A MULTILEVEL ANALYSIS OF STUDENT PERSISTENCE IN HIGH SCHOOL

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To my loving husband, Baba,
and children, Abigail, Alyssa, and baby

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ABSTRACT

The high rates of high school dropouts have been a top educational concern for practitioners, policymakers, and researchers for the past few decades. Despite the extensive research, however, dropout rates have remained relatively stable and below expectations. This study reframes the dropout problem by focusing on the majority of students who remain in school and persist through graduation on time. The purpose of this study is to simultaneously examine the individual and school influences on student persistence during high school.

The multilevel study on student persistence is separated into two phases: early persistence and late persistence. The early persistence phase followed a cohort of eighth graders through their scheduled tenth grade year, while the late persistence phase followed eighth graders through their scheduled twelfth grade year. The outcomes were based on students' educational status at the end of each year (e.g., in-grade, out-of-grade, or dropped out).

The data for this study were obtained from the National Education Longitudinal Study of 1988 (NELS:88) conducted by the National Center for Educational Statistics (NCES). The information was extracted from the student, dropout, and school surveys and student transcripts files. The first model included 13,177 individuals from 1018 schools and the second model included 12,329 individuals from 1150 schools.

The results of the study showed that student persistence seems to be most influenced by individual-level factors (such as demographics, previous school experience, and their academic and social engagement). More specifically, students' academic experiences in the middle school years and early high school years appeared to

have the greatest influence on graduating on time. Students who fell behind early academically were less likely to catch up and graduate. In addition, although there were only a few significant variables, the school-level findings suggested that schools could influence persistence rates. More specifically, public schools and low SES schools had considerably lower persistence rates. School efforts, such as reform efforts to improve student learning, for example, assisted students to be more successful, remain in school, and subsequently graduate on time.

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CHAPTER I: INTRODUCTION TO RESEARCH PROBLEM

The high rates of high school dropouts have been a top educational concern for practitioners, policymakers, and researchers for the past few decades. Extensive research has been conducted at the K-12 level directed at understanding the problem and the numerous state, district, and school interventions. Despite the efforts to address this problem, dropout rates, or the proportion of 16 to 24 year olds who are out of school and do not have a high school credential (i.e., diploma or GED), remained relatively constant at 11-12 percent over the past two decades (National Center for Education Statistics [NCES], 2001). Furthermore, research documented a disparity between whites and their minority counterparts. The dropout rate for Caucasians was 6.9 percent compared with 13.1 percent for African-Americans and 27.8 percent for Hispanics (NCES, 2001).

Recent research suggested that it is not only older students who decide to leave school before they graduate. Students earlier in their school career also drop out (Lee & Burkham, 1992; Rumberger, 1998; Scott, Rock, Pollack & Ingels, 1995). For example, in one longitudinal study of eighth grade students, NCES reported that in 1988 about 7 percent were classified as dropouts by the spring of their scheduled tenth grade year (NCES, 1992; Scott et al., 1995).

Annually published reports of high dropout rates such as these, coupled with continued poor test scores, contributed to the belief that over the past two decades the nation's schools are suffering a major crisis. The National Commission on Excellence in Education's (NCEE) 1983 report, *A Nation at Risk*, for example, convincingly documented the failure of the American public school system. Although the national high school completion rate, or proportion of 18-24 year olds who earned a high school

diploma or equivalent credential, had improved in the latter part of the 20th century (NCES, 2001), *A Nation at Risk* argued that the educational system did not adequately prepare individuals for productive employment and/or higher education. It stated, "the average graduate of our schools and colleges today is not as well-educated as the average graduate 25-35 years ago, when a much smaller proportion of our population completed high school and college" (NCEE, 1983, p.11).

The importance of a high school diploma increased dramatically over the last century (Aronson, 2001). Policymakers and the American public regarded education as "the great equalizer" in ensuring social mobility. A diploma is viewed as a gateway to better employment and higher educational opportunities. With the nation's changing economic structure and continual decrease in low-skilled employment, access to well-paid jobs was difficult without a high school diploma. In 1996, the median annual earnings of young men and women ages 25-34 who did not have a high school diploma were 31 and 36 percent (respectively) lower than their counterparts who had completed high school (U. S. Census Bureau, 1999). Thus, serious social problems are likely consequences for dropping out today. The lack of a diploma may lead individuals to a future of unemployment or poor paying jobs, or dependency on welfare and other social services (Wehlage, Rutter, Smith, Lesko, & Fernandez, 1989).

Background of the Problem

During the Reagan presidential years (1981-1988), the proposed solution to the nation's educational concerns was to shift the responsibility back to the states. Although *A Nation at Risk* listed forty recommendations, the prescription to cure failing schools

was vague because states were left to create their own reform agendas (Wirt & Kirst, 1989). As a result of a diverse set of state initiatives, in 1989 President Bush and the nation's governors laid the groundwork for the *Goals 2000: Education America Act*, one of the most significant public laws on education in the nation's past. Until this act, the United States had never outlined any explicit policy regarding educational content goals (Marshall, Fuhrman, & O'Day, 1994). President Clinton signed it into law in 1994.

The purposes of the *Goals 2000* act were "to improve learning and teaching by providing a national framework for education reform, [and] to promote the research, consensus building, and systematic changes needed to ensure equitable educational opportunities and high levels of educational achievement for all students…" (Congress, 1994). *Goals 2000* promoted equity and quality among all schools that received federal funding. The act included eight national goals addressing (1) children's readiness to learn, (2) school completion, (3) student achievement and citizenship, (4) teacher education and professional development, (5) mathematics and science education, (6) adult literacy and lifelong learning, (7) safe, disciplined, and alcohol- and drug-free schools, and (8) parental involvement.

One of the important objectives of *Goals 2000* was to increase the nation's high school graduation rate to at least 90 percent. The target was to reduce the nation's dropout rates and, more specifically, to eliminate the dropout rate disparity between minority and non-minority students. Despite the identification of a target, the National Center for Educational Statistics (2001) reported that during the past decade the national high school completion rate remained at approximately 85 percent. Moreover, the completion rates for Caucasians and African-Americans remained relatively constant at

approximately 91 percent and 83 percent, respectively. In contrast, Asian/Pacific Islanders improved to 94 percent while Hispanics fluctuated in the lower to middle 60 percent range. Researchers have described the study of high school dropout as problematic, due to inconsistencies in definitions and reporting procedures across the states (Viadero, 2001).

Although the influence of *A Nation at Risk* was substantial in providing a focal point for reform activity for the past two decades, the actual impact of the reforms were modest. Our educational system is still far from where policymakers and the public feel it should be. While dropouts still remain a top priority, there are new concerns raised about how to understand this phenomenon. Traditional research typically focused on describing the problem and identifying the students who were at risk of dropping out. However, critics argued that the focus of research needs to shift from a concern with graduation rates to educational processes and, more specifically, should call attention to preventive and intervention efforts of schools (Catterall, 1998).

Purpose of Study

Although extensive research has been conducted on the dropout problem, national high school completion rates have remained relatively stable and below standards set over the past couple of decades. These rates, however, mask the considerable variability that exists across states, districts, and schools. These differences may in part be due to different types of reporting (e.g., status versus event dropout rates). They may also be due to varied educational goals and processes. Although an 85 percent completion rate is often cited (NCES, 2001), another estimate reported that fewer than 75 percent of

students enrolled in ninth grade complete high school within four years (McWhirter, McWhirter, McWhirter, & McWhirter, 1998). Therefore, the extent to which reporting practices may contribute to schools and state variability in dropout rates is unclear.

The purpose of this study is to reframe the dropout problem by focusing on students who persist through graduation. Traditionally, researchers have chosen to investigate the minority population group of leavers rather than the majority of students who remain in school and graduate. By understanding why students persist as well as why they leave, researchers may provide educational practitioners with helpful insights as to how and why individuals succeed. Furthermore, by using one national dataset, the study addresses the problem of variability in school completion or dropout rates.

Theoretical Framework

Theoretical explanations of student persistence at the K-12 level are not well developed (Ainley, Foreman, & Sheret, 1991; Hemmings, Jin, & Low, 1996). The theoretical framework used in this study, therefore, is borrowed from previous research on high school dropouts, individual departure for institutions of higher education, and organizational research. Two perspectives dominate the existing theories of student persistence: psychological and sociological. The psychological, or individual level, perspective includes literature on high school dropouts and student persistence in higher education. The sociological, or school level, perspective focuses on how organizational structures and processes contribute to outcomes. Together, the research provides a strong foundation for examining the individual and school level influences on student persistence at the K-12 level.

Individual Perspectives on Dropping Out

Historically, research conducted in psychology and education borrowed theoretical models from medicine to identify problems, deficits, and pathologies (Brown, D'emidio-Caston & Benard, 2001; Salzman, 2001). In psychology, for example, chronic poverty, physical abuse, and loss of a parent are some of the risk factors associated with adolescent depression (Carbonnell, Reinherz, & Giaconia, 1998). The presence of these risk factors indicates that an individual belongs to a group that is more likely to develop psychological problems. The medical model posits that if individuals are identified early, appropriate intervention strategies might be implemented to teach them how to delay or avoid such negative outcomes.

Educational researchers have also adopted a medical model to identify students at risk for dropping out of high school. Children of low socioeconomic status, low parental education, single parent, or English as a second language have been identified as susceptible to dropping out of school (McWhirter et al., 1998). Moreover, poor academic school performances at specific points in time are also indicators of future difficulties (Catterall, 1998; Croninger & Lee, 2001). Students with low grades, low educational expectations, grade retentions, and discipline problems are more likely to experience educational failure (Alexander, Entwisle, & Kabbani, 2001; Rumberger & Larson, 1998). Although some risk factors are more influential than others, the belief is that the more risk factors students have, the more likely they will decide to leave school before graduation.

From a psychological perspective, dropping out of high school has been typically viewed as an individual decision (Rumberger, 1995). Empirical studies have identified

three general areas of causes or factors that are strongly associated with decisions to drop out: (1) student demographics; (2) family background; and (3) previous school experience (Rumberger & Larson, 1998; Rumberger & Thomas, 2000; Wehlage et al., 1989). Some individual factors include ethnicity, socioeconomic status, siblings that have dropped out, and parental education. Previous school achievement, absenteeism, and grade retention are other variables associated with dropping out.

Rumberger and Larson (1998) found a strong association between student mobility and student performance. Rumberger and Larson reported that more than 25 percent of high school students made school changes (excluding regular grade/school promotions) between the eighth and twelfth grades. Although not all changes were synonymous with residential changes, nearly 25 percent of all students who changed schools two or more times dropped out by the twelfth grade and only about half remained in regular high school programs. These findings suggest that student mobility is another individual level variable that has a negative impact on the completion of high school.

Theory on Individual Departure from Institutions in Higher Education

In contrast to secondary education, theories of student persistence are a well-developed area of study in higher education. Ainley, Foreman and Sheret (1991) reported that only a small proportion of the growing literature concerned with the holding power of schools has focused on factors in early secondary years that might shape students' intention to continue their schooling. In addition, Hemming, Jin, and Low (1996) stated that there is a lack of research over an extended period of time to explain the high school persistence or attrition process. Thus, theoretical models dealing with the process of

student persistence over time at the university level might be helpful in understanding the high school persistence process. To date, however, only a limited amount of studies have used these models (Hemmings, Jin & Low, 1996; Rumberger & Larson, 1998).

This study draws on Tinto's (1975; 1993) theory of individuals' departures from institutions of higher education and uses it to explain the process of high school students' decisions to stay in school and persist through to graduation. Tinto's theory is a single-level formation that explained the longitudinal process by which individuals come to withdraw from an institution prior to graduation. Tinto posited that a student's original intention or *goal* for attending higher education might influence her level of commitment. For example, if a student's goal is to be an accountant or a teacher, which requires a four-year degree, then she may be more motivated to persist through college. In general, Tinto claims that "the higher the level of one's educational or occupational goal, the greater the likelihood of college completion" (1993, p.38).

In addition to student goals, Tinto (1993) suggested that *institutional commitment* might also influence student persistence. Institutional commitment refers to the personal commitment of students to a particular institution, such as wanting to graduate from a prestigious college or keeping up family traditions. For individuals who do not have prior institutional commitments, subsequent experiences at the institution could have a considerable influence on their decisions to stay or leave. Thus, Tinto (1993) defined student goals and commitments through their family background, skills and attributes, and prior schooling. Congruency between individual and institutional characteristics helps shape individuals' commitments (Cabrera, Castaneda, Nora, & Hengstler, 1992).

This may explain why private K-12 and church schools do better at keeping students in school than public schools (Heck & Mayor, 1993; Rumberger & Thomas, 2000).

Tinto (1993) also posited that the impact of students' background is mediated by the quality of individuals' interactions within the institution. Individuals' experiences with other members of the institution affect how well they are integrated into the school community, both academically and socially. In Tinto's model, academic performance and faculty/staff interactions affect students' *academic integration*. Similarly, participation in extracurricular activities and peer group interactions also impact students' *social integration*. Positive interactions and participation influence how well students are integrated within the institution, subsequently leading to stronger goals and commitments, and ultimately influencing students to stay in school and persist through graduation.

Drawing from Tinto's (1993) theory, several promising individual-level variables emerge. Such variables include student background, student goals or expectations, and student perceptions of the quality of their interactions with peers and faculty and the support received from the institution. Though not formally articulated as a multilevel model, the theory also suggests that institutions can influence the social and academic integration of students, and their subsequent decision to stay or leave.

Dropping Out as a Disengagement Process

Similar to student persistence models in higher education, earlier work on high school dropout theory argued that dropping out of high school is a disengagement process that may begin early in students' school career (Finn, 1989; Newmann 1981). Finn

(1989), for example, suggested that school failure is a possible starting point for student rejection of or disengagement with school, while dropping out may be the final outcome for complete withdrawal from school.

Finn (1989) offered two models for explaining the dropping out process. The first was the frustration/self-esteem model. The model suggested that school failure causes students to become frustrated and reduces their self-esteem. Subsequently, individuals deter from choosing appropriate behaviors, and ultimately withdraw from school. The second model, the participation-identification model, highlighted the importance for students to develop and maintain some sense of attachment to the school. Active participation in classroom and school activities lead to successful school performance, and a strong sense of identification and belonging with the school. Students who are well integrated with the school are less likely to dropout. Although these models do not explain all situations in which individuals leave school before graduation, Finn argued that they support the notion that dropping out is a process that does not occur in a single semester or school year.

Similarly, Newmann (1981) suggested that many of the common problems such as dropouts, vandalism, and low commitment to schoolwork that plague high schools may be attributed to the essential aspects of alienation. Issues regarding student alienation were also described from a psychological perspective and a sociological perspective. From a psychological perspective, Newmann explained that individuals' perceptions of the world are a key part of their social reality. Feelings of estrangement and detachment from school could result in a process of isolation and withdrawal. In addition, from a sociological perspective, social structures, roles, and functions may prevent individuals

from bonding with the school community. Some school practices such as tracking, for example, can be seen as alienating when individuals are labeled and grouped into units. Newmann, like Finn, suggested that by reducing alienation, through promoting individuality, communality, and integration, schools could reduce such problems as dropouts.

School Perspective on Dropping Out

While identifying the psychological or individual influences that affect dropping out are clearly important, studies on dropping out should not restrict their view to the individual level. Some researchers suggested the need to examine these major individual influences and the influences of school simultaneously (Catterall, 1998; Rumberger, 1995). A few recent studies have taken a sociological approach to studying dropping out, focusing on how schools as organizations influence students to stay in school or leave before graduation (Lee & Burkam, 1992; 2003; Rumberger, 1995; Rumberger & Thomas, 2000).

An organizational perspective offers a very different view of the dropping out phenomenon. First, organizational research is generally concerned with problems that investigate the relationship between organization structures, resources, and processes and the individuals that comprise them. Second, organizational research recognizes the hierarchical structure of organizations (Heck & Thomas, 2000). Students are arranged in classrooms and schools in districts and states. Because these interdependent relationships are not always apparent, the hierarchical structure is also referred to as a *nested* data structure.

One of the theories that provide the foundation for organizational research includes structural-functionalism (Heck & Hallinger, 1999). Structural-functionalism suggests that organizations such as schools have structural features and processes that provide a framework in which their activities take place (Heck & Hallinger, 1999; Kronick, 1997). The focus is upon identifying the interconnections between the internal and external subsystems of an organization. From this perspective, school structures and processes can influence the educational environment for teachers and students. The lowest level of the hierarchical structure is called the *microlevel*, while all the higher levels are referred to as the *macrolevels* (Heck & Thomas, 2000). Organizational studies often examine the relationships within and between these different levels. School structures and educational processes can affect student achievement. Moreover, the skills and attitudes of students can also affect school structures and processes.

The natural hierarchical structure of schools suggests multilevel theories are needed to explain the influence of variables at each level of the organization. Unfortunately, however, multilevel theories seem underdeveloped compared to the recent advances in conceptual models and statistical techniques (Hox, 1995). This is specifically the case in most previous studies on dropping out. Thus, the several decades, but limited amount of, multilevel studies on dropouts and school effects tend to serve as the foundation for future conceptual frameworks (Teddlie & Reynolds, 2000).

From a sociological perspective, the focus shifts away from identifying factors that place individuals at risk of dropping out to examining how schools as organizations influence students to leave school before graduation. In these studies, the unit of analysis is school differences as opposed to individual decisions to drop out. From the

sociological perspective, the responsibility is shifted from student decisions to organizational environments. The three sets of variables associated with school dropout rates are (1) student composition (2) school structures, and (3) school resources (Lee & Burkam, 1992; Rumberger, 1995; Rumberger & Thomas, 2000). More specifically, a number of student background variables such as ethnicity and socioeconomic status (SES) expressed at the school level (e.g., percent of low SES students) have demonstrated effects on explaining differences in school dropout rates. Other school-level variables, including location, school size, type of control (e.g., public or private), and teacher quality, may also influence the academic and social climate of the school, and the students' subsequent decision to stay or leave school.

Researchers have also recently noted that school process variables such as school policies, practices, and programs that create environments that are more academically and socially supportive may influence school dropout rates. The belief is that these processes encourage students to stay in school (Lee & Burkam, 1992, Rumberger, 1995; Rumberger & Thomas, 2000). Rumberger (1995), for example, conducted a multilevel study, examining both the individual-level and school-level variables that influence dropping out of middle school. While the results of the individual-level influences were consistent with the findings of previous studies, Rumberger's study also showed that schools perceived by students as having fair discipline policies accounted for lower dropout rates across schools. The school-level variables accounted for 42 percent of the variance in mean dropout rates among schools (Rumberger, 1995).

Rationale for the Approach to the Problem

Several conclusions mentioned in previous research established the rationale for the approach to studying the problem of students dropping out. The overview of the empirical work also identifies several previous limitations in work addressing student persistence. Calls for a new theoretical approach, longitudinal study, and multilevel modeling are addressed in this study.

Need for a New Approach

Although researchers have conducted numerous studies to describe the dropout problem, critics argue that there needs to be a shift in focus from identifying what is wrong to nurturing what is right (Catterall, 1998). Researchers of positive psychology, for example, have determined that major studies in prevention of serious psychological diseases, such as depression, have largely come from a perspective of focusing on the competencies of individuals rather than their weaknesses (Seligman & Csikszentmihalyi, 2000). Some researchers claimed a similar approach is needed in preventing students from dropping out of school (Alspaugh, 2000; Catterall, 1998).

Benard (1993) argued that educators, in general, should move beyond a focus of identifying and labeling children and aim at the school processes that will facilitate healthy development. Benard (1997) suggested that schools could support students by creating a caring environment that encourages high expectations and allows for student participation. By providing for individuals' basic needs of being cared for, safety, and having (some) control over their lives, schools may help individuals to avoid potentially negative outcomes (Benard, 1993; Benard, 1997). In addition, through the development

of curriculum and programs that address student needs, schools may function more proactively towards helping students persist through high school.

Need for Longitudinal Study

Previously, student persistence had been most often studied as an individual decision at a single point in time. As suggested, however, some researchers argued that a students' decisions to remain in school or to drop out is an end result of a disengagement process (Alexander et al., 2001; Finn, 1989; Jimerson, Egeland, Sroufe, & Carlson, 2000; Lee & Burkam, 1992; Newmann, 1981; Rumberger, 1995; Wehlage et al., 1989). More specifically, feelings of estrangement, rejection, or disengagement experienced by students early in their school career, compounded by school failure, may discourage students from continuing their education and eventually lead them to a complete withdrawal from school. Thus, to gain a clearer understanding of the student persistence process, there is a need for long-term studies.

A number of studies have addressed dropping out early during high school. In one of the first studies of early dropouts, NCES (1992) tracked a nationally representative group of eighth-grade students through their tenth grade. Between the base-year and the first follow-up at the tenth grade the study found that 6.8 percent of the cohort had dropped out of school (NCES, 1992). Furthermore, the dropout rates for Hispanic and African-American students were significantly higher than those of Asian and White students. In addition, students who attended public schools were also less likely to persist and graduate from high school than their Catholic and other private schools counterparts.

However, the study also suggested the need for further longitudinal studies to track students' experiences over a more extended period of time.

Scott, Pollack, and Ingels (1995) also examined the issue of early grade dropouts. Students in the lowest socioeconomic quartile and from single parent families were disproportionately represented among dropouts after the transition to high school. Scott and colleagues (1995) also reported that the incidence of dropping out for eighth graders scoring in the lowest quartile on the 1988 cognitive test (13 percent) more than doubled that of the national average of 1988 eighth graders (6 percent).

Studies on early grade dropouts have identified the transition to high school as a key event in the process. An unsuccessful transition could begin or further advance the school disengagement process, resulting ultimately in students dropping out. Scott and colleagues (1995) reported some of the students' perceptions of school changed after their transition from a more homogeneous middle school setting to a more heterogeneous high school setting. Nearly 20 percent of students claimed that the social milieu of their new school was more unfriendly and lonely than their previous eighth grade school. Although a strong pattern did not exist, these perceptions were thought to affect student achievement indirectly (Scott, Rock, Pollack, & Ingels, 1995). Longitudinal studies, therefore, may also provide insight to the effects of school transitions on student persistence.

Alspaugh's (1998b) study of the effect of school-to-school transitions on high school dropout rates showed that the number of school transitions and the grade level of the last transition influenced student dropout rates. More specifically, this further supports the idea that educational transitions can disrupt student progress (Isakson &

Jarvis, 1999; Rice, 1997). Likewise, Barone, Aquirre-Deandreis, and Trickett (1991) and Isakson and Jarvis (1997) concluded that the high school transitions were related to decrements in grade point average and attendance (key predictors of dropping out) that may persist or worsen over time.

Other studies have examined the disengagement process over a longer period of time. In one of the few longitudinal studies on dropouts, Alexander, Entwisle, and Kabbani (2001) followed a group of students from first grade through high school. Their findings further support the notion that dropping out is a disengagement process that may begin in the elementary grades. Over 40 percent of the original student cohort had left school at some point without a high school diploma. In addition, students who were held back a grade at any stage of schooling had an increased risk of dropping out. For example, middle school grade retentions increased students' likelihood of dropping out by several-fold. Alexander and colleagues (2000) hypothesized that middle school students who repeated a grade are at a greater disadvantage in transitioning to high school than their peers who have not been retained. Being over-aged for their grade level and near the legal age of dropping out (16 years old in most states), repeaters were more likely to drop out (Alexander et al., 2001; Lee & Burkam, 2003). This supports the ideas that previous school experiences and school-to-school transitions may be negatively related to the student persistence process.

Need for Multilevel Study

Most of the literature explaining student success or failure during the high school years have focused on how students respond to high school as a result of their

demographics, family background, peers, and school experience. While the individual perspective is clearly important in understanding the student persistence process, schools have little or no influence on student demographics and family backgrounds. Recent writing suggests that the concern should be with identifying the characteristics and conditions of schools that promote student decisions to stay or leave (Rumberger, 1995).

Rumberger and Thomas (2000) conducted a multilevel study following a cohort of tenth grade students through the twelfth grade. The study closely examined the influences of various school factors on high school dropout and turnover rates. The results showed that 75 percent of all schools had dropout rates of less than ten percent between the tenth and twelfth grades. Yet, the two-year dropout rates were extremely high in a small proportion of high schools. In addition, the large variability in the two-year turnover rates among schools (5 to 60 percent), suggested that if the holding power of schools were measured by turnover rates, differences existed among schools' ability and/or willingness to educate students. These findings further supported the belief that what goes on in individual high schools does affect student persistence (Rumberger and Thomas, 2000).

