial/ethnic composition, though not always in the direction expected. Study 1 also provided evidence of racial/ethnic variation in the relation between changes in the school racial composition and students' achievement growth trajectories, such that a decline in same-ethnic peers was disruptive for Latino/a/x's math achievement growth but appeared to benefit White and Asian students' math achievement.

Study 2 focused on the transition to high school and utilized a community-based sample to examine students' school performance and attendance trajectories across the normative transition to high school and the influence of changing school racial climate on transition challenges. In Study 2, I observed short-term and longer-term transition disruptions for students' school performance, however, these mean effects masked unique trajectories for school performance. Study 2 contributed to the field of school transition research by utilizing person-centered approaches to identify three distinct school performance trajectories across the high school transition: a stable-high trajectory, an average and increasing trajectory, and a high but declining trajectory. Results of Study 2 also showed that school racial climate was influential for students' high school performance and attendance. For school performance, more positive perceptions of high school racial climate were associated with greater likelihood of

having high and stable school performance compared to average and increasing school performance. For attendance, students who reported worsened perceptions of school racial climate across the high school transition showed increased attendance immediately following the high school transition whereas students who reported no change or positive change in school racial climate perception displayed immediate disruptions in attendance following the move to high school, which was unexpected. However, improved school racial climate perceptions across the transition were related to more attenuated declines in attendance compared to experiencing no change in school racial climate.

Together, the findings of the current dissertation document disruptions in students' trajectories across school moves, which echoes existing research (Welsh, 2017). This emphasizes the need to provide support for students experiencing non-normative mobility or making a normative school transition, though the current dissertation studies suggest that the need for support may vary depending on the student and their context, as I observed variation in students' trajectories across the school move tied to school racial/ethnic composition, race-related processes, and students' race/ethnicity. In identifying variation in students' school transition experience, the current dissertation contributes to the ongoing research that contextualizes student mobility and explores potential sources of variation in how student outcomes are impacted by school transitions (Anderson, 2017; Benner, 2011; Ding, 2008). Paying mind to factors that may influence how students' respond to school moves can help pinpoint areas for

intervention and identify students most in need of support. The current study also expands on existing school mobility literature by focusing on the influence of racial composition on students' non-normative mobility experiences, which has seldom been investigated, and by focusing on school racial climate in relation to the normative school transitions, which is another area of emerging research (Benner & Graham, 2009; Coelho et al., 2020; Graham & Morales-Chicas, 2015).

While the current dissertation expands our understanding of students' transition experiences, there are limitations to be noted. First, the generalizability of the findings in this dissertation are limited by the selection of the samples. Study 1 consists of large school districts, and the schools in the sample self-select into administering the MAP Growth assessments. Study 2 utilizes a smaller community-based sample that consists of both urban and suburban school districts, and thus the data may not be generalizable to the general U.S. student population. Future research utilizing large nationally representative data can help replicate the results of the current dissertation and provide insights into the influence of race/ethnicity-based school contextual factors for students' school transition experiences at a national level. Moreover, attempts to replicate the current works in various contexts (e.g., urban versus rural neighborhoods) can also contribute to our understanding of variation in transition experiences.

The current study is also limited by unobserved third variables. Examining the influence of student mobility is notoriously complex in that many unobserved factors related to the individual and their context may influence both student mobility and

students' academic outcomes (Welsh, 2017), and these complications are reflected in the current dissertation. Study 1 could not control for certain student characteristics, such as family income and housing stability, which are known to be related to students' mobility status (Rumberger, 2015; U.S. Government Accountability Office, 2010) and their educational outcomes (Reardon, 2013; Voight et al., 2012). Study 1 also does not include information regarding why students move schools, which is of particular importance when studying non-normative mobility. There are a multitude of reasons students may change schools. For example, some families may be seeking a better fitting school, while other students may experience mobility due to economic hardship or other familial circumstances, such as divorce. Without accounting for these factors, it is difficult to disentangle whether the disruptions in students' educational outcomes across a school move are due to the mobility itself or the cause of mobility (Welsh, 2017; Hanushek, 2004).

Along similar lines, although study two did implement more student-level covariates, there are inter-personal processes within the school context unaccounted for that may influence students' performance and attendance across the transition to high school. For example, the measure of school racial climate in Study 2 does not ask students about their experiences of racial discrimination in school, which is known to negatively influence students' achievement (Benner et al., 2018). Likewise, cross-ethnic friendships, also not included in the current study, have been found to promote students' academics (Serdouk et al., 2022). Given the growing diversity in the U.S.

school system, future work should examine the influence of a broader range of race-related contextual processes on students' academic trajectories at times of school transitions. Despite these limitations, the current dissertation expands our current understanding of the impact of school moves by going beyond documenting the consequences of mobility and investigating for whom and in what contexts mobility is most harmful.

Contextualizing school mobility by identifying sources of variation in students' transition experiences is critical for both advancing student mobility research and enabling researchers and school leaders to pinpoint targeted areas for intervention. This dissertation also contributes to the ongoing mobility research by placing attention on racial/ethnic differences in transition experiences and focusing on race-related processes in schools, providing insights into exactly who needs particular support across normative and non-normative school moves and which contexts are more promotive for students' transition success. As the population of school-aged children increases in racial/ethnic diversity, it is pertinent to understand if and how educational processes vary by race/ethnicity to ensure all students have positive educational experiences, particularly given that mobile students are more likely to be racial/ethnic minorities, particularly Black and Latino/a/x (Xu et al., 2009). Additionally, creating culturally-responsive school climates has been shown to benefit students academically and emotionally (Byrd, 2016; Golden et al., 2018) and can thus serve as a means to promote educational success during times of transition.

While school mobility has been studied for decades, understanding the impacts of mobility remains a highly relevant topic with a number of school choice policies (Rumberger, 2015) and policies that instigate the closure of schools (ibid). Such policies initiate student mobility and can impact mobile and non-mobile students alike. While mobile students may experience varied responses to moving schools, as demonstrated in the current dissertation, research finds that students in schools with high rates of student turnover are negatively impacted academically (LeBoeuf & Fantuzzo, 2018). As such, the implications of research expanding the current knowledge on mobility consequences are far reaching. Moreover, the life course theory views transitions as potential turning points that influence subsequent trajectories (Elder & Shanahan, 2006). As such, a normative or non-normative school transition can place students on improving trajectories, when students are supported and climates facilitate such moves, or on declining trajectories if their academic and emotional needs are not met as they move schools. Moreover, the high school transition may be particularly important as it sets the stage for students as they transition into adulthood. Therefore, providing supports during and after school transitions is critically important to ensure students have a more rewarding academic experience and thrive in their new school contexts. While there is strong consensus that school mobility is detrimental to students' educational outcomes (for review, see Welsh, 2017) the current dissertation serves to identify ways of optimizing student outcomes during times of transition and is a strong first step to setting students on a trajectory of educational success.



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