Lee and Smith (2001) suggested that "good high schools" strive for both equity and effectiveness. Equity can refer to students' opportunities to learn, such as, their access to curriculum, quality instruction, and resources. These processes represent the social distribution of learning. For example, if a certain group of students are more likely to dropout, then this suggests an uneven social distribution of valued educational outcomes that may be related in part to school processes. Similarly, effectiveness suggests students that attend certain schools learn more and are more likely to complete

high school. A sociological perspective concerns how school structures and processes may influence the drop out process for certain groups of students. Hence, school processes such as expectations, instruction, and support programs may enhance student attendance and persistence. One aspect of policy research is to identify structural aspects and processes of schooling that can be manipulated to influence desired student outcomes. It is evident that if educators have a clear understanding of the attributes of student success and the causes of student failure, school structures, processes, and policies could be modified to serve the needs of their diverse clientele.

Catterall's (1998) recent research on at-risk students and student resilience in the transition to high school also has particular relevance to the proposed study. The term "at-risk" refers to young people who are vulnerable to dropping out of school and "resilience" refers to the ability to overcome or avoid potentially negative experiences. Catterall (1998) followed the progress of a nationally representative group of eighth graders through the tenth grade. The results showed that the majority of eighth graders classified as at-risk were achieving higher levels of performance two years later. The improvements of the children of minority groups suggested higher resiliency than those of non-minority groups. Unfortunately, the study provided limited information about schools' role in providing support for students identified as at-risk in the eighth grade. Catterall (1998) concluded that the process of resilience could be influenced by several factors within the realm of educators and policymakers. Catterall (1998) proposed that a multilevel model that included data about school supports and structures, and a more detailed following of students, could better examine school influences on students' changes in orientation, motivation, performance, and persistence.

In a related study, Croninger and Lee (2001) examined whether teachers' emotional support, guidance, and personal assistance reduce the probability of dropping out for all students. The study also examined whether these teacher-based forms of social capital have specific benefits for students at risk of educational failure. The results indicated that, in general, dropouts perceived their relationships with teachers less favorably than students who completed high school. In addition, teachers reported a smaller proportion of dropouts received support and guidance from teachers outside of class. More importantly, however, is that the findings suggested that teacher-based forms of social capital increase students' likelihood to persist through graduation. Furthermore, students who were at risk of dropping out benefited the most.

The study provided a strong argument for the inclusion of social capital in future persistence studies. However, since it was conducted at the individual level, Croninger and Lee (2001) stated the study did not maximize its explanatory potential. A more comprehensive study would provide researchers with a clearer understanding of the role of these relationships and helpful insights to how schools can facilitate the process.

Need and Significance

Despite a vast amount of empirical research to explain why students drop out during the high school years, there is little research concerned with the holding power of schools that might shape students' intention to continue their schooling (Ainley et al., 1991). This study takes a different perspective by focusing on student persistence and the factors that influence students' decisions to remain in school. Furthermore, this study combines the previous research completed in the areas of dropouts, school transitions,

and school effects and extends the work to include the various suggestions made. Most importantly, it uses longitudinal data to examine student experiences over a four-year time span and to ensure consistent reporting. Unlike most dropout studies focusing on individual-level data, this study also includes data on various school processes (i.e. practices and policies) to determine the schools' influence on students' persistence to graduate.

Conceptual Model of Study

This longitudinal study follows a cohort of eighth grade students as they transition from middle school and continue through high school. The study extends previous work by combining the psychological and sociological perspectives of dropping out and simultaneously investigating the effects of individual-level and school-level variables on student's decision to stay in school until graduation. More specifically, the study examines how school structures and processes serve as supports to students' academic and social engagement, and its subsequent influence on student persistence. The first part of the study examines the influences that encourage students to remain in school and in-grade at the tenth grade, while the second part examines the consistency of those influences to help students to persist and graduate at the twelfth grade.

The conceptual model, listed as *Figure 1.1*, incorporates several strands of previous research, including individual departure in higher education, high school dropouts, school-to-school transitions, and school effects (Catterall, 1998; Lee & Smith, 2001; Rumberger & Larson, 1998; Schiller, 1999; Scott et al., 1995). The model, which is a modified version of Rumberger and Thomas's (2000), suggests several ways that

demographics, backgrounds, and experiences, and school contexts, structures, and processes can affect an individuals' persistence to graduate.

Individual Level

The factors used in individual-level analysis are grouped into several major categories, including demographics, family background, and individual school experiences (Hemmings, Jin, & Low, 1996; Rumberger, 1995). The conceptual model used in this study posits that student persistence is a developmental process of engagement (Tinto, 1995). Student persistence is viewed as a long-term process influenced by several types of factors including students' academic and social behaviors.

The model hypothesizes that a number of student background characteristics such as socioeconomic status, family composition, ethnicity and parental education, as well as previous schooling and achievement, impact a range of experiences in school (e.g., how well they are integrated in courses, whether they are socialized into the school culture) that ultimately affects their decision to persist through graduation. The model also addresses the concern for the lack of research that operationalizes a theoretical framework over an extended period of time (Hemmings et al., 1996). The model suggests that students who are integrated academically and socially within a school over time are more likely to earn their high school diploma.

School Level

Although previous studies on dropouts have identified a wide range of factors associated with students' decision to leave school before graduation, few studies have

examined these factors in a comprehensive fashion (Hemmings et al., 1996; Rumberger, 1995). Some studies focused primarily on student and family backgrounds (Rumberger, 1983), while others focused more on schooling experiences (Ainley et al., 1991; Lee & Smith, 2001; Rumberger, 1995; Rumberger & Thomas, 2000).

The school level of the conceptual model postulates that the formal and informal aspects of the school structures can influence student experiences and their subsequent decision to leave or remain in school. School contextual characteristics, such as student composition, school type, teacher quality and resources influence the organization and climate of the school. In addition, a number of school processes such as high school transition and intervention programs (e.g., freshmen orientation, parent night, articulation with feeder schools, motivational programs and dropout prevention programs) can help students adjust to their new school and encourage them to persist through graduation. Students who feel supported by their schools may increase their engagement, and, subsequently their academic achievement and graduation.

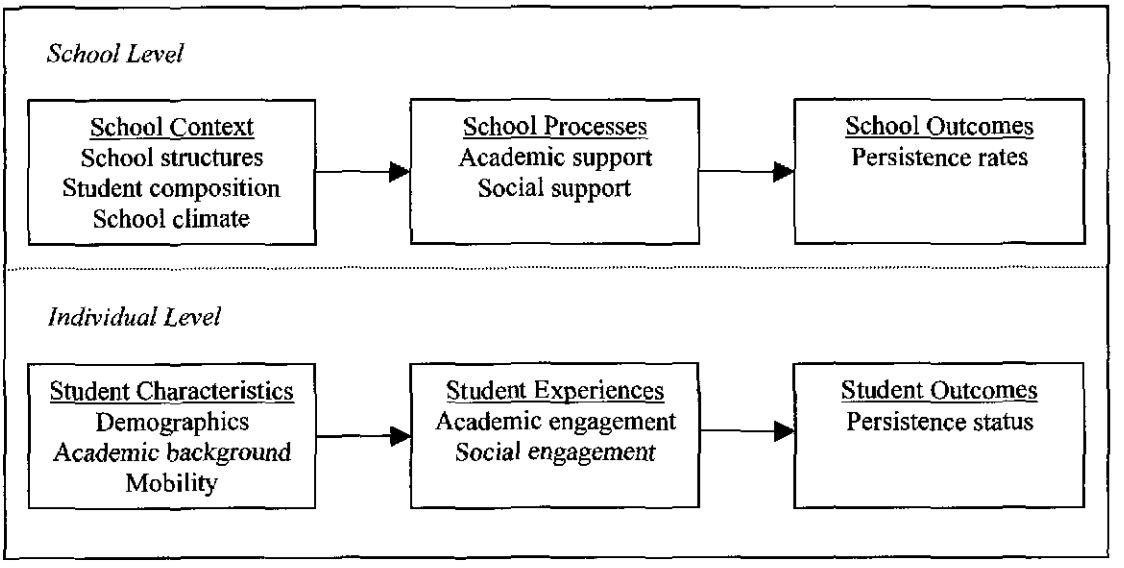


Figure 1.1
Conceptual Model for Analyzing Student Persistence in High School

Despite the large number of studies on how schools affect student achievement, only a few studies have examined the influence of high schools on student persistence (Ainley, Foreman & Sheret, 1991; Lee & Burkam, 2003; Rumberger, 1995; Rumberger & Thomas, 2000). In part, this lack of literature has been due to methodological problems in analyzing multilevel data (e.g., dichotomous and categorical outcomes) and the lack of adequate theoretical models that addressed both individual-level and school-level factors (Hox, 1995; Rumberger, 1995).

Research Questions

This study simultaneously investigates the influence of both student-level and school-level variables on student decisions to stay and complete high school. The study examines student persistence in two phases, the early persistence phase and the late persistence phase. The first model follows a cohort of students from eighth to tenth grade. The early persistence phase looks at the influence of students' background and prior school experiences, high schools' academic and social organizations, and schools' efforts to assist students to remain in school and on track for graduation at the tenth grade. The second model, or late persistence phase, is an extension of the first. This phase addresses the long-term impact of various school efforts by following the same group of students through the twelfth grade. Several school-level variables will be examined as possible supports that influence initial student experiences (ninth and tenth grades) and their persistence to graduate. Importantly, the study also investigates whether school supports affect the differential likelihood of different groups of students dropping out (i.e., low

SES and minority status were identified in the literature as a key equity policy question). The study focuses on the following four questions:

Model 1: Early persistence phase

1. What student-level factors influence student persistence at the tenth grade?
2. What school-level factors influence student persistence at the tenth grade?

Model 2: Late persistence phase

3. What student-level factors consistently influence student persistence to graduation? In particular, how important are students' experiences during the first year of high school to completing high school?
4. What school-level factors consistently influence student persistence to graduation?

CHAPTER II: REVIEW OF THE LITERATURE

This chapter summarizes the theoretical and empirical literature that serves as foundation for the conceptual framework of the study. The main premise of this study is that student persistence, like dropping out, is a developmental process that may be influenced by both individual-level and school-level variables. Research on high school dropouts, school-to-school transitions, and school effects are separated into a psychological (i.e., individual level) and a sociological (i.e., school level) perspective.

Individual-Level Perspectives on Student Persistence

Empirical interest in the phenomenon of leaving school early has grown over the past few decades. Most work views student departure as an individual decision based on family, peer, and school relationships. While the knowledge base on the dropping out process has grown considerably, researchers agree that is still incomplete (Hemming, Jin, & Low, 1996; Lee & Burkham, 1992). Newmann (1981) and Finn (1989), for example, were able to argue that dropping out is a gradual disengagement process, however, neither one was able to provide a developed conceptual model for future studies. Hence, other dropout theories at the K-12 level, such as Wehlage, Rutter, Smith, Lesko and Fernandez (1989), based their theoretical framework on student persistence in higher education and previous empirical studies on dropouts.

Dropout Theory at K-12 Level

Based on the earlier work of Tinto (1975), Wehlage and colleagues (1989) reported that the two major concepts of their dropout prevention theory are *school*

membership and *educational engagement.* They described school membership as having a sense of belonging and being accepted as part of a peer group, as well as being supported and approved by school adults. School membership is primarily established through the quality of reciprocal relationships between students and the adults of the institution. The social interactions between students and adults affect the formal and informal aspects of schooling. Being integrated and accepted as part of a school is linked with students' own willingness to engage in classroom and school activities, and to conform to school norms.

Drawing from Tinto's (1975) social integration theory, Wehlage, Rutter, Smith, Lesko and Fernandez (1989) reported four impediments to school membership: *adjustment*, *difficulty*, *incongruence*, and *isolation.* If students are able to overcome the challenges of a new school, then they are more likely to engage socially. Adjustment referred to the required transition from middle school to high school. The new demands of high school require students to adjust to the various standards and expectations of their new setting that may have detrimental effects. Second, difficulty with schoolwork was one cause of academic failure. Students' academic success affected their socially bonding to a school. Students who were struggling academically were susceptible to withdrawing socially. Third was incongruence. Wehlage and colleagues (1989) stated that incongruence is an important dimension in research on students at risk of dropping out of school. Incongruence referred to the lack of fit between the student and institution. If the goals and rewards of schools were inconsistent with the goals of non-academically inclined students, for example, then schools were perceived as meaningless and students may decide to leave before graduation. Last, isolation referred to the lack of meaningful

faculty-student [and student-student] interactions. High quality interactions with adults helped students to feel accepted as a part of the school community.

Wehlage and colleagues (1989) referred to educational engagement as the level of student involvement in the formal work prescribed by teachers and the curriculum. Although engagement occurs on a continuum, it is prerequisite to comprehending and mastering knowledge and skills (Wehlage et al., 1989). Modeled after Tinto's (1975) academic integration theory, positive interactions between the students, teachers, and curriculum, and the congruence between students' value system and those of the school can influence students' psychological investment for learning. The belief is that higher levels of student engagement or integration will positively affect students' decisions to persist through graduation.

Wehlage, Rutter, Smith, Lesko and Fernandez (1989) also identified three impediments to students' educational engagement. The three impediments include: (1) schoolwork is not extrinsically motivating; (2) schoolwork is intrinsically unsatisfying; and (3) the learning process is too narrow. The suggested solution to these impediments is to focus on the educational curriculum and pedagogy. What is taught in school, and how it is taught are equally important to educational engagement. Traditional teaching often over-attends to the curriculum by covering vast amounts of information. Wehlage and colleagues (1989) contended that covering breadth, instead of depth, leads to a superficial understanding that inhibits gaining a sense of competence for learning and undermines the intrinsic interest the subject matter might hold. Thus, one suggestion for schools is to focus on courses that have academic rigor. Courses that are more

academically challenging may be more interesting to students and encouraging for students to do well.

Individual-Level Studies on Dropouts

Research conducted at individual level has consistently found a wide range of student characteristics that are related to dropping out. These student-level variables can be categorized as demographic characteristics, family background, and academic background. In a longitudinal study of high school dropouts, Jimerson, Egeland, Sroufe, and Carlson (2000) followed a cohort of 177 children from age one to age 19 with follow-ups at first grade, third grade, sixth grade, and age 16.

Jimerson and colleagues (2000) found ethnicity and gender are associated with dropping out. Among the group of dropouts, 63 percent were of Caucasian ethnic background, 14 percent were African-American, and 14 percent were of mixed race. In contrast, the proportion of total "traditional" students, individuals who graduated or were making progress towards a diploma, were 68 percent Caucasians, 8 percent African-Americans, and 28 percent were of mixed race. In addition, 28 percent of the dropouts and 52 percent of the traditional students were female. Other predictors of educational status at age 19 were the home environment and quality of caregiving students experienced within their first few years of life. Further analyses explored measures of IQ, problem behaviors, academic achievement, peer competence, and parental involvement. Although all of the variables were associated with students' educational status, the influence of each varied at each follow-up. A key point, however, was that problem behaviors in the sixth grade was one of the strongest predictors of dropping out. The

results are consistent with the belief that dropping out is a developmental process that may begin early in a child's school career.

In another longitudinal study, Alexander, Entwisle, and Kabbani (2001) followed approximately 300 students from a large suburban city from the first grade through high school. The purpose of the study was to understand the factors that place students at risk of dropping out and to identify resources that might lessen the risk. One key objective was to determine critical periods or turning points in the dropout process. The panel of students was examined at four schooling benchmarks: the first grade (year 1), a second elementary grade (year 2-5), a middle school grade (year 6-8), and the first year of high school (year 9).

Alexander and colleagues (2001) found that 14 percent of the panel group dropped out before the end of the tenth grade. In addition, the vast majority of dropouts repeated one or more grades before the ninth grade. Although grade retention had a significant influence at every stage of schooling, repeating a grade during middle school had a more detrimental effect than at the other stages. Alexander and colleagues (2001) hypothesized that the high dropout rates were a result of the stress caused by being behind in grade level and the pressures of transitioning to high school. Furthermore, being retained a grade prior to high school makes individuals "over-aged" by the time they transition to high school. Thus, students who were close to the age of sixteen were more likely exercise their power to leave school legally in most states (Alexander et al., 2001; Lee & Burkam, 2003). Other significant variables included family socioeconomic status, change in family structure, school performance in the first grade, and student behaviors and attitudes during the first year of high school.

Other individual-level studies on dropouts have included student transfers as an intermediate step to dropping out (Lee & Burkam, 1992; Rumberger & Larson, 1998; Rumberger & Thomas, 2000). Rumberger and Larson (1998), for example, examined student mobility between eighth and twelfth grades, the individual-level and school-level factors associated with mobility, and its impact on high school completion. The study followed a nationally representative cohort of eighth graders through high school and two years after high school. The findings further support the idea that prior school experiences do influence students' likelihood to complete high school.

The results of the study showed that students who were less engaged in middle school, both socially and academically, had an increased likelihood of transferring schools or dropping out by the twelfth grade (Rumberger & Larson, 1998). Low social engagement was measured by high absenteeism and misbehaviors, while low academic engagement was measured by low educational achievement. In addition, family characteristics (i.e., low socioeconomic status, single parent, and stepparent families) were also strong predictors of student mobility and dropping out. Several school characteristics, such as urban and non-Catholic private schools, were also examined. Although there were no differences between dropout rates of public and Catholic high schools, students that attended non-Catholic private schools were less likely to dropout out of school that their public school counterparts.

More important, however, was Rumberger and Larson's (1998) finding that school mobility increased the odds of dropping out. Students who made at least one non-promotional school change between eighth and twelfth grades were twice as likely not to complete high school compared with their counterparts who did not change schools. In

addition, less than 60 percent of the students who changed schools two or more times received a high school diploma within six years (two years beyond the normal time for completion). In contrast, more than 86 percent of students who did not change schools graduated within six years. Hence, student who moved schools were more likely to earn a GED or alternative certificate.

In a related study, Lee and Burkam (1992) defined student departure as either transferring schools or dropping out. Lee and Burkam contended that transferring high schools and dropping out were two possible responses of disenfranchised or disengaged students. The study investigated students' (and parents') initial choice of high schools and their subsequent decision to stay or leave that (or any) school. Lee and Burkam followed a cohort group of sophomores through the twelfth grade. The results indicated that for both public and Catholic schools fewer African-Americans dropped out than transferred, and dropouts were older and from larger and nontraditional families than transfers. In addition, dropouts had less positive academic characteristics than transfers. Dropouts were less likely to be on an academic track, more likely to be at-risk, absent more often, scored lower in achievement, and completed less homework. Although there were some slight differences with transfer students, the results on dropouts in contrast to the individuals who remained in school are pertinent to this study.

Tracking a similar group of students, Croninger and Lee (2001) investigated the effects of teacher-based forms of social capital on student persistence in completing high school. Social capital refers to the networks of relationships and patterns of interactions that occur within social organizations that help individuals and groups to function productively. In this individual-level study, social capital was measured by student

perceptions of their relationships with teachers, and teacher reports of informal talks with specific students.

After controlling for gender and academic background, the results of the study showed that teachers were an important source of social capital for all students. Furthermore, Croninger and Lee (2001) reported that student-teacher relationships and student-teacher talks were most beneficial for students who were academically and socially at risk of dropping out of high school. Although the impact of each type of social capital varied across students risk status, supportive relationships and guidance from teachers reduced the probability of dropping out by nearly half (Croninger & Lee, 2001). Other findings on gender, risk, and academic backgrounds further supported previous individual-level studies. However, interestingly, Croninger and Lee reported that students' academic behaviors during high school had a greater influence on high school completion than students' academic behaviors before high school. While the results of this study are useful in understanding why some students drop out and others do not, they also suggest that schools can serve as more supportive institutions to help all students succeed.

Individual-Level Studies on the Transition to High School

The issue of whether dropping out of high school is a disengagement process and the awareness of early grade dropouts has brought increased attention to the transition from middle school to high school. Research indicates that school-to-school transition is a critical time for adolescents. School transitions interrupt the normal patterns of life (Anderson, Jacobs, Schramm, & Splittgerber, 2000). School transitions introduce

students to two general types of school discontinuities: organizational and social (Rice, 1997). The organizational [and physical] changes that students may experience include students leaving a small, secluded, nurturing environment of middle school and entering a larger, less personal and more challenging climate of high school. In addition, social changes include adjusting to a new social structure, and establishing new relations with teachers and a more diverse student population. These school discontinuities could result in rapid changes in students. Some students may find this transition to be exciting and liberating, while others perceive it as confusing and stressful. Poor transitions may result in devastating effects (Schiller, 1999).

Although all students are affected by systemic transitions in some way, little research has shown why the majority students are successful in high school while others are not. Similar to the literature on dropouts, most studies viewed the transition from middle school to high school as an event, rather than a process. Thus, Schiller (1999) claimed that the long-term effects of school transitions on individual student performance are not very clear. However, it is reasonable to hypothesize that an unsuccessful transition could begin or further advance the school disengagement process and may ultimately result in students dropping out. The failure to negotiate successfully the transition to high school could have a dramatic impact on students' subsequent decisions to stay in school. This is one possible explanation for a suggestion that "fewer than 75 percent of students enrolled in ninth grade go on to graduate from high school in four years" (McWhirter, McWhirter, McWhirter and McWhirter, 1998, p.96). Yet, there is little empirical evidence to support this case.

At the individual level, the factors associated with poor transitions parallel those associated with dropping out. Anderson, Jacobs, Schramm, and Splittgerber's (2000) summary of previous empirical studies identified four individual factors closely related with school-to-school transitions. The first was gender. Females tended to be more vulnerable to the negative consequences of school transitions. The disruptions in peer relations, for example, may result in lower self-esteem and difficulties in adjustments. Secondly, prior problem behaviors in school were also associated with unsuccessful transitions. Anderson and colleagues suggested that existing problem behaviors might be further exacerbated by discontinuities of a new school. The third factor was low academic achievement. Students who were not academically prepared for the next school level tended to have the greatest difficulties with school transitions. Students with poor test scores and grade-point averages were at a greater risk of dropping out of high school. Lastly, some combination of socioeconomic status (SES) and race was associated with successful systemic transitions. Because in the United States SES and ethnicity are highly related, Anderson and colleagues considered them as one factor. They suggested that more privileged students were exposed to stronger parental support, which allowed for more successful school transitions.

In a related work, Isakson and Jarvis (1999) followed a group of eighth graders from a public, university-affiliated K-8 laboratory school through the ninth grade. The study was designed to evaluate student adjustments by taking measurements the end of eighth grade and twice during the ninth grade. Isakson and Jarvis found that student grade point averages (GPAs) at the end of their eighth grade year were significantly higher than those during their ninth grade year, suggesting that grades usually suffered during the

initial transition to high school. In addition, attendance rates were higher at the beginning of the ninth grade than eighth grade, but lower at the end of ninth grade than eighth grade, lending credence to the assertion that overall attendance rates decrease during the transitional period. Although there was no support for the expected changes in school membership, autonomy, and parental support, Isakson and Jarvis posited that differences in the elapsed time between measurements and school organization may produce different results. They noted that a longer period of study and a study of the transition from a middle school (rather than K-8 school) might produce different results.

In addition, the growing literature on school transitions suggests that high school is a new environment for adolescents in which their sense of belonging or feeling of school membership may decrease from the time students were in middle school. Consequently, there are some negative effects associated with the transition to high school that could persist or worsen over time. However, researchers have suggested that the focus of the transition to high school, like dropouts, should be to identify ways in which schools can better support students (Alspaugh, 1998a; Isakson & Jarvis, 1999; Rice, 1997; Rice, 2001).

School-Level Perspective on Student Persistence

Although there is a growing recognition of the school role in student persistence (Lee & Burkam, 2003; Rumberger & Thomas, 2000; Wehlage et al., 1989), a clearly defined multilevel theory has not been developed. Hox (1995) explained that despite the statistical advances made in multilevel modeling, multilevel theories are still an underdeveloped area in many areas of social research. Thus, the school-level perspective

on student persistence is grounded in the theoretical literature of organizational research discussed in previous chapter and the literature on school effects research (SER).

School Effects Research

Previous school effects research consisted of studies that focused on the potential impact of school inputs to include school resources (e.g., per pupil expenditures) and student background (e.g., family SES) variables on school outputs such as student achievement. The initial input-output model usually limited outputs to only standardized test scores of students (Teddlie & Reynolds, 2000). However, later studies extended the model to include school process and contextual variables, more sensitive outcome measures, and multilevel modeling. Creemers, Scheerens, and Reynolds (2000) synthesized the school effects literature to develop a multilevel model of schooling effects on various types of outcomes including achievement and dropout rates.

Extending Carroll's (1963) two-level model of student learning, Creemers and colleagues (2000) developed a four-level model to include students, classrooms, schools and contexts (i.e., national agenda). Carroll (1963) defined student learning as a function of a student's aptitude, ability to understand instruction, and perseverance, and a classroom's opportunity to learn and quality of instruction (Creemers, Scheerens, & Reynolds, 2000). More specifically, the degree of learning is calculated by dividing the time spent on a learning task by the time needed by the individual.

Creemers and colleagues (2000), however, argued school and contextual level variables also affect the quality of instruction, the time spent on instruction, and the opportunity to learn at the classroom level. School and national practices and policies

create certain conditions for classroom level factors. For example, a school evaluation policy on the assessment of student achievement may affect the quality of classroom instruction. Similarly, national funding of schools linked to student achievement may further encourage schools to improve the quality of classroom instruction. Thus, Creemers, Scheerens, and Reynolds' model of school effectiveness (listed as *Figure 2.1*) included all four levels: student, classroom, school and context (2000).

Context-level	
Quality of instruction	• National policy on effectiveness of education • National policy on evaluation/testing system • Training and support for effective schools and instruction • Funding for schools based on outcomes
Time	• National guidelines for time schedules of schools • Accountability of school schedules
Opportunities to learn	• National guidelines and rules for curriculum plan

School-level	
Quality of instruction (organizational aspects)	• School policies on coordination and supervision of teachers • School culture to support effectiveness
Quality of instruction (educational aspects)	• Rules and agreements about classroom instruction • Evaluation policy and system to check student achievement
Time	• Provisions on school time schedule • Rules and agreements about use of time • Maintenance of school atmosphere
Opportunities to learn	• Development and availability of school curriculum plan • Consensus about mission of the school • Rules and agreements about how to proceed and follow curriculum plan

Classroom-level	
Quality of instruction	• Curriculum: goals and content, structure and clarity, and use of advanced organizers and evaluation materials • Grouping procedures: mastery learning, ability grouping, and cooperative learning, • Teacher behaviors: classroom management, use of homework, high expectations, goal setting, structuring curriculum content, clarity of presentation, questioning, use of immediate exercise, and evaluation and feedback
Time	• Time allowed for learning by teacher or amount of content covered
Opportunities to learn	• Supply of learning materials • Experiences and exercises offered to students

Student-level	
Background	• Prior experiences may affect students' actual use of offered opportunities
Time (needed)	• Aptitude: task-specific skills • General intelligence: ability to understand instructions
Time (spent)	• Perseverance/motivation: amount of time willing to spend on task

Figure 2.1
A Model on School Effectiveness Research
(Creemers, Scheerens, & Reynolds, 2000)

According Teddlie and Reynolds (2000), SER has consistently refuted earlier claims that "schools do not make a difference" (p.3). Using similar models, researchers identified a number of school-level factors that influence student outcomes (Teddies & Reynolds, 2000). These factors are typically categorized into three areas: (1) student composition, (2) school resources, and (3) school context. Student characteristics, specifically family and cultural background variables such as socioeconomic status, are consistent predictors of student achievement in the United States (Teddlie & Reynolds, 2000). In addition, although they were not as strongly associated with achievement, school resources, such as percent of quality teachers, and school contextual factors, such as school size, school socioeconomic status, and teacher characteristics (e.g., education, and experience) accounted for some of the variance in other student outcomes. However, more recently, advances in statistical techniques have allowed school effects research to include not only the characteristics and structures of schools, but also school processes (e.g., curriculum, opportunities to learn, standards, teacher instruction).

Multilevel Studies on Dropouts

Although the model presented by Creemers and colleagues (2000) lends itself to the study of school effects on student persistence, fewer studies have examined this from a multilevel perspective. It is a reasonable assumption that if schools do nothing in terms of addressing student needs, then the academic achievement and educational attainment of students will not advance beyond status quo. More advanced students would likely make better use of their learning opportunities, the average students would remain "average," and the lower achieving students would barely, or not, make it to graduation

(Aronson, 2001). Although there would be a few exceptions of unforeseen successes or failures, school personnel, who want all students to remain in school and graduate, need to take appropriate measures so that failures are not compounded.

In a qualitative study of fourteen selected high schools, for example, Wehlage, Rutter, Smith, Lesko and Fernandez (1989) aimed to identify and describe school practices that worked to keep students at risk of dropping out of school in school. Wehlage and colleagues found that schools successful at preventing dropouts created a supportive environment that assisted students to overcome the impediments to school membership and educational engagement. These schools were also successful at establishing a professional culture among educators that was committed to educating at-risk students, and providing sufficient autonomy and resources to encourage the development of programs to meet the diverse needs of their students. The schools' approach also capitalized on student interests and strengths. Some of the programs included vocational experiences, pregnant teens, and safe havens for students with serious home or personal problems. The findings suggested that the success of schools could be attributed to their support, concern, and commitment to students.

In another study, by following nationally representative group of eighth graders through the tenth grade, Rumberger (1995) simultaneously accounted for the effects of individual- and school-level factors on dropping out of middle school. Rumberger reported that the findings were consistent with the predictors of dropping out of high school. Both individual background factors and school experiences during the eighth grade affected students' decisions to stay or leave school before the end of tenth grade. At the student-level, non-Asian minority groups had significantly higher odds of dropping

out than other students. Students with low socioeconomic status and students from nontraditional families such as single or stepparent, or non-English speaking families also had increased odds of dropping out. In addition, students who reported little parental academic support, parental involvement and supervision were more likely to dropout. Also, individuals who were previously held back a grade, misbehaved, did not participate in extracurricular activities had increased odds of dropping out.

Although the preliminary findings showed that the strongest predictors of the dropout behaviors exist at the individual-level, the subsequent results supported the view that schools can influence students' decisions to stay in school or not. Based on prior school effectiveness research, Rumberger (1995) included several school-level variables, such as student composition, structural characteristics, school organization and climate. After controlling for individual differences, the final model showed that students who attended middle schools with reportedly fair discipline policy and lower SES had an increased the odds of dropping out. Specifically, the odds of dropping out for students from lower income-level schools were 60 percent more than students whose socioeconomic status was one deviation above the mean. More interestingly, the findings also showed that school processes relating to discipline, grade retention, and student transferal did affect student odds of dropping out of school.

In a subsequent multilevel study, Rumberger and Thomas (2000) focused on schools as potential contributors to the dropping out and attrition process. Using a nationally representative sample of tenth grade students, the focus of the study was to identify the school characteristics and processes that affect student outcomes. In particular, the study examined the influences of various school-level factors on high

school dropout and turnover rates among urban and suburban school. Turnover rates were defined as the percent of students who transferred or dropped out of school entirely.

The study showed that 75 percent of all schools had dropout rate of less than ten percent between the tenth and twelfth grades. However, the two-year dropout rates were extremely high in a small proportion of high schools, suggesting that the dropout problem may be influenced by what goes on in individual high schools. In addition, there was a large variability in the two-year turnover rates among schools, ranging from five percent to sixty percent (mean = 20.4 percent). This suggested that if the holding power of schools is measured by turnover rates, there are differences among schools' ability and/or willingness to educate students.

Although student-level variables were consistent with previous dropout studies, Rumberger and Thomas (2000) also determined that some of the student demographics characteristics had separate effects when aggregated to the school-level. The mean SES and minority variables affect the social composition of the school, which subsequently affected dropout and turnover rates. Schools with larger proportions of students who were previously retained a grade had higher dropout and turnover rates. Students from high SES schools had lower dropout rates than students from average SES schools. Conversely, students of low SES schools had the highest dropout rates. In addition, ethnic composition was the most powerful predictor of turnover rates. Schools with high concentration of minority students, particularly black or Hispanic, had 50 percent higher turnover rates than schools that had a lower concentration.

School mean dropout rates were also explained by a number of structural variables. Rumberger and Thomas (2000) reported that Catholic and other private

schools had both lower dropout rates than public schools. Furthermore, students who left Catholic schools were more likely to transfer schools, whereas their public school counterparts were more likely to drop out. However, after controlling for differences in student composition and other structural factors, the holding power of public schools faired the same as other private schools. In addition, larger schools had lower adjusted dropout rates than smaller schools, and urban schools also had lower rates than suburban schools.

School resources also impacted dropout and turnover rates. Rumberger and Thomas (2000) stated that schools with high percentages of excellent teachers, as reported by students, had lower dropout rates. In contrast, schools with high percentages of excellent teachers, as reported by principals, had higher dropout rates. The conflicting reports suggested that student and principal perceptions of quality teachers were different, and their perceptions had different effects on student outcomes. Also, schools with high student-teacher ratios had high dropout rates and schools with higher teacher salaries had lower dropout rates. These findings further support that the influence of student composition, school structures, and school resources on the dropout process.

In a related study, Lee and Burkam (2003) explored how school structures, and academic and social organizations may influence students' likelihood to remain in high school until graduation or drop out. Using nationally representative samples of high schools and students, the multilevel study followed a group of students from the tenth grade to twelfth grade. The individual-level data included information on students' demographics and academic background, high school mathematics test scores and GPAs, and dropout status at the end of the twelfth grade. The school-level data included

information on school size and sector, curriculum structure, and social relations between students and teachers.

At the individual level, the results of the study were consistent with previous dropout studies. For example, Lee and Burkham (2003) reported that students with low socioeconomic status, who were over-aged, and had low GPAs in mathematics, were more likely to dropout of school. However, after controlling for the individual differences, the school-level results suggest that dropping out is a function of school size. Using medium-sized schools (with 601-1500 students) as the reference group, the smallest schools (fewer than 600 students) had the smallest dropout rates of 7 percent and the large schools (with 1500-2500 students) had the largest dropout rates of 12 percent. Lee and Burkham also stated that school size was closely associated with school sector (i.e., public, Catholic, or independent), and racial and economic composition of their students. Small schools, for example, were typically private schools or schools with high average SES or low proportions of minority groups.

In addition, Lee and Burkam (2003) found that the academic and social organization of high schools affected students' persistence. Schools with a more rigorous academic (mathematics) curriculum had lower dropout rates. More specifically, students attending schools that offer Calculus reduced their odds of dropping out by 56 percent. In addition, schools defined by more positive student-teacher relations had lower dropout rates. However, these effects were contingent upon both school size and sector. For example, students attending small or medium size, public or Catholic, schools had an 86 percent decrease in odds of dropping out with a one standard deviation increase in the average student-teacher relations. In contrast, student-teacher relations do not influence

the dropout rates of independent schools and schools with populations of more than 1500 students. Lee and Burkham hypothesized the effects of student-teacher relations in independent schools may be mitigated by their typical small student populations, low dropout rates, and high average student-teacher relations. Also, larger schools may have difficulties in developing and sustaining positive student-teacher relations due to their anonymous settings.

Building upon these findings, Lee and Burkam (2003) emphasized that although research has shown that the dropping out process is closely associated with individual-level factors, which schools have little control over, schools need to take responsibility for being part of the problem [and solution]. Lee and Burkam stated a need for schools to work on intervention strategies that encourage high school students remain in school.

The empirical research on K-12 dropouts clearly showed that while student-level variables are the strongest predictors of dropping out of high school, schools can influence students' likelihood for success. Because dropping out is, arguably, a disengagement process, schools can organize themselves, through their policies, programs, and practices, in such a way that encourages students to remain in school.

Multilevel Studies on the Transition to High School

Similar to dropout research, recent studies on the transition to high school have included school contextual factors that contribute to student achievement and dropping out. Alspaugh (1998a) conducted a study of 48 school districts to examine the relationship between achievement loss and school-to-school transitions, and school transitions and dropout rates. Each school district was placed into one of three categories

based on its grade-level organizations. The first group consisted of school districts arranged with only one K-8 elementary school transitioning into one 9-12 high school. The second group focused on a linear transition arrangement of one elementary school, one middle school, and one high school. The third group included school districts with a pyramid transition arrangement consisting of multiple elementary schools, feeding into one middle school and one high school. All of the schools included in the study transitioned to high school after the eighth grade. Also, the school districts were typically from small, rural towns. No urban districts were included (Alspaugh, 1998a).

In comparison to students' eighth grade achievement scores, Alspaugh (1998a) found that all school groups experienced a mean achievement loss during the first year of high school. More specifically, the achievement loss was greater in the larger school districts of multiple elementary schools and a single middle school, than the other two school groups with only one feeder elementary school. Furthermore, there was a direct correlation between the grade level size and student achievement. As the number of students per grade increased, the deficit in achievement associated with the transition from middle school to high school also increased.

Alspaugh (1998a) also determined that there was a significant difference between the five-year mean dropout rates for the K-8 school group and the two middle school groups. High school students who transitioned from K-8 elementary schools had an average dropout rate of approximately 3.4 percent, while students who transitioned from middle schools had an average dropout rate of approximately 5.8 percent. The results suggest that schools with only one transition have lower dropout rates.

In a related study, Alspaugh (2000) found a correlation between the school transition grade and the school dropout rates. The results showed that the higher the grade-level of the last transitions to high school, the higher the dropout rate. The dropout rates for the 7-12, 9-12, and 10-12 schools were 4.4 percent, 6.6 percent, and 6.8 percent, respectively. This suggests that the grade-span of the school may influence student outcomes. Furthermore, the study showed that dropout rates peaked at the eleventh grade for all three types of high schools. Alspaugh (1998a) suggested that schools could reduce the number of students per grade by lengthening the school's grade span (through lowering the transition grade). This suggestion complements a previous finding that school size is associated with student learning (Lee and Smith, 1997).

However, Rice (1997) argued that the important point is that all students, regardless of the grade-span of their school, experience some discontinuity across the transition to high school. Although students in K-12 schools, for example, may never physically change institutions or school buildings, they do experience changes in their school environment, such as teacher expectations, instructional practices, and social structures, which may have an impact on their educational achievement.

Rice (1997) examined a longitudinal dataset, following students from seventh to eleventh grade, for the effect of the transition to high school on student progress of mathematics and science education. Rice compared the mathematics and science achievement scores among students who changed schools between the eighth and ninth grade, and ninth and tenth grade, or made no transition. Although there were modest differences in the overall achievement gains for both subject areas, Rice found that the points of inflection (where the graphs changes its pattern) occurred at the ninth grade year

for all transition groups. For both mathematics and science, the growth curve began to decelerate at the ninth grade, and, particularly for mathematics, it continued to decelerate through the tenth grade. Interestingly, this suggested that all students experienced academic difficulties during the ninth grade. However, Rice speculated that the long-term, negative effects in mathematics achievement might be attributed to the transition to high school; whereas, the short-term effects in science achievement may be attributed to curricular changes.

Schiller (1998) examined structural aspects of students' transition from middle school to high school, focusing specifically on the effects of school feeder patterns on students' academic success, particularly as freshmen. Schiller posited that the freshman year of high school is a critical period in which students must both negotiate new physical settings and integrate into new social settings. It is also a time when students assume greater responsibility for their social and academic lives. Schiller further explained that school transitions affect students' educational trajectories through their consistency of students' academic placement. While "institutional inertia" is usually dependent upon schools' tracking philosophies and registration practices, school transitions are critical points in which some students may deviate from the expected academic pattern. Thus, Schiller contended that feeder patterns might influence students' academic progress as well as their social networks depending on the proportion of middle school students attending the same high school.

Yet, regardless of when and how students' transition to high school, Rice (1997) advocated for greater support of students as they move from one level of education to the next. Rice concluded that all students, whether they transition to a new high school or

remained in the same school, experienced academic difficulties during the high school years. Thus, Rice suggested that continuity across the transition might be achieved through meaningful high school preparation and orientation programs. However, limiting formal institutional supports to one single-day orientation program at best does not constitute sufficient support. More articulation between partner middle schools and high schools, increased involvement of school counselors, and more informal support practices are just a few suggestions to helping students adjust to the discontinuities of the transition to high school.

Summary of Findings

Interestingly, the theoretical and empirical research on student persistence, dropouts, transition to high school, and school effects all complement each other. The individual-level factors show that student demographics, family background, and prior school experiences can influence students' decision to remain in school.

In addition, student composition, school structures, and resources that affect students' likelihood of leaving high school or persisting through graduation include socioeconomic status rates, school size, grade span, and curriculum structure. Furthermore, advances in statistical methods have allowed researchers to explore the influence of school processes on the academic and social environments of students. Most importantly, each area of research consistently supported the need for longitudinal, multilevel study for a more comprehensive look at the high school persistence problem.

CHAPTER III: RESEARCH METHODS

Research Design

A single analytic framework can be used to study the relationships associated among multilevel, nested data. Multilevel models allow researchers to simultaneously examine the influence of individual-level and school-level variables on student persistence at the tenth and twelfth grades. Multilevel modeling facilitates the consideration of substantive issues regarding the relationships of students and their school contexts (Heck & Thomas, 2000; Teddlie et al., 2000). By using a multilevel model, each level of the data structure is formally represented by a sub-model that explains the structural relations and residual variability occurring at that level (Raudenbush et al., 2000). Furthermore, multilevel modeling allows researchers to measure variables at their natural level, investigate the effects of the different levels simultaneously, and avoid common disaggregation/aggregation problems.

Recent developments in multilevel modeling have allowed researchers to properly handle hierarchical or nested data. Previously, researchers would have to compensate for the different levels by either disaggregating or aggregating information to a single level, or conduct a comparison study of several single-level analyses. *Disaggregation* refers to analyzing macrolevel variables (e.g., school size) at a lower level. Since the lower-level variables (e.g., gender) do not have any common associations by the higher-level variables, disaggregated data can cause organizational variables to be treated as if they were qualities of individuals (Heck & Thomas, 2000). Another problem is that a single-level analysis assumes that individuals in the same group (e.g., school) do not have any characteristics in common (e.g., a common teacher, a particular set of school processes).

This assumption is usually violated in situations where students are nested in classrooms and schools. Groups comprised of individuals who have similar characteristics will result in the calculation of smaller standard errors. Because hypothesis tests are conducted on the ratio of the parameter to its standard error, underestimating the standard error may cause the researcher to incorrectly interpret the results and falsely reject the null hypothesis (*Type I error*).

In contrast, *aggregation* refers to variables conceptualized at a lower level being analyzed at a higher level. When using a single-level analysis to investigate the between-unit variance, lower-level variables are given a group mean. By doing so, a single-level analysis removes the individual variation within each group and overemphasizes the group differences. Furthermore, the discontinuity between the level of the conceptualization of variables and the level of analysis may result in "a forced choice over the proper unit of analysis, trade-offs in measurement precision, and limitations in the method used to estimate the model's parameters" (Heck & Thomas, 2000, p.90). Thus, smaller, macrolevel samples may result in unreliable estimates, low statistical power and misleading inferences (Heck & Thomas, 2000). By measuring variables at their appropriate level, investigators can avoid an *ecological fallacy*, or false inference about individuals, which results when the individual variability is ignored and observations are based solely on a group- or higher-level analysis.

Research Models

Model One: Early Persistence Phase

Individual level. The first model, exhibited as *Figure 3.1*, examines the effects of the student-level and school-level variables on student persistence, measured by their educational status at the end of their scheduled tenth grade year. The student level illustrates the background information of the eighth grade cohort and its influence on student experiences in the early years of high school. During the base year, background information was collected to describe the students' demographics, family background, and academic background. The ninth and tenth grade student experiences were measured by students' academic and social engagement. Data were derived from the student, dropout, and restricted transcript files. The academic engagement variables included student expectations of graduation, standardized test scores, and student grade point averages (GPA). In contrast, the social engagement variables included absenteeism, misbehaviors, and school participation. Aside from a few additions, these variables parallel those used in Rumberger and Thomas's (2000) study.

School level. The school level includes information describing the student composition, organization of the schools, and school processes. School characteristic variables report the school grade span (e.g., K-12, 7-12, 9-12), the mean SES of students, and the school dropout rate. The second level also includes how schools respond as "communities of support." The study examines the effectiveness of school efforts to help students overcome the impediments to social and academic engagement. The school practices and policies that support academic engagement are categorized into two areas, extrinsic and intrinsic rewards. The extrinsic rewards refer to school initiatives to

publicly recognize student achievement and the intrinsic rewards refer to school initiatives to improve student learning.

The school supports variables describe schools' efforts to address the four impediments to social engagement (i.e., adjustment, difficulty, incongruence, and isolation). The adjustment variables measure school efforts to help students' transition into their new environment. At the 9th-10th grade, the focus is the transition from middle school to high school. In contrast, the focus at 11th-12th grade is the transition to the working world and/or higher education. The school variables that address students' academic difficulties are the special courses and pedagogy offered at schools that help keep students on track. Variables that address the incongruence students may experience show how schools respond to meeting the needs of students. Finally, the last impediment (isolation) is address by measuring the quality of student-teacher interactions.

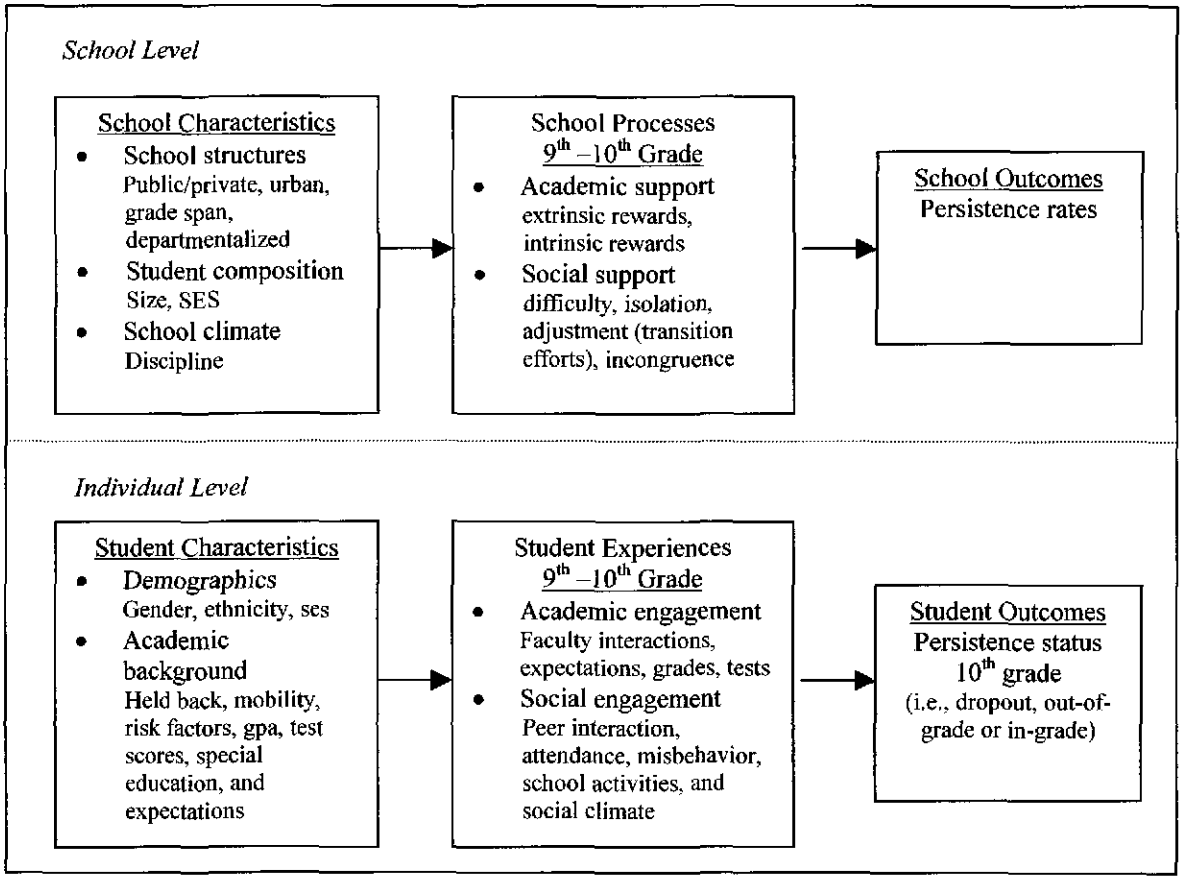


Figure 3.1
Model One: Early Persistence Phase

Model Two: Late Persistence Phase

Individual level. The second multilevel model, exhibited as *Figure 3.2* extends the first model by incorporating student experiences and school supports during the last two years of high school. The full model examines the influences of student experiences and school supports during the tenth and twelfth grades on students' decisions to remain in high school and graduate. The student-level variables in the second model are consistent with those of the first model. The student level shows how student experiences in the early years of high school impact later experiences. However, it also includes information about students' educational stability. Students' educational stability refers to the number of non-promotional school changes and the number of times they moved homes.

School level. The school-level variables in the second level are similar to the first. The school process variables focus on school practices that address students' needs. The transitional supports, however, examine the effects of school efforts to assist students with their post-high school endeavors (e.g., college assistance, vocational training). Student persistence at the school level is measured by persistence rates based on students' educational status at the end of their scheduled twelfth grade year (i.e., dropped out, still in school, or graduated with high school diploma).

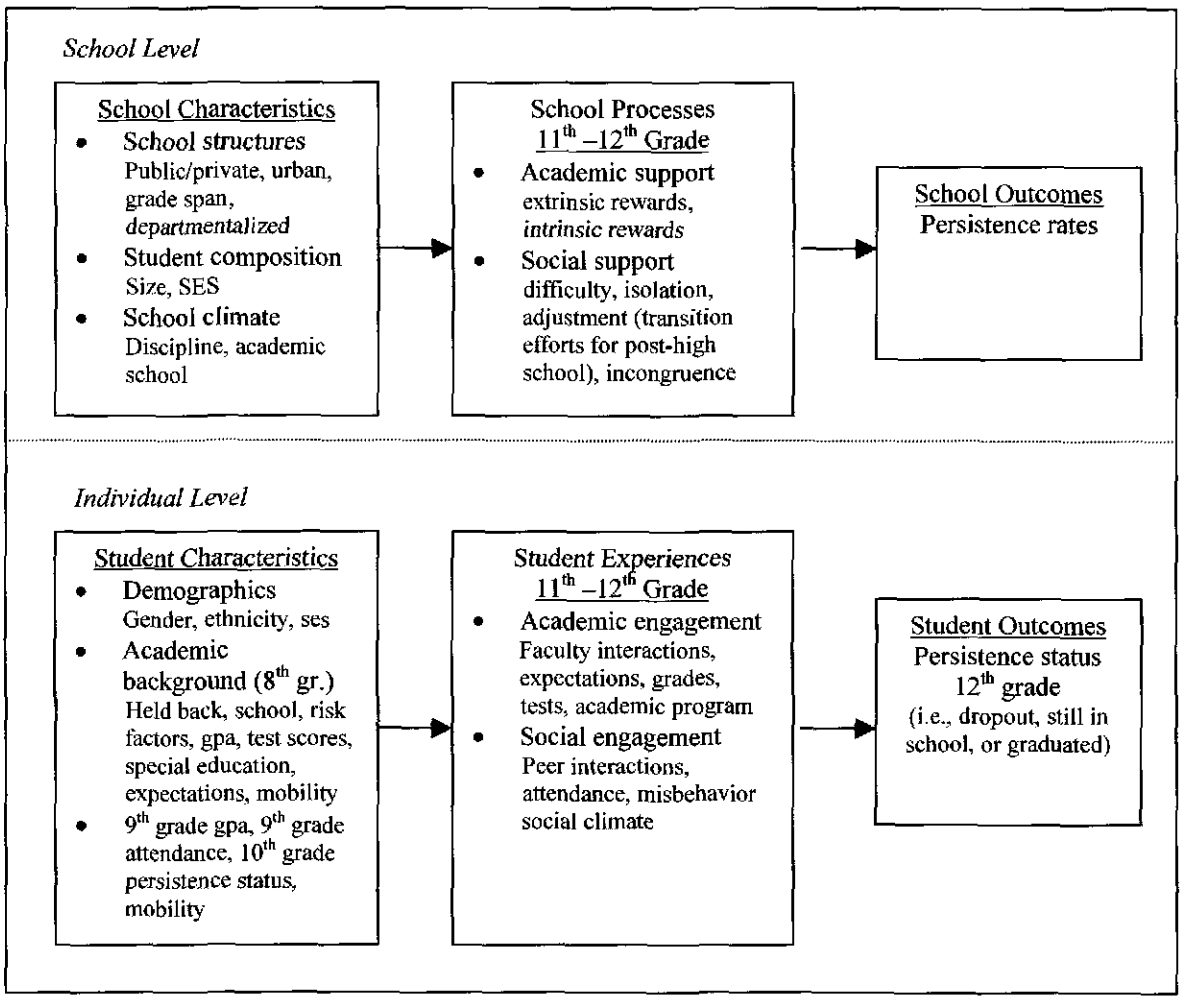


Figure 3.2
Model Two: Late Persistence Phase

Data Source

The data for this study were obtained from the National Education Longitudinal Study of 1988 (NELS:88) conducted by the National Center of Educational Statistics (NCES). One of the key objectives of NELS:88 was to provide longitudinal data about critical transitions experienced by students. This comprehensive study followed a nationally representative sample of eighth graders through their secondary schooling and post high school experiences at two-year intervals. Data collected from students, dropouts, parents, teachers, and schools helped track student achievement, educational status, and transition to school and the work place.[1]

Population

In 1988, NCES selected 1052 schools based on their student composition, size, type, and location to represent the nation's nearly 40,000 eighth grade schools in the NELS:88 study. From each selected school, approximately 25 students were chosen at random to represent the nation's three million eighth graders. Asian and Hispanic students were over-sampled. However, 5.3 percent of the students were deemed ineligible for various reasons, resulting in a total sample of 24,599 students in 815 public and 237 private schools.

Unfortunately, in 1990, the cohort of eighth grade students dispersed to nearly 3800 schools, which made it financially difficult for NCES to follow all of the students. Therefore, NCES was only able to retain about 80 percent of the original cohort, across less than half of the schools. Although the majority of the schools included at least 10 students, NCES "freshened" their sample to compensate for the loss of students. During

the first follow-up survey, a new base-year of tenth grade students were added to the sample. However, no prior eighth grade data were obtained from this new group.

In 1992, the second follow-up tracing of cohort members again determined that students were more widely dispersed than anticipated (Ingels et al., 1994). The remaining eligible sample consisted of approximately 18,000 students among 2300 schools. For financial purposes, NCES retained only 1500 of these schools. All 1030 schools identified by the study as having four or more first follow-up sample members were included in the sample. However, the remaining schools with fewer than four members were retained at random. NCES randomly selected 75 percent (N = 45) of the schools identified as having three first follow-up sample members. Similarly, 65 percent (N = 104) of the schools containing two sample members and approximately 32 percent (N = 321) of the schools with one sample member were also randomly selected. Finally, after the schools were randomly chosen, NCES "freshened" the sample again with a new group of twelfth grade students.

Sample

One of the advantages of using secondary data is that the data were scientifically collected to facilitate a large number of research purposes. On the other hand, because of this, researchers often have to adapt the data to fit their specific purposes. Since the focus of this study included the individual-level and school-level effects on student persistence, several requirements were added to obtain the final sample of students. As a result, not everyone from the original eighth grade cohort could be included.

The first requirement addressed the individual level. The population sample was limited to individuals who participated in the first three waves of NELS:88, 1988, 1990, and 1992. Panel sample members included individuals who completed a base-year student questionnaire, a first follow-up student or dropout questionnaire, and a second follow-up student or dropout questionnaire (Ingels et al., 1994). Consequently, all students of "freshened," ineligible, not applicable, out-of-scope, and unknown statuses were deleted from the sample. A cross tabulation of two NCES generated flags, F1QFLG and F2QFLG, totaled a cohort of 16,489 individuals. The results are exhibited in *Table 1*.

Table 1. Cross Tabulation of Availability of Student and Dropout Surveys

		Second Follow-up Questionnaire Available (1992)		
		Student Survey Completed	*Dropout Survey Completed*	*Total*
First Follow-up Questionnaire Available (1990)	*Student Survey Completed*	14880 (90.2%)	975 (5.9%)	15855
	Dropout Survey Completed	97 (0.6%)	537 (3.3%)	634
	Total	14977	1512	16489

This table shows the available questionnaires completed by the original eighth grade cohort. The results are 14,880 eighth graders completed a student questionnaire in both follow-up years, 97 completed a dropout questionnaire in 1990 and a student questionnaire in 1992, 975 completed a student questionnaire in 1990 and a dropout questionnaire in 1992, and 537 completed a dropout questionnaire in both years.

The second individual-level requirement was the availability of transcript data for the panel sample members at the second follow-up. Since the individual-level outcome

for the second model is extracted from student transcripts, individuals who did not have an available transcript were eliminated from the sample. This further reduced the second model sample to 13,310 students.

The third requirement of the sample addressed the school-level data. Because this study is a multilevel one, the corresponding school-level data for each student were essential. More specifically, not only was it necessary to have school-level data, but it also was imperative to be able to link each student with a specific school. Furthermore, the computer software (HLM5) eliminates schools with only one student (since there is no variability at the group level) or missing information. Therefore, panel sample members without their school identification number for either the first or second follow-ups were eliminated from sample. Therefore, the final sample sizes were 13,177 students in 1018 schools for the first model.

Similarly, the working file for the second model, or late persistence phase, was also reduced to less than 13,000 students. In addition, the final model was further reduced to 12,329 students in 1150 schools because of the elimination of the small sample of students who earned a GED or alternative certificate. The increase in the number of schools between the two follow-ups suggests moderate levels of student mobility existed between ninth and twelfth grades.

The descriptive statistics for the two models (i.e., early and late persistence phases) are summarized in *Table 2* to highlight just a few. These weighted frequency percentages for the scheduled tenth grade students were computed using a relative weight, NELS:88 base year to first follow-up panel weight divided by the mean value of the weight (Thomas & Heck, 2001; NCES, 2001). Similarly, the school-level percentages

were computed using the school contextual weight.[2] A complete list of the descriptives is given in *Appendix D* and *E*.

Table 2: Descriptive Statistics for Model One and Model Two

Characteristics	Model 1	Model 2
School Level		
School structures		
Public high school	84.1%	82.5%
Urban high school	40.5%	35.1%
9-12 or 10-12 high school	95.7%	84.9%
High school organized by departments	94.3%	82.4%
School composition		
Student enrollment less than 1000	46.1%	54.3%
50% + receive free/reduced lunch	8.0%	11.6%
Academic school: offers AP courses	n/a	75.5%
Student Level		
Student characteristics		
Female	50.1%	48.7%
Asian	3.4%	3.9%
African American	12.7%	11.0%
Hispanic	10.1%	9.2%
Native American	1.4%	1.1%
Academic background		
Received special education services in 8th	3.6%	3.3%
Held back prior to ninth grade	16.1%	13.6%
At least one at-risk characteristic	43.6%	40.5%

n/a: Information was not available in the first follow-up survey.

Instrumentation

Student Survey

Student surveys were conducted in 1988, 1990 and 1992. Student questionnaires collected information on basic background variables, schoolwork, student attitudes, future aspirations, and social relationships. In addition, students completed a series of

curriculum-sensitive cognitive tests to measure educational achievement and cognitive growth in reading, mathematics, science and social studies (Ingels et al., 1994).

The first and second follow-up surveys included all continuing students, freshened students, dropouts, and some students who were determined *ineligible* in 1988 because their disability or limited English proficiency. The ineligible students were reassessed during the subsequent follow-ups. Fifty-seven percent of these students were included by the second follow-up. However, no baseline data were available for the freshened or ineligible students.

Dropout Survey

Dropout surveys were given to students who dropped out of school in 1990 and/or 1992. Some of the survey questions mirrored those given to students still in school, but the majority of the questions focused on the influences and reasons for dropping out. Since the primary focus of this study is compare the differences between *persisters* and *dropouts,* all panel members were retained for this study. Only questions listed on both the student and dropout surveys were used for the analysis. Since the individual level data for dropouts were coded separately from their counterparts, students who had dropped out during any of the follow-ups were first coded in a separate database and then merged into the larger student database (to fill in the missing information).

School Survey

School data were also collected at every follow-up interval. In most cases, the school principal or administrator completed the surveys. The primary purpose of the

survey was to gather general descriptive information about the educational setting and environment associated with the individual NELS:88 students (Ingels et.al., 1994). The school data are categorized into five general areas: (1) school characteristics, (2) student characteristics (composition), (3) teaching staff characteristics, (4) school policies and programs, and (5) school governance and climate. The information describing the various high schools was abstracted from the first and second follow-up school administrator surveys. Approximately 100 variables were selected and recoded from the two data sets.

Transcript Files

High schools also provided student transcripts after the second follow-up surveys. Transcripts were collected in the fall of 1992 for all students attending one of the second follow-up contextual schools, all dropouts or dropouts in alternative programs who had attending high school for at least one term, all early graduates, and all sample members who were ineligible for the base year, first follow-up, and second follow-up surveys. These transcripts span students' entire high school career (i.e., ninth or tenth through twelfth grade). The transcript data were collected to provide a framework for the analysis of academic persistence and educational outcomes when merged with student, dropout, and contextual (i.e., school administrator, teacher and parent) data files (Ingels, Dowd, Taylor, Bartot, Frankel, & Pulliam, 1995). The NCES flag variable (F2TRP1FL) showed that 14,283 transcripts were collected from the 16,489 panel members. The NCES:88 transcript component data are only available on the "Restricted Use" data files.

The transcript component data file is organized into two sections. The student data file consists of 68 items abstracted from 17,285 student transcripts. This section

includes numerous flags, a variety of transcript derived and non-transcript composite variables, and the transcript component statistical weight. In contrast, the course data file contains a total of 714,647 course records. One record for each of the secondary school courses taken by 17,285 panel members was created from the transcripts. The raw data included 17 data items, such as the course title, the school year in which the course was taken, the grade received, and the amount of credits earned for each course.

Limitations

NELS:88 is a unique database in that it is arguably the most comprehensive longitudinal study completed in the past few decades. However, because secondary data are not conceptualized, designed, and implemented by the researchers themselves, other users of the data must adjust, and recode information to fit their needs and purposes. One limitation is that the information may focus on some of the relevant issues to a specific topic, but not all. Subsequently, the selection of variables for this study was limited to only variables consistent on both student (i.e., individuals that persisted and remained in school) and dropout surveys. Questions such as, "Did you feel like you belonged in school" could not be used because they were only included on the dropout survey and not the persisting student survey. The inclusion of such variables would lead to biased results.

A second limitation is that, in order to accurately account for the variance at each level, school-level variables were selected from the questions listed in the school surveys. To avoid aggregation problems and provide consistency, the preferred choice was to use only the responses given to the school survey rather than aggregating means of the

individual-level data to the school level. However, the trade-off is that because one individual completed the school survey items, it may reflect some bias in the perceptions of the administrator. In addition, to maximize the school-level data, variables that had missing data were assigned the mean values for each variable. Some statistical software such as HLM5 will delete a school if any of the variables were missing information.

A third limitation is the lack of weights available of the school-level data (Lee & Burkam, 2003) and the inability of the software to handle weights for the student-level data. In the analytic procedure used, this problem is dealt with by using a number of different adjustment techniques (i.e., using grand mean centering to adjust for individual differences, using robust standard errors, and providing a range of significance levels).

Variables in Model

Individual-Level Variables in Model One

The individual-level variables used in this study parallel the work of Rumberger and Larson (1998) on student mobility and dropouts. A few variables were also included from the NELS:88 transcript files.

Demographics and family background. The eighth grade student demographics are measured by a series of dummy variables for gender (*female*), and ethnicity (*Asian*, *black*, *Hispanic*, and *Nativeam* – Native American). In addition, *SES* is a NCES composite variable describing the students' socioeconomic status based on their family income and parent(s) occupation. The original and recoded variable names, and a brief description of each are listed in the *Appendix A*.

Academic background. The second set of control variables describes the academic history of each student. A second composite variable, *atrisk*, developed by NCES was also selected to determine students' risk level of dropping out of school. Although this variable may arguably be defined as an academic background variable, the interval variable (between zero and six) describes the family's educational history. *Atrisk* indicates students of low parental education, low family income, single-parent families, unsupervised home hours, low English proficiency, and/or have siblings who have dropped out of school. A high number represents a high level of risk. The variable also represents a type of student social capital. In addition, two variables are used to describe whether a student was retained a grade prior to eighth grade (*heldback*) and whether their expectation for completing high school was low (*lowexp8*). Dummy-coded variable, *sped*, was also included to indicate whether or not a student was receiving special needs services. Furthermore, since previous dropout studies have found a relationship between the non-promotional school changes and high school completion, a student mobility variable, *changed*, is also included. *Changed* is a continuous variable accounting for the number of times a student changed schools prior to eighth grade.

Eighth grade standardized English and mathematics test scores (*tests8*) and self-reported grades (*gpa8th*) are also included to describe students' prior academic achievement. The results of the eighth grade reading and mathematics tests are given as standardized test scores calculated by NCES. Student GPAs were also computed by averaging student grades for their four core subject areas (i.e. reading, mathematics, social studies, and science).

Student experiences. The student experience variables describe students' perceptions of their integration into the academic and social environments measured by their peer and teacher interactions and their involvement with school activities. Several measures are used to show students' level of engagement, academically and socially.

Academic engagement. The first section describes students' academic engagement as influenced through their interactions with their teachers and their personal commitments to achieve. *Facult10* is a factor score describing the student-teacher relationships and quality of interaction. A higher score represents a more positive relationship. *Lowexp10* is a dummy-coded variable for students who expect, at most, to persist through high school. The remaining variables, *tests10* and *year1gpa*, measure students' academic engagement through their standardized test scores and their ninth grade GPA, respectively. The student GPAs were computed by extracting course data variables from the restricted files. The calculations are described in the *Appendix C*.

Social engagement. The second section describes students' social engagement. Rumberger and Larson (1998) found that student absenteeism, misbehaviors and participation in school activities influence students' educational outcome. *Absent9* was selected and recoded from the student transcript files. However, the original variables, which totaled the number of absences per school year, were recoded into dummy variables, *hiabs9*, for students with 18 or more absences (approximately 10 percent) for their scheduled ninth grade school year. In addition, a factor score was created to describe student behaviors in school (*misbeh10*) and a dummy variable (*no10act*) to describe participation in extracurricular activities. The latter variable does not describe students' community involvement, however.

Other social engagement variables describe individuals' perceptions of the social climate and their peer interactions. *Sclim10* is a factor score created by students' perception of the school spirit and general friendliness of other students. *Noputdow* is a proxy variable for positive peer relations. *Noputdow* is a dummy variable indicating whether students' feel put down by others or not (1 = does not feel put down by others). The last two dummy variables, *safe10* and *fair10*, describe student perceptions of the school environment. A value of 1 for *safe10* indicates students feel safe in school and a value of 1 for *fair10* indicates students feel discipline is fair.

Student outcomes. The student outcomes at tenth grade, *persist1*, refer to students' educational status at the end of 1990. Students were categorized as (1) dropout, (2) in school, out-of-grade (i.e., primarily behind of grade level), or (3) in school, in-grade (tenth grade). Since the focus of the study is student persistence, the NELS:88 variable F1UNIV2C was selected as the outcome variable, *persist1*, rather the commonly used enrollment status variable (F2F1DOST). The reason for the selection is that the first variable better described the students who remained in school (e.g., in-grade or out-of-grade), while the latter better described the students who left school (e.g., stopouts – students who dropped out and returned, or dropouts).

School-Level Variables in Model One

Student composition. In student achievement and dropout research, SES and non-Asian minority groups are closely correlated (Anderson et al., 2000; Rumberger & Thomas, 2000). To avoid multicollinearity, only one measure was selected as a school control variable. *P90_lunch* is a dummy coded variable used to describe the school's

SES. Schools having more than 50 percent of the students on free or reduced lunch were assigned the value of 1. In similar studies using NELS:88, researchers have often aggregated the SES from the individual level by using the student mean value (Lee & Burkam, 1992; Rumberger & Thomas, 2000). However, modeled after Alspaugh (2000), *p90_lunch* is the preferred choice, as it was extracted from the school-level surveys. The other student composition variable, *smsch90,* was created using the school enrollment variable for 1989-90. A dummy code of 1 indicates a high school that has an enrollment of less than 1000 (and 0 = enrollment is greater than or equal to 1000 students). This variable was constructed based on Cotton's (1996) claims that approximately 1000 students is arguably the ideal enrollment size for secondary schools.

School structures. The school classification and location variables were recoded into dummy variables, *public* and *urban*. Previous studies have found that a larger percentage of students transfer from Catholic schools, but a larger percent of students drop out from public schools (Lee & Burkam, 1992; Rumberger & Larson, 1998). In addition, *trans90* is a dummy coded variable indicating a school transition. A code of zero represents K-12 or 7-12 schools, in which students do not have to transition from a middle school to a different high school. A code of 1 represents 9-12 or 10-12 high schools, where students do have to change schools. Lastly, *dept90* represents the formal organization of the school faculty (1 = faculty organized by departments, 0 = not organized by departments).

School climate. The study posits that the working environment of teachers do influences student-teacher relationships. The school climate is measured by four variables describing the working climate of the teachers and students. *Teachq90* is a continuous

variable describing the percent of good or excellent teachers according to school administrators. *Facstab* is a dummy-coded variable indicating whether or not an administrative effort is made to retain a stable staff and reduce teacher transfers. *Att_90* and *Safe_90* are factor scores describing the student environment. A high score for *Att_90* indicates that absences, tardies, and class cutting are problems at the high school. Likewise, a high score for *Safe_90* suggests multiple discipline problems, such as physical conflicts, gangs, robbery/theft, and weapons exist at the school.

Academic support. Initiatives to support student persistence have been measured at students' tenth grade year. The academic support variables focus on the reward structures of the schools. The only extrinsic reward that was measured at the school level, was *honorach.* This dummy-coded variable indicated whether a school publicly recognized students' academic achievement or not. In contrast, *Intrins90* is a proxy variable used to measure school efforts to intrinsically motivate students. *Intrins90* is a factor score created by three variables describing students' priority on learning, student morale, and student motivation. A high factor score represents a school that intrinsically motivates students to do well.

Social support. The social support variables address school efforts to meet the individual needs of students. These variables describe the support structure of the school. The composite variable, *strat90*, indicates the number of different strategies and courses schools offer to help students succeed within the classroom. These include interdisciplinary teaching, cooperative learning strategies, addressing adolescence problems, alternative and dropout programs, staff development activities, and monitoring of student progress.

In most states, students are required by law to attend school to at least the age of 16 (Alexander et al., 2001; Lee & Burkam, 2003). Despite the incongruence that may exist between individuals' desire to attend school and their mandatory attendance, three variables were created to measure how schools respond to the "fit" between students and schools. *Attendp* indicates whether or not the school has an attendance policy. *Expect90* is a factor score indicating the level in which classroom activities are highly structured, student achievement is emphasized, students are expected to do homework, and academic classes are encouraged. High expectations for students will hopefully result in high student achievement.

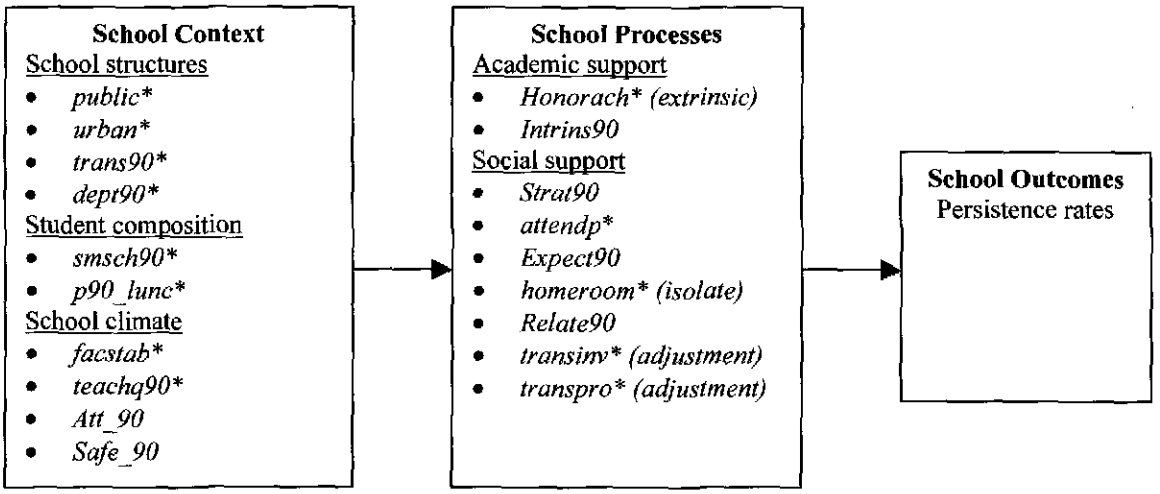
The variables describing the type of interactions student have with school adults are *homeroom* and *Relate90. Homeroom* is a dummy coded variable indicating whether the school has implemented a homeroom or advisory period for students. Homeroom is considered a distinct effort to support the development of positive student-teacher interactions. In addition, *Relate90* captures the attitude of teachers. *Relate90* is a factor score measuring high teacher morale and positive teacher attitudes about students. The belief is that positive teacher attitudes will lead to positive student-teacher relations.

A series of dummy coded variables are used to evaluate whether or not schools have a particular program or practice to help students' transition to high school. The programs and practices examined during the ninth and tenth grade years were transition, buddy, remedial, peer tutoring, dropout prevention, and counseling programs, and articulation meetings with students' previous middle school. Composite variables, *trans8act* and *transact*, were constructed to describe the number of school initiatives that occurred during students' eighth grade year and those that occurred during their first year

of high school, respectively. However, these variables where later dummy-coded to *transinv* and *transpro*, respectively. A value of 1 indicated a moderate to high level of support in the high schools' involvement with the feeder middle schools and the transition programs offered after the students moved schools. Moderate to high level of support was categorized based on the mean value for composite variables *trans8act* and *transact*.

School outcomes. Using HLM, the school-level outcome variables can be simply referred to student persistence rates. However, technically speaking, the level-2 outcome variable is the grand mean of the level-1 outcomes. That is, the school outcome is the average outcome of the population (Raudenbush & Byrk, 2002). Although this outcome is not a direct output of the analysis, multilevel modeling allows researchers to estimate the variability of student outcomes across the different schools.

School Level



Individual Level

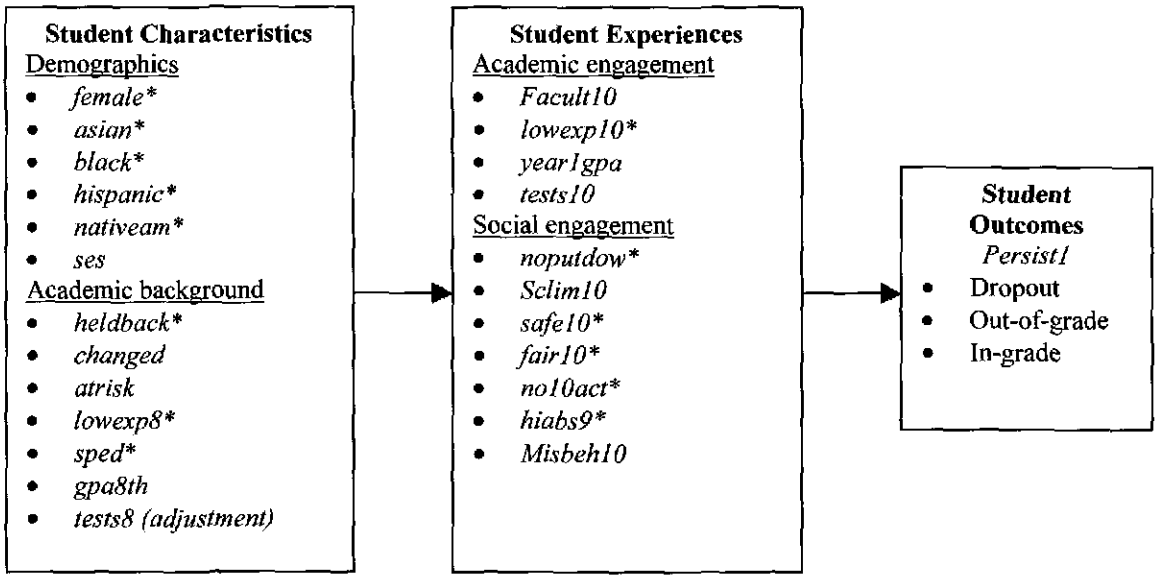


Figure 3.3
Variables in Model One: Early Persistence Phase

Individual-Level Variables in Model Two

Student demographics. The student characteristic variables remained the same as model one. Variables describing students' gender, ethnic background, and family socioeconomic status are included. A detailed description is listed in *Appendix B.*

Academic background. In addition, student experience variables that were significant in the first model were also retained to supplement the academic background variables. Two new student mobility variables were introduced: *changed1* and *changed2. Changed1* and *changed2* are dummy variables indicate whether a student changed schools once and/or twice or more times since the eighth grade (not including regular school promotions).

Academic engagement. Students who are near meeting the requirements for graduation are likely more motivated to persist and complete high school. Thus, model two, the persistence phase, includes variables that parallel those of the first follow-up year. In addition, students' academic program (*acadprgm*), and *Acadprgm*, a transcript variable, was dummy coded to describe whether or not the student's transcript reflected an academic program. For example, Wehlage, Rutter, Smith, Lesko and Fernandez (1989) suggested that a strong curriculum does affect students' educational engagement. Lee and Burkam (2003) found having AP courses influenced students' likelihood of staying in school.

Social engagement. All of the social engagement variables in the first model that were available on the second follow-up surveys for both students and dropouts were retained for the second model. Unfortunately, information on peer relations and

participation in school activities were not available on the dropout questionnaire, and therefore, were not included.

Student outcomes. Although dropouts have been typically looked at as a dichotomous outcome, Rumberger and Larson (1998) analyzed students' high school completion status using four categories: (1) dropped out of school, (2), currently enrolled in school, (3) completed high school by earning alternative certificate, such as a graduate equivalency degree (GED), and (4) completed high school by diploma. However, only the first, second, and fourth categories were retained for this study to determine the twelfth grade educational status at the end of 1992, referred to as *persist2*. The third category, GED or alternative certificates, was eliminated due to the small number of individuals that were in this category (i.e., 13 individuals).

The student outcome variable, *persist2,* was recoded from the NELS:88 variable F2TROUT, a transcript-indicated outcome. F2RTROUT, available only on the "Restricted Use" data files, was selected as the outcome variable for the second model over the commonly used outcome variable F2DOSTAT because it is the most accurate school-reported method of reporting student status (Ingels et al., 1995). Recoding twelve categories into three categories created *persist2*. The three categories were (1) dropped out (or aged out or left for health reasons), (2) still enrolled in school, and (3) graduated with high school diploma. The students categorized as "transferred" or "other" were treated as missing data due to the uncertainty of whether they were enrolled in school or not. The few students who died before the study was completed were also treated as missing data.

School-Level Variables for Model Two

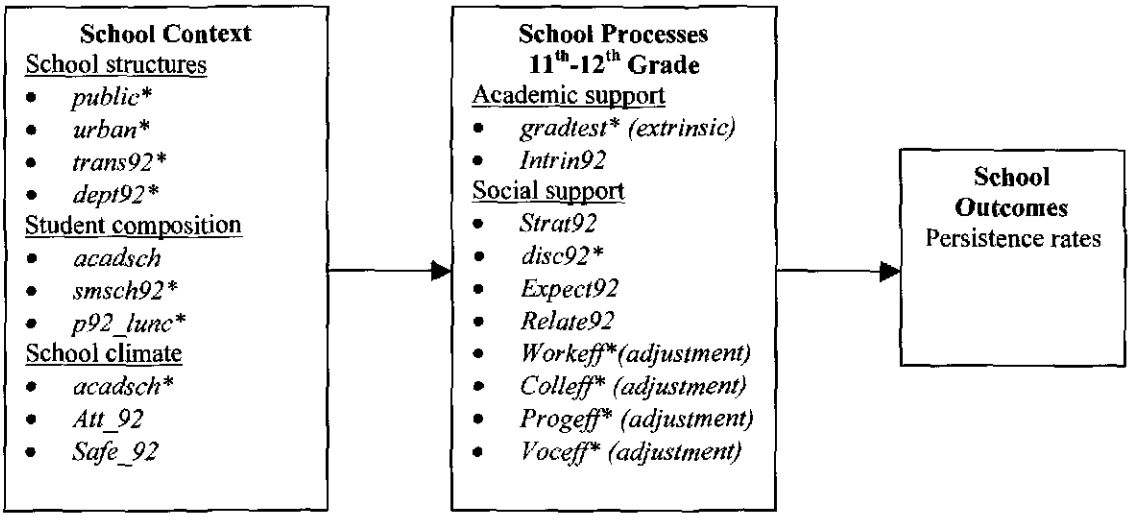
School context. Similar to the first model, the school context variables describe the high schools that the students attended in 1992. Efforts were made to retain similar measurements to the first model. However, a few variables such as efforts to retain a stable staff (*facstab*) and the percent of quality teachers (*teacherq*) were taken out due to their unavailability.

Academic supports. Many of the twelfth grade school process variables in model two parallel those in model one. For the academic support variables, *Intrin92* measured the same type of responses regarding student motivation as *Intrin90*. However, the extrinsic reward variable was changed. For the second model, *gradtest* is a dummy coded variable indicating that an exit test was required for a high school diploma.

Social supports. The social support variables were slightly different from the first model, as different types of questions were asked during the second follow-up survey. For example, the focus on the adjustment segment of the social supports shifted to the transition *from* high school rather than the transition *to* high school. The attention shifted to supporting students through graduation, assisting them for future employment, and focusing on higher education. *Progeff, workeff, colleff,* and *voceff* are dummy variables describing the schools' efforts in addressing student needs. Similar to the transition variables in model 1, a composite variable was first created for each category, and then recoded into dummy variable based on whether or not the school exceeded the average mean value. *Progeff* describes school efforts based on general programs offered (i.e., truancy/dropout and motivational programs, and adult mentorship and scholarship programs) to help students succeed. However, *voceff* is more specifically designed to

address vocational education programs offered at school. *Workeff* and *colleff* are two adjustment variables designed to describe school efforts to help students' transition to the work force or higher education, respectively. The other remaining variables, *Strat92*, *Expect92*, *Relate92*, and *disc92*, were consistent with the previous model. It should be noted that *disc90*, which indicated whether or not discipline was emphasized at the school during the first follow-up, was not included in the model due to multicollinearity. However, *disc92* was retained for the second model.

School Level



Individual Level

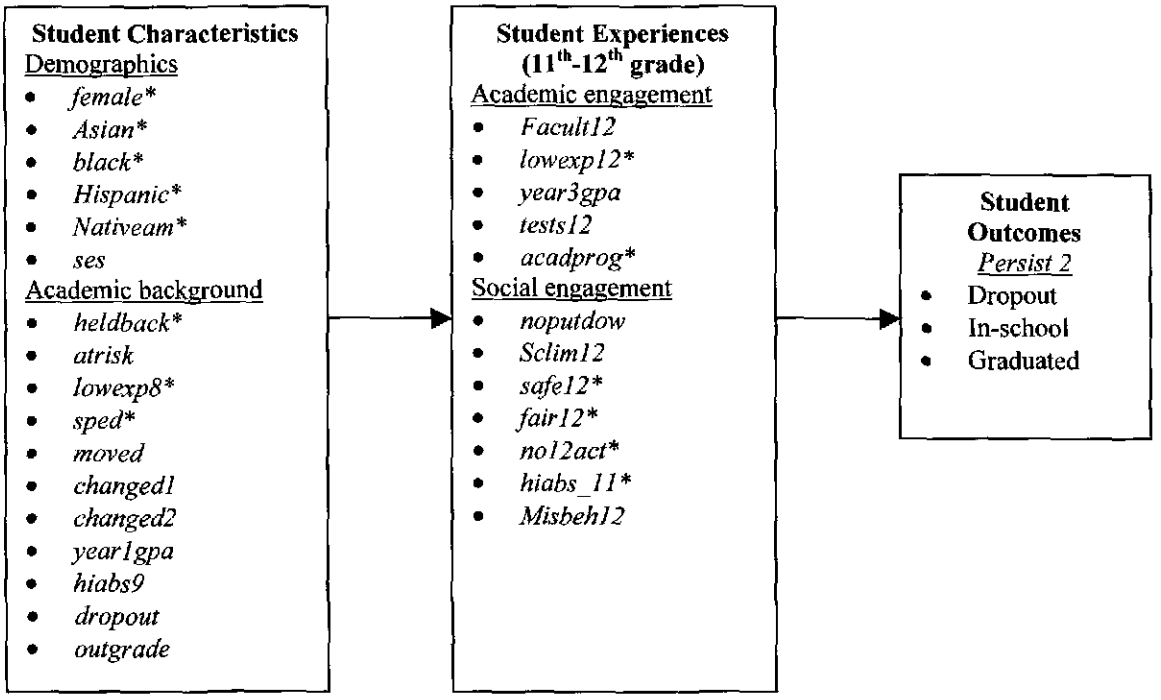


Figure 3.4
Variables in Model Two: Late Persistence Phase

Data Analysis

Hierarchical Linear Modeling

The goal of multilevel modeling is to develop an explanatory model that represents the best estimate of the outcome based on the selected, theoretically relevant variables included in the model (Heck, 2000). In a single-level model, the coefficients of the individual-level variables represent their influence on the likelihood that an event will occur. However, a two-level model extends the logic to include school-level variables and allows the researcher to examine the influence of the level-two factors and explain the variation in intercepts and slopes across the level-two units (Raudenbush et al., 2000). In particular, the model will investigate the differences in student outcomes between schools after adjusting for student differences within schools (Phillips & Adcock, 1997). To do so, all of the coefficients in level one are given the average effect, or "adjusted mean," for a particular variable across the set of schools in the sample. The variation in school means can be explained by the second level that simultaneously includes a set of school predictors that may explain the differences in variation in the level-1 coefficients. Both the levels of the mean effects and the strength of the effects may be investigated.

With respect to the nested data structures, a multilevel analysis also produces better estimates of the model's parameters (Heck & Thomas, 2000). Multilevel modeling uses maximum likelihood (ML) estimates which provide better calibrated, estimates of random parameters and, therefore, provide more accurate insights to organizational processes. ML, which is based on the covariance matrix, also acknowledges the individual and group relationships presented in the sampling scheme (Heck & Thomas, 2000). Thus, ML provides a better account of the error term at each model level and,

therefore, the effects of variables not included in model.[3] It should also be noted that robust standard errors are reported. This provides an adjustment upward for the likelihood of underestimating the standard errors and a more conservative estimate of a variables impact.

Multinomial Models

Early multilevel or hierarchical linear models (HLM) were restricted to continuous outcomes, such as test scores, but recent advances have extended multilevel modeling to include discrete outcomes (i.e., dichotomous, count, ordinal, and categorical outcomes). HLM is now viewed as a special case of hierarchical generalized linear models (HGLM) that incorporates nonlinear structural models and non-normally distributed errors (Raudenbush & Bryk, 2002). HGLM is a regression model in which the expected outcome is transformed and equated to a linear function of regression coefficients (Raudenbush & Bryk, 2002). The level-one model in HGLM consists of three parts: a sampling model, a link function, and a structural model from which the level-two model extends.

In a regression model with multinomial outcomes, or multi-categorical outcomes that are not clearly ordered, the level-1 random effect is restricted to a discrete set of values (e.g., 0 and 1) and therefore cannot be normally distributed. As Raudenbush, Bryk, Cheong, and Condon (2000) explain, restrictions on the outcome, such as (1) dropped out, (2) out-of-grade (behind or ahead), or (3) in-grade (tenth grade), do not allow for the predicted value to legitimately take on any real value. Thus, logarithm or *logit* transformations are often used to help interpret the results.

In order to determine the log-odds of an event or response occurring, the probability of each is first computed. Raudenbush and Bryk (2002) report that for M possible categories of the outcome, the response, R, takes on the value of m with probability Prob($R = m$) = φ_{ij} for $m = 1,\ldots, M$. Using model one as an example, $M = 3$ and

$$\text{Prob}\left(R_{ij} = 1\right) = \phi_{1ij}, \tag{1}$$

$$\text{Prob}\left(R_{ij} = 2\right) = \phi_{2ij}, \text{ and} \tag{2}$$

$$\text{Prob}\left(R_{ij} = 3\right) = \phi_{3ij} = 1 - \phi_{1ij} - \phi_{2ij}, \tag{3}$$

where I = individual/student and j = unit/school.

Level-1 sampling model. According Raudenbush and Bryk (2002), for multinomial distributions, dummy variables $Y_{mij} = 1$, if $R_{ij} = m$, and $Y_{m'ij} = 0$, if otherwise, are constructed. Then, the expected value and variance of Y_{mij}, given φ_{mij}, are

$$\text{E}\left(Y_{mij} \middle| \varphi_{mij}\right) = \varphi_{mij}, \tag{4}$$

$$\text{Var}\left(Y_{mij} \middle| \varphi_{mij}\right) = \varphi_{mij}\left(1 - \varphi_{mij}\right), \text{ and} \tag{5}$$

the covariance between outcomes Y_{mij} and $Y_{m'ij}$ is

$$\text{Cov}\left(Y_{mij}, Y_{m'ij} \middle| \varphi_{mij}, \varphi_{m'ij}\right) = -\varphi_{mij}\varphi_{m'ij}. \tag{6}$$

Level-1 link function. At level-1, the probabilities are transformed using a link function. For dichotomous outcomes, the log-odds or *logit* is calculated by taking the natural logarithm (i.e., ln = $\log_e$) of the odds-ratio (i.e., the probability of an event of occurring compared to the probability of an event not occurring). In contrast, for multinomial data, the log-odds are calculated by taking the natural logarithm of the

probability of falling into one category (e.g., being in-grade) compared to the probability of falling into the "reference category" (e.g., dropping out) (Raudenbush et. al., 2000). The log-odds coefficient describes the likelihood of being in one category relative to a reference category using the set of real numbers (versus intervals). The specific equation to calculate the log-odds of falling into category m relative to category M is as follows:

$$\eta_{mij} = \ln\left(\frac{\phi_{mij}}{\varphi_{Mij}}\right). \tag{7}$$

The multinomial logit link functions for 3 categories are

$$\eta_{ij(1)} = \ln\left(\frac{\varphi_{ij(1)}}{\varphi_{ij(3)}}\right), \text{ and} \tag{8}$$

$$\eta_{ij(2)} = \ln\left(\frac{\varphi_{ij(2)}}{\varphi_{ij(3)}}\right). \tag{9}$$

To help understand the results, let (1) be dropped out and category (3) be in-grade. If the probability of each category is the same, then the logit is zero. However, when the probability of dropping out is greater than the probability of being in-grade, the logit is positive. In contrast, when the probability of dropping out is less than the probability of being in-grade during the scheduled tenth grade year, the logit is negative.

Level-1 structural model. For level-1 models, the number of structural equations used to analyze the data is one less than the number of categories. For example, when $M = 3$, there will be two level-1 structural equations. These models assume "proportional odds," that is, the relative odds that $R_{ij} \leq m$ associated with a unit increase in the predictor do not depend on m (Raudenbush, et. al., 2000). By substituting

$\phi_{Mij} = 1 - \sum_{m=1}^{M-1} \phi_{mij}$ into the level-1 link function, the level-1 structural equation is obtained. More specifically, however, the structural equations for three categories are

$$\eta_{1ij} = \beta_{0j(1)} + \sum_{q=1}^{Q_1} \beta_{qj(1)} X_{qij}, \text{ and} \tag{10}$$

$$\eta_{2ij} = \beta_{oj(2)} + \sum_{q=1}^{Q_2} \beta_{qu(2)} X_{qij} \,. \tag{11}$$

Level-2 model. The level-2 structural model builds off of the level-1 model. The level-2 model uses the intercept of the level-1 model to explain the unaccounted for differences between groups. Hence, the level-2 structural model parallels that of the level-1 model.

$$\beta_{qj(m)} = \gamma_{q0(m)} + \sum_{s=1}^{S_q} \gamma_{qs(m)} W_{sj} + u_{qj(m)}, \text{ for } q = 0,\ldots,Q_m \,. \tag{12}$$

Similar to the level-1 structural model, two sets of level-2 equations are required for M = 3 categories:

$$\beta_{0j(1)} = \gamma_{0j(1)} + \sum_{s=1}^{S_q} \gamma_{0s(1)} W_{sj} + u_{0j(1)} \text{ and} \tag{13}$$

$$\beta_{1j(1)} = \gamma_{10(1)}, \text{ and} \tag{14}$$

$$\beta_{0j2} = \gamma_{0j(2)} + \sum_{s=1}^{S_q} \gamma_{0s(2)} W_{sj} + u_{0j(2)} \text{ and} \tag{15}$$

$$\beta_{1j(2)} = \gamma_{10(2)} \,. \tag{16}$$

The outcome variable, $\beta_{qj(m)}$, at level-2 is just the population mean intercept for each of the other two categories.

Unconditional model. The first step in the analysis is to estimate an unconditional model for level-2. By allowing the level-2, school-specific, intercepts to vary randomly over schools, researchers are better able to gauge the extent of variation that exists in the outcomes. The estimates show the plausible likelihood of being in one category, such as dropping out, for example, in comparison to the reference category, such as in-grade. Large variations in log event rates may suggest similar variations between schools (Raudenbush & Bryk, 2002). Furthermore, by estimating an unconditional model as a preliminary step before adding the level-two variables, researchers may be provided insights as to how to treat subsequent variables as fixed or random effects. However, the unconditional model will only serve as a baseline for comparison of the variables in the conditional model. Only the final model will be reported in the subsequent chapter.

Conditional model. The conditional model shows the effects of various level-two variables. After adjusting for several level-1 variables, the results will show the relationship between certain level-2 variables, such as school sector (e.g., public), and the change in log-odds of dropping out relative to being in-grade. The reported coefficients, or log-odds, will indicate a positive, negative, or neutral (zero) relationship of being in one category in relation to the reference category for one unit increase for each variable. A positive value for female, for example, indicates that females are more likely to be in one category (e.g., dropout) than the reference category (e.g., being in-grade). A negative value indicates that an individual is less likely to be in the specified category than the reference category and zero means there is no change in log-odds. The number of times more (or less) likely one event will occur relative to the other, is approximately the absolute value of its log-odds coefficient.

CHAPTER IV: RESULTS

The results of the study are presented in this chapter by models. The first theoretical model addresses early persistence (grades 9 and 10). It compares students who have dropped out of school and students who are out of grade during their scheduled tenth grade year (i.e., behind or ahead of grade) against the reference category (i.e., students who are in grade and making normal progress). Similarly, the second model addresses later persistence (grades 11 and 12) by comparing students who have dropped out and students who are still in school (i.e., behind normal progress) against the reference category of graduating on schedule.

As previously suggested, the organizational structure of schools is multilevel in nature. First, students come to school with a range of backgrounds and experiences. Students have unique educational histories including abilities, experiences, and previous academic success. Students are also grouped together in classes pursuing various academic programs within the school they attend.

Second, school-level variables (i.e., contexts, processes) affect groups of students that attend each school. Students belong to schools that have certain practices and policies that create various classroom conditions. Students, for example, interact with teachers whose backgrounds, experiences, and teaching abilities differ. It is likely that contextual and processes variables may account for differences in persistence rates and numbers of students who fall behind among schools in the study.

For each model, the individual-level variables that explain student persistence are examined first for dropping out versus persisting (i.e., being on schedule), and then being behind grade versus persisting. Variables in the individual models were grand mean

centered. This has the effect of adjusting school estimates for differences among students. This is one means of dealing with the issue of student-level weights (S. L. Thomas, personal communications, 2002). Then, the school-level variables are examined to determine their possible impact in explaining differences across schools.

Results for Model One: Early Persistence Phase

The log-odds coefficient, standard error, and expected odds ratio for each model are reported[4]. The mathematical equations used to calculate these numbers are listed in *Appendix F*. Since the log-odds metrics (β) are not easily interpretable, each coefficient is converted into an odds ratio. Expected odds ratios are calculated by raising *e* to the power of the log-odds coefficient (i.e., $\exp\{\beta\}$) (Lee & Burkam, 2003; Raudenbush & Bryk, 2002; Rumberger & Thomas, 2000). Thus, positive log-odds values result in odd ratios greater than one; negative values result in odd ratios less than 1; and zeros are equal to an odds ratio of 1.

To interpret the odds ratio, the result for students with low expectations of graduating is used as an example. Students with low graduation expectations at eighth grade have a log-odds coefficient of 0.688. This coefficient is converted to an odds ratio of 2 or 2:1 (i.e., $2.71^{0.688}$). This may be interpreted as with an increase of one unit for low expectations, the expected odds of a student dropping out is twice the odds of a student being in-grade during his/her scheduled tenth grade year (Raudenbush & Bryk, 2002, Rumberger & Thomas, 2000). The reciprocal relationship is that with a 1 unit increase for low expectations, an individual is half (or 1:2) as likely to be in-grade than to drop out.

An addition to the tables is change in odds ratios for a one standard deviation increase for each variable. The change in odds ratios for continuous variables is calculated by first computing the change in log-odds by multiplying the log-odds coefficient (β) by the standard deviation (sd) associated with that variable, and then raising *e* to the power of the change in log-odds (i.e., $\exp\{\beta * sd\}$) (Raudenbush & Bryk, 2002). These standardized values allow the odds ratios to be compared with the other variables. However, the change in odds ratios for dichotomous variables and factor scores (with standard deviations equal to 1) remain the same.

Individual-Level Results for Model One

Student demographics and family background. The results of the first model showed that gender and ethnicity had no significant effect on dropping out versus being in-grade (persisting) during the scheduled tenth grade year. More specifically, *female*, *Asian*, African-American (*black*), *Hispanic*, and Indian or Alaskan Native (*Nativeam*), all had significance levels (or p-values) greater than 0.05. Family socioeconomic status (*SES*) also had no significant effect.

In contrast, the second category, which included students who were in school but out-of-grade, individuals of African-American (*black*) or Native American (*Nativeam*) ethnic backgrounds were 1.5 and 2 times as likely to be out-of-grade than in-grade during their scheduled tenth grade year, respectively. Furthermore, students from higher socioeconomic status families were less likely (or more specifically, 0.81 times as likely) to be out-of-grade and, therefore, more likely to be in-grade and on-track for graduation.

The remaining variables, such as *female*, *Asian*, and *Hispanic*, were not significant at the 0.05 level.

Academic background. For the first category, dropouts versus in-grade, all of the variables were significant at the 0.01 level. Students who were held back (*heldback*), changed schools (*changed*), had identified risk factors (i.e., single-parent families, low parental education, low income, siblings who have dropped out, unsupervised home hours, or low English proficiency), or had low expectations prior to eighth grade (*lowexp8*) had an increased likelihood of dropping out during tenth grade. Students who were previously held back were approximately 2.6 times as likely to drop out rather than to persist at the tenth grade. Also, changing schools prior to eighth grade, having identified risk factors for dropping out, and having low expectations of graduation increased the odds of dropping out (with odd ratios of 1.2, 1.4, and 2 times respectively). In contrast, students who received special education services in the eighth grade, and students who had high eighth grade GPAs (*gpa8th*) and standardized test scores were slightly more likely to persist than to dropout. The odd ratios for each variable were 0.85, 0.56, and 0.94 respectively.

The second category produced similar results in that all of the academic background variables were significant for students being out-of-grade as compared to being in-grade through grade 10. Student that were previously held back (*heldback)*, changed schools (*changed*), had several identified risk factors (*atrisk*), or had low expectations of graduation (*lowexp10*) had a significantly higher likelihood of being out-of-grade during their scheduled tenth grade year. The respective changes in odds were 1.4, 1.1, 1.2, and 1.4. Similarly, the expected odds for students who received special

education services (0.53), and students who had high eighth grade GPAs (0.64) and test scores (0.96) were more in favor of being in-grade than being out-of-grade.

Academic engagement. All of the academic engagement variables at the tenth grade year for the first category were significant at the 0.01 level. Surprisingly, however, students perceiving they had positive faculty interactions were more likely to drop out early by 40 percent (1.4) rather than to be in-grade. In addition, students' ninth grade GPAs were significant predictors of students' grade level status. More specifically, students with high GPAs were approximately twice as likely to be in-grade than to drop out (odds ratio = 0.48). Also, although tenth grade test scores were significant, there was only a small effect on student persistence (1.06). However, the largest effect on students being in grade was their expectation for graduation. Students with low expectations of graduation were highly unlikely to persist through grade 10. The odd ratio for having low expectations of graduating from high school was 90.6 to 1 for dropping out rather than being in-grade and on-track for graduation.

In contrast, positive faculty interactions, high student expectations, and high standardized test scores had no significant effect on students being out-of-grade rather than in-grade during their scheduled tenth grade year. Only ninth grade GPA was significant. The change of odds for students with high GPAs was 0.54. This may be interpreted that, as expected, students with high ninth grade GPAs were nearly twice as likely to be in-grade and on-track for graduation relative to being out-of-grade.

Social engagement. Most of the social engagement variables for the first category were significant at the 0.01 level. Students who felt safe in school (*safe10*) and that discipline was fair (*fair10*) were nearly four (reciprocal of 0.24) and two (reciprocal of

0.54) times as likely to be in-grade rather than dropping out, respectively. In addition, students who participated in school activities were approximately 3.5 (reciprocal of 0.28) times as likely to be in-grade than dropped out. Students who had positive peer relations and did not feel put down by others were also were also more likely to persist and be in-grade (0.54).

Not all of the results, however, were consistent with the theoretical framework. Students who often misbehaved had a decrease in odds of dropping out relative to being in-grade. With a one-unit increase in *Misbeh10*, students were 0.62 times as likely to dropout than to be in-grade. This may suggest that student behaviors are not really the issue for dropping out. Likewise, students who believed a positive social climate (*Sclim_90*) existed in school were more likely (or approximately 1.2 times as likely) to drop out rather be in-grade. Student perceptions of the social climate of the school may not indicate how well a student is socially engaged in school. Student absences in the ninth grade (*hiabs9*) were not significant at the 0.05 level.

Results for the second category, however, were more consistent with the theoretical framework. Students who did not participate in extracurricular activities (*no10act*), students who had high absences (*hiabs9*), and students who said they often misbehaved (*Misbeh10*) were more likely to be out-of-grade than to be in-grade during their scheduled tenth grade year. The change of odds for being out-of-grade relative to being in-grade for each variable was approximately 1.4, 1.4, and 1.2 respectively. Furthermore, students who felt safe in school (*safe10*) and discipline was fair (*fair10*) were also more likely to be in-grade than to be out-of-grade. The changes in odds associated with these two variables were 0.59 and 0.71. Student perceptions of feeling put

down by others (*putdown*) and the social climate of the school (*Sclim90*) had no significant effects on student persistence. A summary of the findings is given in *Table 3*.

Table 5. Individual-Level Results for Model Two: Late Persistence Phase

	Dropouts				Still in School			
	Log-Odds	Std. Error	Δ *Odds*	Std. Δ Odds	Log-Odds	Std. Error	Δ *Odds*	Std. Δ Odds
Individual level								
Student demographics								
Female	0.028	0.106	*1.028*	1.028	-0.505 ***	0.152	*0.604*	0.604
Asian	-0.168	0.321	*0.845*	0.845	0.527	0.389	*1.694*	1.694
African American	-0.186	0.181	*0.830*	0.830	0.279	0.247	*1.322*	1.322
Hispanic	-0.098	0.161	*0.907*	0.907	0.024	0.267	*1.024*	1.024
Native American	0.545	0.409	*1.725*	1.725	1.022 ***	0.379	*2.779*	2.779
Socioeconomic status	-0.326 ***	0.096	*0.722*	0.773	-0.044	0.140	*0.957*	0.966
Academic background								
Previously held back	0.492 ***	0.115	*1.636*	1.636	0.292	0.175	*1.339*	1.339
At-risk characteristics	0.156 ***	0.060	*1.169*	1.147	0.164	0.087	*1.178*	1.155
Low expectations at 8th	0.268 **	0.140	*1.307*	1.307	0.075	0.212	*1.078*	1.078
Special education at 8th grade	-0.042	0.222	*0.959*	0.959	0.054	0.306	*1.055*	1.055
Changed schools once	0.571 ***	0.160	*1.770*	1.770	0.715 ***	0.231	*2.044*	2.044
Changed schools more than once	1.060 ***	0.203	*2.886*	2.886	0.480	0.335	*1.616*	1.616
Moved homes during high school	1.013 ***	0.115	*2.754*	2.754	0.259	0.163	*1.296*	1.296
Ninth grade GPA	-0.943 ***	0.108	*0.389*	0.507	-0.414 **	0.158	*0.661*	0.742
High absences in 9th grade	0.588 ***	0.179	*1.800*	1.800	0.264	0.242	*1.302*	1.302
Dropped out at 10th grade	6.407 ***	0.794	*606.073*	606.073	4.978 ***	0.897	*145.184*	145.184
Out-of-grade at 10th grade	2.051 ***	0.202	*7.776*	7.776	2.881 ***	0.247	*17.832*	17.832
Academic engagement								
Positive faculty interactions	-0.062	0.059	*0.940*	0.940	-0.057	0.087	*0.945*	0.945
Low expectations at 12th	1.398 ***	0.131	*4.047*	4.047	0.636 ***	0.228	*1.889*	1.889
Eleventh grade GPA	-0.942 ***	0.092	*0.390*	0.512	-0.749 ***	0.131	*0.473*	0.588
Twelfth grade test scores	0.027 ***	0.007	*1.027*	1.275	0.021 **	0.011	*1.021*	1.208
Enrolled in academic program	-0.619 ***	0.122	*0.538*	0.538	-2.583 ***	0.175	*0.076*	0.076
Social engagement								
Positive social climate	0.110 **	0.052	*1.116*	1.116	0.114	0.074	*1.121*	1.121
Feels safe at school	-0.015	0.159	*0.985*	0.985	0.116	0.210	*1.123*	1.123
Discipline is fair	0.205 **	0.102	*1.228*	1.228	0.145	0.165	*1.156*	1.156
High absences in 11th grade	0.710 ***	0.145	*2.034*	2.034	0.797 ***	0.192	*2.219*	2.219
Misbehaved in 12th grade	-0.028	0.051	*0.972*	0.972	0.156 ***	0.037	*1.169*	1.169

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

School-Level Results for Model One

School structures. In general, most of the school resource variables were non-significant at the 0.05 level for both categories. Schools in urban areas (*urban*), schools with 9-12 or 10-12 grade configuration (*trans90*), and schools that were departmentalized (*dept90*) had no significant effect on student persistence rates. For the first category, only type of school setting had a significant effect on holding power of schools. More specifically, students who attended public high school during their scheduled ninth and tenth grade year had lower persistence rates than students who attended private schools. Persistence rates for public high schools (*public*) were 3.8 times in favor of students dropping out of school rather than remaining in-grade at the tenth grade. Attending a public school, however, was not significant for being out-of-grade.

Student composition. Similarly, only one variable was significant for the student composition variables. Schools with more than 50% of the students receiving free or reduced lunch decreased the odds for student persistence. With respect to the first category, in schools composed of students of lower socioeconomic status (*p90_lunch*), students were almost 2 times as likely to drop out (odds ratio = 1.9) than to remain on track for graduation. SES was also related to students being out-of-grade ($p < 0.1$). School size, however, was unrelated to student persistence. High schools with less than 1000 students (*smsch90*) had no significant impact on student persistence for either category.

School climate. All of the school climate variables were non-significant. School efforts to retain a stable staff (*facstab*) and the percent of good/excellent teachers (*teacherq*) had no significant effect on student persistence rates for either category.

Similarly, school concerns on student attendance (*Att_90*) and safety (*Safe_90*) were also non-significant.

Academic support. The informal reward structures of high schools had no positive effect on student persistence. More specifically, schools that incorporated the extrinsic motivational strategy of publicly recognizing student achievement had a negative impact on persistence rates. For the first category, *honorach* actually increased the likelihood of students dropping out rather than remaining in-grade. The odds ratio for dropping out relative to being in-grade was 3.1. Likewise, for the second category, school efforts increased the likelihood of students being out-of-grade relative to being in-grade by 2.2 times. This may suggest that this extrinsic motivational strategy may further discourage lower achieving students rather than encourage the persisters or those who are already doing well. The intrinsic motivational strategies (*Intrin90*) had no significant effect on student persistence for either category.

Social support. Similarly, none of the school social support variables had a significant impact on student persistence for either category. School involvement (*transinv*) and programs (*transprog*) to help students' transition from middle school to high school were not significant. Also, schools having an attendance policy (*attendp*), or a homeroom/advisory period (*homeroom*) also had no significant effect. Likewise, schools focusing on improving instructional strategies (*Strat90*), having high expectations (*Expect90*), and having positive students-teacher relations (*Relate90*) also had no impact on keeping students on-track and encouraging them to persist through graduation.

Table 4. School-Level Results for Model One: Early Persistence Phase

	Dropouts				Out-of-Grade			
	Logit	Std. Error	Δ *Odds*	Std. Δ Odds	Logit	Std. Error	Δ *Odds*	Std. Δ Odds
Intercept	-5.980 ***	0.183	*0.003*		-4.668 ***	0.119	*0.009*	
School level								
School structures								
Public	1.347 **	0.651	*3.846*	3.846	0.604	0.393	*1.829*	1.829
Urban	0.120	0.213	*1.127*	1.127	0.219	0.184	*1.245*	1.245
Grade configuration: 9-12 or 10-12	0.064	0.366	*1.066*	1.066	-0.052	0.352	*0.949*	0.949
Departmentalized	0.077	0.406	*1.080*	1.080	0.269	0.370	*1.309*	1.309
Student composition								
Small school (<1000)	0.240	0.214	*1.271*	1.271	0.078	0.173	*1.081*	1.081
Low SES composition (50%+)	0.660 ***	0.251	*1.935*	1.935	0.389 *	0.227	*1.476*	1.476
School climate								
Effort to retain stable staff	0.205	0.221	*1.228*	1.228	-0.294 *	0.160	*0.745*	0.745
Percent of quality teachers	0.005	0.006	*1.005*	1.077	-0.008	0.005	*0.992*	0.888
Attendance problems	0.200 *	0.112	*1.221*	1.221	0.021	0.094	*1.021*	1.021
Safety problems	-0.011	0.104	*0.989*	0.989	0.067	0.089	*1.069*	1.069
Academic support								
Extrinsic student recognition	1.146 ***	0.324	*3.146*	3.146	0.781 **	0.358	*2.184*	2.184
Intrinsically motivates students	0.130	0.128	*1.139*	1.139	-0.024	0.111	*0.976*	0.976
Social support								
School effort to improve learning	-0.013	0.065	*0.987*	0.982	-0.042	0.060	*0.959*	0.943
School has attendance policy	0.256	0.210	*1.292*	1.292	0.007	0.171	*1.007*	1.007
High teacher expectations	-0.167	0.122	*0.846*	0.846	-0.003	0.094	*0.997*	0.997
HS has homeroom/advisory period	0.179	0.184	*1.196*	1.196	-0.183	0.165	*0.833*	0.833
Positive student-teacher relations	-0.103	0.110	*0.902*	0.902	0.027	0.089	*1.027*	1.027
Transition involvement at MS	0.093	0.190	*1.045*	1.045	-0.106	0.181	*0.899*	0.899
Transition programs at HS	-0.098	0.189	*0.907*	0.907	0.086	0.162	*1.090*	1.090

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Summary of Findings for Model One

Dropping out versus being in-grade. Student demographics and family background variables had no influence on student persistence versus dropping out early from school. Gender, ethnicity, and socioeconomic status were not significant on dropping out relative to being in-grade during students' scheduled tenth grade year. In contrast, however, all of the academic background variables were significant ($p \leq 0.01$). Receiving special education services, and having high GPAs and test scores during the eighth grade positively influenced student persistence. Students were slightly more likely to be in-grade rather than dropped out. In contrast, being previously held back a grade, changing schools prior to eighth grade, and having low expectations of graduation during eighth grade had negative impacts on student persistence. Being held back a grade had the strongest influence and further supports the belief that grade retention is not a constructive practice. This suggests strongly that students' academic progress from the middle years is critical to their success through their transition years to high school. Being held back and changing schools are factors that interrupt students' progress. Once students fall behind in school, it is likely that they will stay behind.

All of the student engagement variables were significant. The strongest influence on student persistence was student expectations of persisting at the tenth grade. This suggests that a type of self-fulfilling prophecy may result from poor academics that are too hard to overcome. Student with low graduation expectations were 90 times more likely to drop out of school rather than to be on track to graduate at the tenth grade. In contrast, students with high expectations of graduation were more likely to be on track to graduate. In addition, students with high ninth grade GPAs are more likely to be on track

at the tenth grade. This may suggest that GPA is a better predictor of students' academic engagement than commonly used standardized test scores.

The social engagement variables, although significant, were slightly harder to interpret. While the academic engagement variables were consistent with the theoretical framework, the social engagement variables were mixed. Students who felt there was a positive social climate in school, for example, were more likely to drop out than to be in-grade. This suggests that the general social climate of the school may not affect student engagement or persistence. Similarly, students who did not participate in school activities, or students who often misbehave were more likely to be in-grade than to drop out. These findings suggest that student participation is not a key factor in whether or not students remain in-grade. However, the last three variables were more consistent with the theoretical framework. Students who have positive peer relations, who said they felt safe in school, and students who felt discipline was fair were more likely to persist than to drop out. These results suggest that while the general social climate may not affect student persistence, individuals' who have positive school experiences are more likely do well in school.

The school-level variables as a group were not as useful in explaining possible differences in persistence across schools. After controlling for the student variables, only three school-level variables were significant (i.e., *public90*, *p90_lunch*, and *honorach)*. Public high schools negatively influenced student persistence rates. Students who attended public high schools were nearly three times more likely to drop out of school than to be in-grade during their scheduled tenth grade year compared with their private school counterparts. In addition, schools with more than 50 percent of the students

receiving free or reduced lunch also negatively affected student persistence. Low socioeconomic schools were nearly half as likely to be in-grade rather than dropped out. In addition, public recognition of student achievement did not encourage student persistence. Rather, students attending schools with such practices were somewhat more likely to drop out than to be on track for graduation. This may reflect situations where educators were trying to change the school's culture by increasing attitudes and beliefs about achievement. This also raises question about to why some intentional programs do not help students to improve.

Being out-of-grade versus in-grade. The significant influences for out-of grade students were fewer, but still similar to those of dropouts. Furthermore, there were only slight differences in the odd ratios between the two categories. However, some ethnic and socioeconomic variables, such as students of African Americans, and Indian or Alaskan ancestry, and of low socioeconomic status, increased students' likelihood of being out-of-grade during their scheduled tenth grade year (and had no significant impact on dropping out). In addition, all of the academic background variables were significant. The most significant difference among these variables is that receiving special education services had a stronger impact on student persistence (0.54 for being out-of-grade versus 0.85 for dropping out).

Among the student engagement variables, ninth grade GPA was the only significant academic engagement variable. Similar to the first category, high GPA increased student persistence by nearly 50 percent. In addition, social engagement variables, *safe90* (feeling safe in school) and *fair90* (discipline is fair) had a positive influence on student persistence. In contrast, students who did not participate in

extracurricular activities, students who were frequently absent, or students who reported they often misbehaved were more likely to be out-of-grade than to be in-grade and on-track for graduation. These variables were consistent with the theoretical framework.

The school-level model was also not very useful in explaining differences in student progress across schools. All of the school characteristic variables for being out-of-grade were not significant. Furthermore, the only influential school support variable was publicly honoring student achievement (*honorach*). Similar to dropping out, the change of odds for *honorach* suggested that while educators may believe that this practice encourages student persistence, publicly honoring student achievement may actually further discourage students that are already be doing poorly. An alternative explanation is that the practice may reflect schools that are attempting to raise awareness and expectations for performance in hopes that it will change student behaviors (e.g., higher grades lead to higher persistence rates).

Results for Model Two: Late Persistence Phase

The results of the second model, or late persistence phase, are organized similarly to the first model. The individual-level results are presented first (*Table 5*) followed by the school-level results (*Table 6*). The outcome categories for the second model are (1) dropping out; (2) still in school, and (3) graduating on time. The last category is the reference category.

Individual-Level Results for Model Two

Student demographics and family background. For the first category, gender and ethnicity did not have a significant influence on student persistence. Being *female*, *Asian*, African American (*black*), *Hispanic*, or Native American (*Nativeam*) were not significant on dropping out relative to graduating on time during students' scheduled twelfth grade year. Students from high socioeconomic families, however, were approximately 1.4 times as likely to graduate than to dropout (reciprocal of 0.72).

In contrast, the second category compared students who were still in school (behind) to students who graduated on schedule (persist). Regarding gender, females were more likely to graduate than to be still in school during their scheduled twelfth grade year. More specifically, females were nearly half (or 0.6 times) as likely to be behind than to graduate on time. For ethnicity, students of Native American ethnic background (*Nativeam*) were less likely to graduate on time. Native American students were 2.8 times as likely to be still in school as opposed to graduating during their scheduled twelfth grade year. *Black* and *Hispanic* had no significant effect, nor did students' socioeconomic status.

Academic background. All of the academic background variables, except for special education, were significant in explaining the probability of dropping out. Being held back prior to high school (*heldback*), having identified risk factors (*atrisk*), and having low graduation expectations at 8th grade (*lowexp8*) negatively impacted student persistence. For these variables, student odds were 1.6, 1.2, and 1.3 times in favor of dropping out versus graduating on time. In addition, changing schools or moving homes (which are not synonymous) during high school also increased the odds of dropping out.

Changing schools just once during high school was associated with odds of dropping out of approximately 1.8. Furthermore, changing schools more than once increased the odds ratio to 2.9, and moving homes increased the odds of dropping out to 2.8.

Also, early high school experiences also influence student persistence at the twelfth grade. Students who were frequently absent in the ninth grade were 1.8 times as likely to drop out than to graduate on time. In contrast, students with high ninth grade GPAs were 2.5 (reciprocal of 0.39) times as likely to graduate than to dropout. However, the stronger influences on student persistence were students' educational status at the end of tenth grade. As we might expect, students who dropped out or were out-of-grade during their scheduled tenth grade year were 606 and 7.8 times (respectively) as likely to dropout than graduate at twelfth grade. The inflated ratio for being dropped out at the tenth grade suggests once students drop out early, they are not likely to return. Moreover, students who fall behind academically during their early high school years are not likely to catch up.

The results of the being behind relative to dropping out at the twelfth grade, however, were slightly different. Only four of the academic background variables were significant for the second category. Students who experienced one non-promotional school change between the ninth and twelfth grades were twice as likely to still be in school rather than graduated during their scheduled twelfth grade year. In addition, students who had dropped out in the tenth grade were 145 times as likely to behind in school rather than graduate as scheduled. Since early school dropouts would most likely be behind in grade level if they returned to school, the reduced odds (of 145 as opposed to 606) further support the belief that few dropouts return. In contrast, students who were

out-of-grade during their scheduled tenth grade year were 17 times as likely to still be behind instead of graduating as scheduled. In contrast, ninth grade GPAs significantly increased student odds of persisting and graduating on time. Students with high ninth grade GPAs were approximately one and a half times as likely to graduate on time rather than being still in school. These findings suggest that students' academic experiences in their early high school years do affect their persistence in their later high school years.

Academic engagement. Students' academic engagement during their later high school years does have a significant influence on student persistence and graduation. Students' expectations of graduation during the twelfth grade (*lowexp12*) had a negative impact on graduating on time. Students who expected at most to graduate from high school were four times as likely to drop out than to graduate during their scheduled twelfth grade year. In addition, students with high standardized twelfth grade test scores (*tests12*) were equally as likely to dropout than graduate (odds of 1.02). In contrast, eleventh grade GPAs (*year3gpa*), and academic curriculum programs (*acadprgm*) positively influenced student persistence. Students who had high eleventh grade GPAs were approximately 2.5 times as likely to graduate on time than drop out of school. Also, students enrolled in academic curriculum programs were nearly twice as likely to graduate on time. Faculty interactions (*facult12*) had no significant influence.

The academic engagement variables had a similar influence on the second category. Student with low expectations of graduation were 1.9 times as likely to still be in school than graduated during their scheduled twelfth grade year. Twelfth grade test scores also had little impact on students' grade level status, with an odds ratio of 1.02. In addition, eleventh grade GPAs nearly doubled student odds of graduating on time versus

being still in school and students in academic programs were 13 times as likely to graduate than remain in school. Faculty interactions had no significant influence.

Social engagement. The results of social engagement variables were somewhat confusing in explaining student persistence. Consistent with previous dropout studies, students with high absences were more likely to drop out than to graduate on time. Students who were frequently absent in the eleventh grade (*hiabs11*) were twice as likely to drop out of school rather than graduate on time during their scheduled twelfth grade year. Unexpectedly, however, students who reported a positive social climate in their school (*Sclim12*) and students who believed discipline was fair at their schools (*fair12*) were somewhat more likely to drop out than to persist (with odds ratios of 1.1 and 1.2 respectively). Students' misbehaviors (*Misbeh12*) and perceptions of a safe school (*safe12*) were not significant.

The results of the second category were more consistent with the theoretical framework. Students who were often absent during their scheduled eleventh grade year were 2.2 times as likely to still be in school than graduated. In addition, students who often misbehaved were 1.2 times as likely to be in school than graduated as scheduled. Student perceptions of a positive social climate, and feeling safe at school and discipline is fair were not significant predictors of persistence behaviors.

Table 3. Individual-Level Results for Model One: Early Persistence Phase

	Dropouts				Out-of-Grade			
	Logit	Std. Error	Δ *Odds*	Std. Δ Odds	Logit	Std. Error	Δ *Odds*	Std. Δ Odds
Individual level								
Student demographics								
Female	0.044	0.167	*1.045*	1.045	-0.196	0.109	*0.822*	0.822
Asian	-0.847 *	0.487	*0.429*	0.429	-0.784 *	0.434	*0.457*	0.457
African American	-0.509 *	0.286	*0.601*	0.601	0.387 **	0.179	*1.473*	1.473
Hispanic	0.027	0.250	*1.027*	1.027	0.054	0.178	*1.055*	1.055
Native American	-0.290	0.534	*0.748*	0.748	0.707 **	0.350	*2.028*	2.028
Socioeconomic status	-0.231	0.166	*0.794*	0.833	-0.216 **	0.109	*0.806*	0.843
Academic background								
Previously held back	0.958 ***	0.171	*2.606*	2.606	0.306 **	0.306	*1.358*	1.358
Changed schools prior to HS	0.218 ***	0.187	*1.244*	1.345	0.086 **	0.037	*1.090*	1.124
At-risk characteristics	0.352 ***	0.087	*1.422*	1.373	0.141 ***	0.054	*1.151*	1.135
Low expectations at 8th grade	0.688 ***	0.181	*1.990*	1.990	0.300 **	0.140	*1.350*	1.350
Special education at 8th gr.	-0.163 ***	0.292	*0.850*	0.850	-0.623 **	0.261	*0.536*	0.536
Eighth grade GPA	-0.583 ***	0.128	*0.558*	0.653	-0.450 ***	0.091	*0.638*	0.720
Eighth grade test scores	-0.064 ***	0.017	*0.938*	0.525	-0.037 ***	0.012	*0.964*	0.689
Academic engagement								
Positive faculty interactions	0.365 ***	0.110	*1.441*	1.441	0.012	0.061	*1.012*	1.012
Low expectations at 10th	4.507 ***	0.218	*90.649*	90.649	-0.064	0.318	*0.938*	0.938
Ninth grade GPA	-0.725 ***	0.153	*0.484*	0.606	-0.622 ***	0.115	*0.537*	0.651
Tenth grade test scores	0.056 ***	0.016	*1.058*	1.736	-0.013	0.011	*0.987*	0.880
Social engagement								
Positive peer relations	-0.611 ***	0.213	*0.543*	0.543	-0.022	0.137	*0.978*	0.978
Positive social climate	0.178 **	0.082	*1.195*	1.195	0.046	0.057	*1.047*	1.047
Feels safe at school	-1.429 ***	0.193	*0.240*	0.240	-0.523 ***	0.147	*0.593*	0.593
Discipline is fair	-0.613 ***	0.175	*0.542*	0.542	-0.337 ***	0.104	*0.714*	0.714
No participation in act. at 10th grade	-1.271 ***	0.097	*0.281*	0.281	0.344 ***	0.115	*1.411*	1.411
High absences in 9th grade	0.365 *	0.202	*1.441*	1.441	0.359 ***	0.134	*1.432*	1.432
Misbehaved in 10th grade	-0.480 ***	0.097	*0.619*	0.619	0.193 ***	0.036	*1.213*	1.213

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

School-Level Results for Model Two

School structures. Consistent with the first model, only a few of the school structure variables were significant influences on student persistence rates. More specifically, students who attended public high schools (*public92*) were nearly 5.7 times as likely to drop out of school than to graduate during their scheduled twelfth grade year. These numbers may be slightly inflated due to the over-sampling of private schools (In addition, students who attended high schools with typical grade configurations (i.e., 9-12 or 10-12) (*trans92*) were 1.6 times as likely to drop out than to graduate on time. However, these two variables were not significant for the second category. Moreover, *urban* and departmentalized (*dept92*) schools were not significant for either category.

Student composition. Consistent with previous research, schools composed of a majority of students from low socioeconomic families had a negative effect on student persistence rates. Schools in which the majority of students received free/reduced lunch (*p92_lunch*) had higher odds for dropping out (1.8) relative to graduating on time. Similarly, the odds ratio for still being in school versus graduating on time was 1.7 for low SES students. In addition, although the school size (*smsch92*) was not significant for students dropping out, it was significant for students being behind in school. Schools with enrollments of less than 1000 students had higher rates of on-time student graduation (0.6) as opposed to having students still in school during their scheduled twelfth grade year.

School climate. None of the school climate variables had a significant influence on student persistence for either category. Schools with attendance or safety problems, or schools that offered advanced placement courses, did not affect school completion rates.

Academic support. Both of the academic support variables did not have a significant impact of student persistence rates. Schools having a required test for earning a high school diploma or schools that had programs to motivate students had no effect on their students' graduation status.

Social support. One of the social support variables had a significant influence on student persistence rates. Importantly, schools whose reform efforts focused on improving student learning (*Strat92*) had a positive effect on graduating students as scheduled. Student odds were 0.9 times as likely to drop out than persist and graduate. This suggests that in schools where the focus is on academic improvement, students were more likely to graduate. Efforts to improve student learning may assist students to engage both socially and academically. However, this variable was not significant for the second category of being behind in school. Schools emphasizing discipline (*disc92*), schools having high teacher expectations of students (*Expect92*) and schools reporting positive student-teacher relations (*Relate92*) had no effect on student persistence. Likewise, school efforts to transition students to higher education (*hiedeff*) or the work force (*workeff*) also had no significant influence on student persistence for either category.

Table 6. School-Level Results for Model Two: Late Persistence Phase

	Dropouts				Still in School			
	Log-Odds	Std. Error	Δ *Odds*	Std. Δ Odds	Log-Odds	Std. Error	Δ *Odds*	Std. Δ Odds
Intercept	-4.493 ***	0.12	*0.011*		-5.282 ***	0.156	*0.005*	
School level								
School structures								
Public	1.739 ***	0.494	*5.692*	5.692	-0.608 *	0.357	*0.544*	0.544
Urban	-0.065	0.147	*0.937*	0.937	-0.168	0.213	*0.845*	0.845
Grade configuration: 9-12 or 10-12	0.455 ***	0.171	*1.576*	1.576	0.284	0.233	*1.328*	1.328
Departmentalized	-0.380 *	0.231	*0.684*	0.684	-0.285	0.372	*0.752*	0.752
Student composition								
Small school (<1000)	-0.243 *	0.138	*0.784*	0.784	-0.462 **	0.201	*0.630*	0.630
Low SES composition (50%+)	0.570 ***	0.163	*1.768*	1.768	0.504 **	0.244	*1.655*	1.655
School climate								
Attendance problems	0.029	0.780	*1.029*	1.029	0.096	0.111	*1.101*	1.101
Safety problems	-0.001	0.065	*0.999*	0.999	-0.075	0.108	*0.928*	0.928
Offers AP course(s)	-0.015	0.149	*0.985*	0.985	-0.217	0.220	*0.805*	0.805
Academic support								
Test required for diploma	-0.018	0.126	*0.982*	0.982	0.090	0.192	*1.094*	1.094
Intrinsically motivates students	-0.121	0.084	*0.886*	0.886	-0.190 *	0.108	*0.827*	0.827
Social support								
School effort to improve learning	-0.101 **	0.047	*0.904*	0.885	-0.124 *	0.070	*0.883*	0.861
Discipline emphasized	-0.116	0.152	*0.890*	0.890	-0.089	0.267	*0.915*	0.915
High teacher expectations	0.095	0.071	*1.100*	1.100	0.129	0.116	*1.138*	1.138
Positive student-teacher relations	0.036	0.068	*1.037*	1.037	0.078	0.106	*1.081*	1.081
Offers vocational education prog.	0.173	0.135	*1.045*	1.045	0.010	0.232	*1.010*	1.010
Offers other support programs	0.151	0.129	*1.163*	1.163	-0.083	0.183	*0.920*	0.920
Offers college assistance	-0.009	0.131	*0.991*	0.991	-0.026	0.186	*0.974*	0.974
Offers work transition assistance	-0.106	0.178	*0.899*	0.899	-0.247	0.226	*0.781*	0.781

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Summary of Findings for Model Two

Dropping out versus graduating on time. In general, many of the individual-level variables were significant in explaining student persistence in high school. Although gender and ethnicity were not significant, family socioeconomic status was. Students from high SES families were more likely to graduate during their scheduled twelfth grade year. In addition, students who received special education services during the eighth grade and students who had high ninth grade GPAs were more likely to graduate on time than drop out of school. However, students who were previously held back a grade, had at-risk characteristics, had low expectations of graduation during the eighth grade, or moved homes and/or school during high school were more likely to dropout by the end of their fourth year of high school. In addition, students who had dropped out of school at the end of tenth grade were highly likely to remain out-of-school two years later. Importantly, falling behind early (i.e., being out-of-grade at the tenth grade) also increased the odds of dropping out before graduation.

The results of the academic engagement variables were fairly consistent with the theoretical framework. Students with low expectations of graduation at the twelfth grade were more likely to drop out than to persist through school and graduate on time. In addition, students enrolled in an academic curriculum program and had high eleventh grade GPAs were more likely to graduate than to drop out. Although significant, twelfth grade standardized test scores had little effect on student persistence.

In contrast, the social engagement variables were not as consistent with the theoretical framework. Students who perceived the school to be fair in discipline and a positive social climate were less likely to persist. With a one-unit change, the odds were

slightly more in favor of dropping out than graduating on time. This may suggest that perceptions of discipline issues and climate have little to do with students' decisions to drop out. However, students who were frequently absent during the eleventh grade were more likely to drop out. These findings suggest that student decisions to persist or drop out may result from their summative academic experience (e.g., GPAs, previous success and expectations). This further supports the theoretical framework that student persistence is a process that unfolds over time around academic experiences.

School-level variables as a group were not as strong in explaining student persistence across schools as the individual-level variables were at why individual students drop out. Only four of the school variables were significant. Public schools, low SES schools, and schools with 9-12 or 10-12 grade configurations had a negative influence on students graduating on time. In addition, all of the school climate and academic support variables were not significant. Only one of the social support variables was a significant predictor of student persistence. It was, however, a potentially important one. Schools who focused reform efforts on improving classroom instruction and student learning increased student odds for graduating on time.

Still in school versus graduating on time. The results of the second category were somewhat similar to the first in that many of the individual-variables were significant, but only few school-level ones. Being female increased student odds of graduating on time relative to being behind their peers and still in school. Socioeconomic status had no significant influence as well as being Asian, African American, or Hispanic. Students who were of Native American ancestry had increased odds of being in school rather than graduating on time.

With respect to students' academic background, student mobility, ninth grade GPA and students' educational status at the end of tenth grade had a significant influence on graduation. Students who moved school just once due to non-promotional reasons were less likely to graduate on time. In addition, students who dropped out or were out-of-grade during the tenth grade were also less likely to graduate and more likely to still be in school during their scheduled twelfth grade year. Students with high ninth grade GPAs, however, had increased odds of graduating on time.

Students' academic engagement also influenced high school persistence. Students with high eleventh grade GPAs and who were enrolled in an academic program were more likely to complete school as scheduled. Students having low expectations of graduation, however, decreased their odds of graduating on time. Although significant, high twelfth grade test scores only slightly decreased student odds of graduation.

Two social engagement variables significantly influenced student persistence at the twelfth grade. High absences in the eleventh grade and misbehaviors at the twelfth grade negatively affected student persistence. Students were less likely to graduate on time and more likely to be still in school. Various student perceptions of the school did not significantly influence students' likelihood of graduation. More specifically, the social climate (*Sclim12*), safety (*safe12*), and discipline (*fair12*) were not significant.

The strength of the second model lies at the individual level. For the second category, only two of the school level variables were significant. More specifically, the two student composition variables had a significant impact on student persistence. Students who attended small school (i.e., with enrollment of less than 1000) were more likely to persist and graduate on time than to still be in school during their scheduled

twelfth grade year. In addition, students attending low SES schools were less likely to graduate on time.

Summary of Findings Across Models

In general, the findings of the study across both models support the belief that student persistence is a process that may be affected by individual- and school-level factors. While dropping out appears to be a process primarily affected by individual variables (i.e., student background, academic experiences), it would be a mistake to conclude that dropping out is entirely a result of individual decision-making. This study suggests that several key school-level variables appear to explain differences between schools in persistence rates (or the number of students out of grade). School structures and processes may influence their students' likelihood of graduating of falling behind academically. Similarly, among individual-level predictors are several variables that have to do with student' perceptions of the school processes within their schools. Although whether or not schools offered advance placement courses had no effect on student persistence, for example, students enrolled in an academic curriculum program were more likely to persist and graduate on time. This may suggest that what schools teach does affect student persistence. Other individual-level variables that may have school-level implications include student mobility, students' status at the tenth grade, and students' perceptions of school discipline. While it is unclear from the results of this study exactly how these variables might contribute, keeping students in school and on-track early in their high school career may positively affect their later high school years.

CHAPTER V: DISCUSSIONS, IMPLICATIONS, AND CONCLUSIONS

This chapter begins with a summary of the study. It then draws on the findings and interprets them with respect to the problem, purposes, and research questions. Finally, the study's implications for theory, policy and practice, and future research will be discussed.

Summary of Study

With the nation's changing economic structure and continual decrease in low-skilled employment, access to well-paid jobs is difficult without a high school diploma. Thus, serious social problems are likely consequences for dropping out today. The lack of diplomas may lead individuals to a future of unemployment or poor paying jobs, or dependency on welfare and other social services (Wehlage et al., 1989). Although extensive research has been conducted on the dropout problem, national high school completion rates have remained relatively stable and below expectations over the past couple of decades. One estimate reported that fewer than 75 percent of students enrolled in ninth grade complete high school within four years (McWhirter et al., 1998).

The purpose of this study was to take a different approach to the dropout problem by focusing on the students who persist through graduation. Traditionally, researchers have chosen to investigate the minority population group of leavers rather than the majority of students who remain in school and graduate on time. By understanding why students persist as well as why they leave, researchers may provide educational practitioners with helpful insights as to how and why individuals succeed. In addition, the

longitudinal study simultaneously examined several individual- and school-level influences on student persistence.

There is a limited amount of research that addresses the high school persistence or attrition process (Hemming, Jin, and Low, 1996). Thus, the conceptual framework for this study was grounded in the theoretical and empirical research on student persistence in higher education (Tinto, 1975; Tinto, 1993), high school dropouts (Finn, 1989; Lee & Burkam, 2003; Newmann, 1981; Rumberger, 1995; Rumberger & Larson, 1998; Rumberger & Thomas, 2000; Wehlage et al., 1989), and school effects (Creemers et al., 2000; Reynolds et al., 1994). The study also included literature on school-to-school transitions (Alspaugh, 1998a; Anderson, 2000; Catterall, 1998; Rice, 1997; Scott et al., 1995).

The theoretical framework for the individual level of this study was primarily based on Tinto's theory of individual departures from institutions of higher education (1975, 1993). Tinto (1993) posited that students with strong goals and commitments, and students who are well integrated, academically and socially, within their institution are more likely to persist and finish college. Similarly, Wehlage, Rutter, Smith, Lesko, and Fernandez (1989) stated that students who do not feel like a member of the school and are not engaged educationally are more likely to drop out of high school. Wehlage and colleagues also contended that schools could make a difference by addressing the impediments of school membership (i.e., isolation, difficulty, incongruence, and adjustment) and educational engagement (i.e., extrinsic/intrinsic rewards, and depth of curriculum).

Organizational research served as the theoretical foundation for the school level. The second level of the model was generally concerned with the relationship among organizational structures, resources, and processes and the individuals that comprise them. Organizations such as schools have structural features and processes that provide a framework in which their activities take place (Heck & Hallinger, 1999; Kronick, 1997). School process variables such as school policies, practices, and programs can create environments that are more academically and socially supportive and may subsequently encourage students to stay in school and graduate (Lee & Burkam, 1992, Rumberger, 1995; Rumberger & Thomas, 2000). The multilevel conceptual model of this study (presented as *Figure 5.1*) paralleled the work of Rumberger and Thomas (2000).

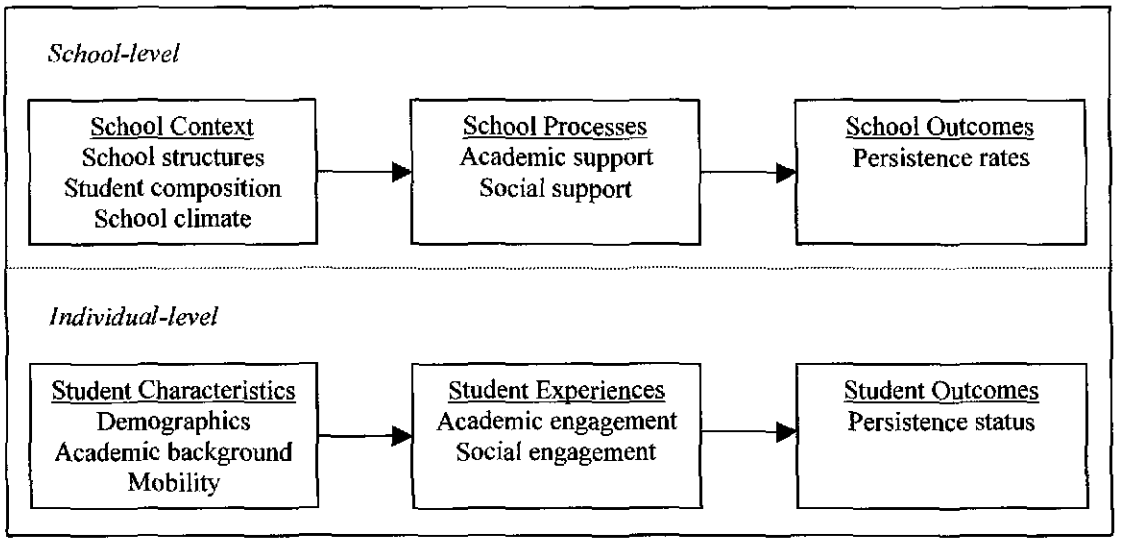


Figure 5.1
Conceptual Model for Analyzing Student Persistence in High School

The study of student persistence was separated into two models: the early persistence phase and the late persistence phase. The first model followed a cohort of

students from eighth to tenth grade. The early persistence phase looked at the influence of students' background and prior school experiences, high schools' academic and social organizations, and schools' efforts to assist students to remain in school and on track for graduation at the tenth grade. The second model, or late persistence phase, was an extension of the first. This phase addressed the impacts of various school efforts by following the same group of students through the twelfth grade. Several school-level variables were examined as possible supports to students who remained in school and completed their high school diploma.

Discussion

The discussion of the findings is organized by the four research questions that guided the study. The research questions address the relevance of several theoretical constructs regarding student persistence over time. The first two research questions address the early persistence phase, while the second two questions address the late persistence phase.

Research Question 1

What student-level factors influence student persistence at the tenth grade? Although the effects were slightly different for students who were in-grade and on-track for graduation from those who were out-of-grade, many student background variables were significantly related to whether or not students remained in school during their scheduled tenth grade year. More specifically, students' prior school experience influenced their persistence in high school. For example, having high GPAs and test

scores in the eighth grade had a positive impact on students remaining on-track for graduation. Receiving special education support services was also related to keeping students on track for graduation. In contrast, being held back a grade, changing schools prior to high school, having low expectations of graduation, or having several identified at-risk characteristics at the eighth grade had negative impacts on student persistence. In particular, being identified early as a potential risk for dropping out of school based on family socioeconomic background provides further support that social capital does affect student persistence (Croninger & Lee, 2001). Although gender, ethnicity, and socioeconomic status had no significant impact on students dropping out, students who were African-American, Native American, or from a low-income family had a significant increase in odds of being out-of-grade during their scheduled tenth grade year.

Consistent with Tinto's theory (1993), students' academic engagement also influenced their likelihood of being in-grade and on-track for graduation. In particular, student GPAs for their ninth grade year significantly influenced their likelihood of being in-grade during their scheduled tenth grade year. This variable, which was computed and extracted from the rarely used, restricted NELS:88 transcript files, provides support for importance of a successful transition year from middle school to high school in promoting student success. In contrast, students having low expectations of graduation during the tenth grade had inflated odds of dropping out, rather than remaining in school and being on schedule for graduation. This odds ratio suggests that it may be extremely difficult for schools to change student attitudes about school. Another interpretation is that individuals' expectations of graduation may be a stronger reflection of the attitudes students are exposed to outside of school.

The results of the remaining two academic engagement variables were puzzling, however. Positive faculty interactions and high tenth grade test scores both resulted in an increase in students' likelihood of dropping out rather than to staying in school. While further analyses showed that independently these variables positively affected students remaining in school, when all of the other variables were controlled in the model, they did not. One explanation is that dropping out is not just an academic problem. Many of the problems that students encounter may extend beyond the classroom. A separate analysis of the data showed that over half of the dropouts had high-standardized test scores for reading and mathematics at the tenth grade. Thus, the slight increase in odds of dropping out related to test scores, for example, suggests that some students who could do well in school still chose to drop out. Similarly, although students may have positive interactions with teachers, these relationships may not suffice to reduce the long-term causes of their academic problems or reasons for dropping out.

There were also a few surprising results in the social engagement section of the model. This included the social climate of the school, students' misbehaviors in the tenth grade, and their participation in extra-curricular activities. Students who dropped out were actually more positive about their schools' social climates than students who were on track to graduate at grade 10. It is probably best not to attach too much significance to this result. The reasons why students drop out are likely less related to their perceptions of school conditions and more related to their cumulative academic record. The analyses also suggest that students with chronic misbehaviors were more likely to be out-of-grade but not necessarily more likely to drop out. Students who did not participate in extracurricular activities were more likely to be in-grade than to drop out, but they were

less likely to be in-grade than to be out-of-grade. One explanation of this inconsistent finding is the age of the dataset. This data was collected when high school student-athlete policies were probably not in place. Only recently has academic achievement affected students' eligibility to participate in school activities. Prior to 2.0 GPA policies or athletic grade checks, for example, many students were allowed to participate as long as they were enrolled in school.

There were, however, some results concerning social engagement that were more consistent with the conceptual framework. The findings showed that students who had positive peer relations, felt safe in school, and agreed that discipline policies were fair were more likely to be in school and in their scheduled grade than to be either dropped out or out-of-grade. In addition, being absent more than 10% of their ninth grade school year affected student persistence negatively at the tenth grade. This is another finding that supports the importance of students' first year transition to high school.

Research Question 2

What school-level factors influence student persistence at the tenth grade? Many of the school-level variables were not significant for the "early persistence" phase. Only attending a public high school, a low SES high school, and a school that publicly honored student achievement were significant predictors of student persistence status at grade 10. All three variables negatively affected student persistence. Students who attended public schools or schools that had low SES student composition were more likely to dropout than students who attended private schools or schools with more average or high socioeconomic levels. These variables likely represent proxies for other types of

processes occurring in these types of schools. For example, these latter types of schools may have increased resources that contribute to their better holding power (e.g., enhanced curricular programs, increased teaching quality, increased parent support). Enrollment in a low SES or public school may imply a more limited amount of financial support or resources. Public or low SES schools may be doing well with what they have, but in contrast to those that have better services or resources, they may not be able to best serve their entire student clientele.

Wehlage and colleagues (1989) hypothesized that an internal and external reward structure might influence students' academic engagement. In this early persistence phase, the effect of an external reward program on student persistence was examined. Surprisingly, the results suggested that students who attended schools that publicly honored student achievement were actually slightly more likely to drop out or be out-of-grade than students who attended schools that did not adopt this practice. This finding implies that contrary to popular belief, such school-level practices may not encourage students to persist, but rather discourage those that may be doing poorly and further enhance the disengagement or dropping out process. An alternative explanation may be that such programs more commonly exist in schools where personnel have determined there is dropout problem and, hence, they represent school efforts to enhance the development of an achievement-oriented culture.

Despite the number of non-significant variables, however, the school-level model should not be perceived as unimportant. Although variables such as attendance and safety, for example, were not significant when defined at the school level, student perceptions of school safety and attendance were significant in explaining their

persistence status at grade 10. Limitations of the school-level data may provide one explanation of the discrepancies in the model. Since the school principals most often completed the school surveys, the school-level information for some items may only reflect that one person's perception of the school. Thus, the climate and motivation variables may not accurately reflect the perceptions of students or others in the school. In contrast, the individual-level information, however valid, could not be aggregated to the school-level appropriately (as some previous studies have done) because the within-school sample sizes did not represent the student population sufficiently. Importantly, therefore, issues related to safety, attendance, and discipline should not be disregarded at the school level, just because they were not significant in that portion of the model. Schools should still focus their efforts on these areas because they do have a positive impact on persistence at the individual student level. NOTE: *Table 7* summarizes the significant variables for the first and second models.

Table 7. Significant Variables for Student Persistence Models.

	Model 1		Model 2	
	Dropouts	Out-of-Grade	Dropouts	Still in School
School level				
School structures				
Public	X	---	X	---
Grade configuration: 9-12 or 10-12	---	---	X	---
Student composition				
Small school (<1000)	---	---	---	X
Low SES composition (50%+)	X	---	X	X
Academic support				
Public recognition of student achieve.	X	X	n/a	n/a
Social support				
School effort to improve learning	---	---	X	---
Student level				
Student demographics				
Female	---	---	---	X
African American	---	X	---	---
Native American	---	X	---	X
Socioeconomic status	---	X	X	---
Academic background				
Previously held back	X	X	X	---
At-risk characteristics	X	X	X	---
Low expectations at 8th	X	X	X	---
Special education at 8th grade	X	X	---	---
Changed schools prior to HS	X	X	n/a	n/a
Changed schools once (during HS)	n/a	n/a	X	X
Changed schools more than once	n/a	n/a	X	---
Moved homes during high school	n/a	n/a	X	---
Eighth grade GPA	X	X	n/a	n/a
Eighth grade test scores	X	X	n/a	n/a
Dropped out at 10th grade	n/a	n/a	X	X
Out-of-grade at 10th grade	n/a	n/a	X	X
Academic engagement				
Positive faculty interactions	X	---	---	---
Low expectations at 10th/12th gr.	X	---	X	X
Ninth grade GPA	X	X	X	X
Eleventh grade GPA	n/a	n/a	X	X
Tenth/Twelfth grade test scores	X	---	X	X
Enrolled in academic program	---	---	X	X
Social engagement				
Positive peer relations	X	---	---	---
Positive social climate	X	---	X	---
Feels safe at school	X	X	---	---
Discipline is fair	X	X	X	---
No participation in activities at 10th	X	X	n/a	n/a
High absences in 9th grade	---	X	X	----
High absences in 11th grade	n/a	n/a	X	X
Misbehaved in 10th/12th grade	X	X	---	X

X - denotes variables significant at $p < 0.05$.
n/a - variables not included in model

Research Question 3

What student-level factors consistently influence student persistence to graduation? In particular, how important are students' experiences during the first year of high school to completing high school? For the second model, or late persistence phase, many of the student characteristics variables consistently influenced student persistence. For example, students from high SES families were more likely to complete school and graduate on time than students from average or lower SES families. This suggests that high SES families may be able to provide additional supports that help students remain on track through graduation. Also, students identified at the eighth grade for having several at-risk characteristics, low expectation of graduation at the eighth grade, or who were held back a grade prior to high school were less likely to persist and graduate on time. Furthermore, students who changed schools before or during high school were also more likely to dropout than to graduate than students who stayed in their high schools.

Other important findings included support for academic success in the early years of high school. Students' ninth grade GPA and attendance had an influence on student persistence. Students with high ninth grade GPAs were more likely to persist and graduate on time as compared to students with average or low GPAs. This suggests that ninth grade GPA may be an indicator of a successful or unsuccessful transition to high school (McWhiter et al., 1998). In contrast, students who were chronically absent from school during their ninth grade were more likely to drop out or to still be in school during their scheduled twelfth grade year than students whose attendance patterns were more regular. Importantly, students' persistence status at the end of the tenth grade (i.e.,

dropped out, out-of-grade, or in-grade) was a strong predictor of their future success. Students who were dropped out or out-of-grade at the tenth grade were highly likely to be in the same situation at the end of their twelfth grade year.

The results of the academic engagement variables were similar to the first model. Student expectations were a strong predictor of their persistence status. Students who had low expectations had increased odds of dropping out or still being in school rather than graduating as scheduled. Student academic performance was also an important predictor of persistence. For example, students with high eleventh grade GPAs were more likely to persist. Similarly, students who were enrolled in academic (or more rigorous) curricular programs (i.e., information that was extracted from the "restricted use" NELS:88 transcript files) were several times more likely to persist than students who participated in more average or weak curricular programs. Another similarity with the early persistence model was that although standardized test scores were significant predictors of persistence status, they did not amount to any real substantive change in odds of student persistence.

The results of the social engagement variables in the second model were also fairly consistent. Similar to the early persistence model, students who perceived a positive school climate in their high school had a slight increase in odds for dropping out in comparison to students who perceived their school's climate in more negative terms. In addition, students with high absenteeism in the eleventh grade were also less likely to graduate or to still be in school compared with students having more regular attendance. In contrast, student perceptions of discipline in the late persistence phase were a little more confusing. Students who dropped out actually were slightly more positive about

their schools' discipline policies in the 12th grade than students who persisted. One explanation is that discipline may not be a reason for dropping out at the twelfth grade. This may be further supported by the non-significant results for student misbehaviors. In sum, the student conduct variables at both the tenth and twelfth grades were not very good at explaining student persistence.

Research Questions 4

What school-level factors consistently influence student persistence to graduation? The school-level results for the late persistence phase of high school were similar to the first model. Many of the variables simply were not related to student persistence patterns. The significant variables were attending a public school as opposed to a private school, attending a high school with typical grades configuration (i.e., 9-12 or 10-12) as opposed to other configurations, attending a high school with low SES student composition as opposed to average or high SES, and attending a high school with focused efforts to improve student learning were found to have significant effects on student persistence rates.

Most of the school-level variables that were significant for the late persistence phase pertained to the school context variables. Consistent with the early persistence phase, students who attended public high schools were several times more likely to drop out by their twelfth grade year than students who attended private schools. More specifically, student odds for dropping out increased from the tenth to the twelfth grades. This leads to more questions about what types of processes are taking place in public schools that are different from private or church-related schools. In addition, schools with

grade configurations of 9-12 or 10-12 had higher student dropout odds than schools with other configurations. More specifically, consistent with Alspaugh's (2000) study, the results suggests that students who transitioned to schools with a high school grade configuration (e.g., 9-12, 10-12) produced slightly higher dropout rates than other grade configurations (e.g., 7-12, K-12).

In addition, both student composition variables (i.e., size and SES) also impacted persistence rates. Although impact of school size was not significant for dropping out, students who attended high schools with less than 1000 students were more likely to graduate on time (as opposed to falling behind) than students who attended larger schools. This finding supports the research on the benefits of small schools (Cotton, 1996; Lee & Smith, 1997; Raywid, 1999). Students who attended schools with low SES student composition, however, had decreased odds of persisting and graduating on time relative to students attending schools with average or higher SES. This is an important point, in that even after controlling for student SES within schools, there seem to be disadvantages associated with persistence for attending schools where community SES is low (i.e., above 50%).

Only one school support variable was significant for the late persistence model. Schools that focused their efforts to improve student learning increased student odds for persisting and graduating on time as opposed to schools where this was not an identified goal. This process variable reflected the number of reform efforts schools implemented to help students succeed within the classroom (e.g., interdisciplinary teaching, changes in instructional methods, changes in ability grouping, and changes in student assessments). This positive finding should be an encouragement to educators that their efforts are not

fruitless. This implies that if schools need to focus on just one type of support effort to improve persistence, they should consider investing their resources in improving student learning.

Summary

The results between the early persistence phase and late persistence phase were fairly consistent. At the individual level, the majority of the variables were significant in both models. Consistent with previous research on high school dropouts, student demographics, previous school experiences, and students' academic and social engagement influenced student persistence. In contrast, many of the school-level variables (e.g., school support variables, process variables) were not significant in affecting student persistence over time. Some of the non-significant findings may be attributed to the limitations (e.g., how surveys were filled out) of the data set (further discussed in Chapter 3). Despite the presence of only a few significant variables (e.g., public versus private schools, school SES levels), however, the school-level model should not be disregarded. The school findings provide some new insights and also raise several questions for further research. Most importantly, despite the lack of differences found between schools at the school level, it is clear that school processes do affect students' academic performance within schools (e.g., students taking more academic programs, being in school more consistently, being successful in class, being stable within a school).

Implications

In this study, a relatively complex model of individual and school variables was been proposed and tested to examine students' persistence during their high school years. In this section, the results' implications for theory, policy and practice, and future research are discussed.

Implication for Theory

Individual level. Tinto's (1975, 1992) theory on individual departure from institutions in higher education is a commonly used theoretical framework for student persistence studies in higher education. Tinto's theory and previous empirical work on high school dropouts provided preliminary evidence that suggested family background and students' previous school experiences affect students' decisions to stay in school (Lee & Burkam, 2003; Rumberger, 1995; Rumberger & Larson, 1998). In addition, the quality of students' academic and social integration within the school subsequently affected their persistence to graduate (Rumberger & Thomas, 2000; Wehlage et al., 1989). The individual-level findings of this study provided evidence that Tinto's theory may also be used to explain student persistence at the high school level. The explanatory power of the constructs in the individual portion of the model lend support to the view that student persistence consists of an interconnected constellation of academic skills, and social and academic integration variables. Students who develop the necessary academic orientation and skills and are integrated into the school academically and socially are more likely to persist.

Furthermore, the individual-level results further support the rationale for a different approach to studying the dropout problem. By following the majority of students who remain in school and graduate on time, researchers may begin to investigate the process of what keeps students in school rather than the process of why students leave school. Several of the key findings at the individual student level in this study resulted from using the "restricted" transcript files of the NELS:88 data set. Gaining access to more detailed information about student experiences during their high school years helped unlock the "black box" of what happens to adolescents over time academically and socially within their school. Specifically, student academic experiences early in their pre-high school and high school career were strong predictors of their later successes.

School level. The school-level perspective of this study is grounded in multilevel perspectives on organizational processes. More specifically, this suggests that there are features (e.g., structures, leadership processes, goals, rewards) that provide a framework for activities among individuals that take place within organizations. Furthermore, individuals and groups can create conditions that also influence organizational processes and outcomes.

The school-level results showed schools' efforts to integrate students academically and socially (i.e., through support, transition programs, rewards) appear to had little influence on student persistence rates across schools, at least as measured within this data set. This likely represents an area that needs further investigation, especially with more complete school level information (e.g., in data sets with larger within-school samples so student perceptions can be aggregated, as opposed to relying on the perceptions of an individual administrator). In contrast, however, context variables were

more important. School type (i.e., public versus private) and SES were consistent predictors. Although there were only a few significant findings, the school-level results of this study do provide some support for the view that schools differ in their holding power over students. It seems schools affect students both as individuals (i.e., their unique experiences academically) and as groups (i.e., whether they attend public or private schools, or low versus more average or high SES schools). The existing school-level variables in this data set likely do not adequately reflect the potential differences between schools in terms of their holding power over students.

Implications for Policy and Practice

In January of 2002, the United States Congress passed *No Child Left Behind Act* (NCLB) with the intent to amend the *Elementary and Secondary Education Act* of 1965. The purpose of this act was to unite accountability, flexibility, and choice so that no child is left behind. Among some of the concerns, NCLB addressed the improvement in the academic achievement of the disadvantaged and minority groups (e.g., at-risk populations, Native Americans, English-as-second-language students) and the promotion of informed parental choice and innovative programs. The results of this study have several implications for both public policy and school practices.

Educational policies are reflections of the interplay of four policy values: quality (excellence), equity, efficiency, and choice (Marshall, Mitchell, & Wirt, 1989). These policy values provide one way to structure the interpretation of the study's results.

Equity. Both *Goals 2000* and NCLB strive to close the achievement gap between minorities and non-minorities, and the advantaged and disadvantaged. The individual-

level results of this study showed that, compared with Caucasian students, ethnic minority groups tended to fall behind a grade level more frequently (i.e., rather than to drop out at increased levels within their high school years). Likewise, students who were identified as being at risk for dropping out, or having poor social capital (due to their family background), were also likely to fall behind and drop out compare with students who did not have these risk factors. Thus, the recommendation is to provide further school monitoring and assistance for students through the first few years of high school, so that these students do not fall behind early. Furthermore, the influence of students' socioeconomic status at both the individual and school level suggests that students who are financially advantaged (and attend advantaged schools) may have access to additional resources (both in and outside of the school) that help them persist. Previous research has also shown that school context (e.g., low SES) groups are related to mobility. From an equity standpoint, therefore, it is important to consider how educational opportunities can be enhanced for students with low social capital and who may attend schools that are not on equal footing with other schools. Attempts to do this have proven elusive over time.

Choice. One aspect of NCLB is to provide parents with information about schools' annual progress and then allow parents to enroll their child in their school of choice. An implication of this study is that changing schools may not always be in the best interest of the child. Consistent with previous studies (Lee & Burkam, 1992; Rumberger & Larson, 1998), the more school changes an individual experiences, the more likely she will be to fall behind or to drop out. Changing schools more often makes it more difficult for students to learn the routines associated with success in each new setting. Consequently, students are more likely to experience difficulties in integrating

academically by having their academic progress interrupted. In contrast, however, choosing schools may create a stronger vested interest for parents and increase students' supports at home. Therefore, policymakers and educational practitioners should keep parents well informed of the potential benefits and drawbacks to moving students.

Quality. Although only a few school variables were significant, school efforts should not be ignored. The individual-level findings clearly show that school efforts to improve the quality of student life do affect student persistence. The quality of teachers, for example, was not significant at the school level in influencing persistence; however, student perceptions of faculty interactions were significant at the individual level. Another example of the impact of school-level efforts at the individual level was that the type of academic program in which each student was enrolled influenced her or his persistence status. Students who were enrolled in academic curricular programs were more likely complete high school and graduate on time than students who were enrolled in more technical or vocational programs. Therefore, the point is that although school efforts may not be statistically significant at the group level, these processes are vital to the success of individual students. This suggests a need for further investigations regarding the relationships between individual perceptions and group processes.

Efficiency. Many of the school support programs appeared to have little or no influence on persistence rates. The results, however, do have implications for the management of the school. Efficiency issues are not about working harder, but rather smarter. The findings of this study suggest that if schools are to divert any resources or support to improving high school completion rates, their efforts should focus on direct links to the classroom. Random or isolated efforts, such as an 8th grade orientation, may

not be as effective as improving instruction for all 9th grade classrooms. Another example is that a college night for juniors and seniors may be informative to some, but having juniors and seniors develop a portfolio prior to graduation may be a better transition effort to work or higher education. A uniformed, comprehensive effort to help all students may be more effective to helping students persist rather than small, isolated efforts. Transition programs need to be more on-going and integrated into students' academic programs.

Traditionally, high schools evolved to provide a comprehensive set of sources for a diverse, large number of students. From a business or economy-of-scale perspective, efficiency refers to maximizing the number of recipients in the delivery of a given service (Lee & Smith, 1997). There are two results that have implications to school structures. The first is that students who attended schools with high school grade configurations (i.e., 9-12 or 10-12) were less likely to persist. This finding also requires further investigation to understand how structural configurations may affect persistence. For example, it is likely that other types of grade configurations are more often found in rural areas that may have their own problems.

The second finding is that small schools tended to be better at keeping students in school than larger schools. These two findings provide further support for small schools. Consistent with small school research, large comprehensive high schools may not be an effective way to educate students (Lee & Smith, 1997; Raywid, 1999). Small schools allow the main agents of learning (i.e., teachers and students) to be undistracted by the bureaucracy of schools and focus on the substantive issues of education (Lee & Smith, 2001; Walberg & Walberg, 1994). Although it is unlikely that large comprehensive

schools will be downsized into smaller schools, larger school could be organized into other configurations, such as schools-within-a-school and academies, to personalize education and help schools function more efficiently.

Implications for Further Research

The results of this study provide a strong conceptual framework and rationale for future research on student persistence. Although a number of the findings from this study are consistent with previous dropout studies (Croninger & Lee, 2001, Lee & Burkam, 2003; Rumberger & Larson, 1998; Rumberger & Thomas, 2000), the shift in its focus (i.e., studying individuals that remain in school rather than those that leave) has provided a different perspective for examining the persistence problem. The study goes beyond previous research by providing a fairly complete understanding of how the academic and social process unfolds at the individual level. Both models, early persistence phase and late persistence phase, showed that the middle school years and the early years of high school are critical to the persistence process. Students who fall behind early in high school are likely to not recover. Student mobility also contributes to the problem. In addition, these findings provide a strong argument for longitudinal studies. Whether researchers are examining student persistence or the dropping out process, tracking students throughout their high school career is important.

Another important point is for researchers using the National Education Longitudinal Study of 1988 (NELS:88) to make use of the student transcript data files. The information extracted from student transcripts were messy and difficult to compute. However, the information proved to be an invaluable resource. All of the information or

variables exported from the "restricted" transcript files were found to be significant in affecting student persistence. Student GPAs, attendance, and academic programs were a critical aspect of the study. Results have contributed significantly to further understanding of the process of students falling behind academically and eventually dropping out. Student persistence is more completely understood as a problem that unfolds over time with academic performance rather than an individual decision to "disengage" and drop out. The problem likely begins by middle school or elementary school (Alexander, Entwisle, & Kabbani, 2001; Jimmerson, Egeland, Sroufe, & Carlson, 2000).

The conceptual framework (and the theoretical models underlying it) suggests that schools can influence the academic and social engagement of students and their ultimate decision to remain in school and graduate on time. Future research needs to continue to unpack the contextual influences of schools on processes and outcomes such as persistence. For example, what is it about private schools that make students more likely to persist? Even after controlling for student demographics, public schools have less holding power than private schools. Similarly, low SES schools negatively affect persistence rates. Are these proxies for different purposes and levels of support?

The findings in this study also imply that some schools processes or support efforts may positively or negatively affect persistence rates. Publicly honoring student achievement, for example, may actually further disengage students who are not doing well academically from school. In contrast, school efforts to improve student learning may positively affect students in the long term. Clearly, there are some school practices that may help or hinder student persistence through graduation; however, the variables in

this study were not very revealing. Perhaps the inclusion of both teachers' and students' perceptions may be a better measurement of what is going on in schools than one administrator's viewpoint (Heck, 2000). The findings suggest the need for further study about how school processes affect student persistence.

Conclusions

Student persistence is a new perspective for examining the dropout problem. The focus is on the majority group of students who remain in school and graduate within four years, rather than on the minority group of students who leave. While student persistence seems to be most influenced by individual-level factors (e.g., demographics, previous school experiences, academic and social engagement), this study provided hints that some school-level variables also influence persistence. Mostly, they involve school contexts and structures (i.e., public, low SES). The strength of this study is its comprehensiveness in examining the student persistence phenomenon longitudinally and from a multilevel perspective. The study included numerous student and school variables that are robust in nature. It raised a number of questions about how school processes and student experiences are interrelated. These will likely result in future research on how schools contribute to student persistence. Students will be better served if further analyses continue to provide school personnel, administrators, counselors, and teachers with additional options for ways to increase student persistence.

TECHNICAL NOTES

1. Since this study included information during students' scheduled ninth and eleventh grade years (different from the follow-up surveys), access to the "restricted files" of NELS:88 was required. The data are available to researchers holding a license issued by the NCES. A license (control number 030227729) was awarded to Dr. Ronald H. Heck of the University of Hawai'i. In addition, this study had been determined to be exempt from a full review from the Committee of Human Subjects. In accordance with U.S. Department of Health and Human Service regulations, the University awarded a certificate of review (CHS #11529).

2. With many large-scale surveys, individuals with certain characteristics are often over-sampled to provide sufficient numbers for purposes of analysis (Thomas & Heck, 2001). To adjust for such strategies, sample weights are used.

3. The NELS:88 CD-rom data is compatible with both SPSS and SAS statistical software. For this study, the data were recoded and saved as SPSS files. Four unique SPSS files, one for each level of the two models, were created and then converted into a SSM file used in the HLM5 computer software program.

4. The multinomial routine does not permit weighting at the student level. Although the results are reflective of the *unweighted* samples of students and schools, if level-1 variables are grand mean centered, this adjusts for the clustering (i.e., similarities among students in the same school) by producing estimates weighted by their reliability. Because the study's emphasis is on the between-school relations, the reported results compensate relatively well for over-sampled populations at level-1 and should be fairly representative estimates of the students. The over-sampling of some schools (i.e.,

private), however, remains a limitation of the samples (S. L. Thomas, personal communications, 2002).

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APPENDIX A

Table A1. Individual-Level Variables in Model One: Early Persistence Phase

Variable Name	NELS:88 Variable	Description
id	ID	Student identification code
female*	GENDER	Gender: (1 = 0 male, 2 = 1 female)
Asian*	RACE	Ethnicity: (else = 0 other, 1 = 1Asian/P. Islander)
black*	RACE	Ethnicity: (else = 0 other, 3 = 1African Am.)
Hispanic*	RACE	Ethnicity: (else = 0 other, 2 = 1 Hispanic)
Nativeam*	RACE	Ethnicity: (else = 0 other, 5 = 1 Indian/Alaskan)
ses	BYSES	Socioeconomic status composite
sped*	BYHANDPR	8th grader receiving special education services (0 = 0 no, 1 = 1 yes)
atrisk	BYRISK	# of risk factors to dropping out of school (0-6)
lowexp8*	BYS45	Student expects to not go beyond high school (else = 0 other, 1/2 = 1 dropout/high school only)
changed	BYP40	Ed. mobility: # of school changes before 1988 (0-5)
heldback*	BYS74/BYP44	Student held back a grade prior to ninth grade (1/2 = 0 no, 2/1 = 1 yes)
gpa8th	BYGRADS	8th grade grades composite (gpa)
tests8th	BY2XCOMP	8th grade reading and math tests std. scores
Facult10	F1S7G/F1D12G	Faculty interactions (factor): teaching is good (Loadings of 0.748/0.743)
	F1S7H/F1D12H	Faculty interactions (factor): teachers interested (Loadings of 0.820/0.792)
	F1S7I/F1D12I	Faculty interactions (factor): works w/ praise (Loadings of 0.763/0.717)
	F1S7L/F1D12L	Faculty interactions (factor): most teachers listen (Loadings of 0.707/0.688)
lowexp10*	F1S18A/F1D38	Academic engagement: expects high school only
year1gpa	Transcript files	Academic engagement: 1988-89 GPA (ninth grade)
tests10	F12XCOMP	Academic engagement: 1990 std. test scores
noputdow*	F1S7K/F1D12K	Social climate: often feels put down by students
Sclim10	F1S7B/F1D12B	Social climate (factor): school spirit (Loadings of 0.752/0.785)
	F1S7EF1D12E	Social climate (factor): students friendly w/ others (Loadings of 0.752/0.785)
safe10*	F1S7M/F1D12M	Social climate: student feels safe at school
fair10*	F1S7D/F1D12D	Social climate: discipline is fair
no10act*	F1S42/F1D21A-E	Social engagement: no participation in e.c. act.
hiabs_9*	Transcript files	Social engagement: more than 18 absences ('88-'89)
Misbeh10	F1S10C/F1D15C	Social engagement (factor): # times in trouble (Loadings of 0.719/0.810)
	F1S10D/F1D15D	Social engagement (factor): # in-school suspension (Loadings of 0.789/0.769)
	F1S10E/F1D15E	Social engagement (factor): # out-school suspens. (Loadings of 0.765/0.805)
	F1S10F/F1D15F	Social engagement (factor): # disciplinary transfers (Loadings of 0.439/0.466)
persist1	F1UNIV2C	Outcome variable (reverse code; 3 = 1 dropout, 2 = 2 out-of-grade, 1 = 3 in-grade)

Table A2. School-Level Variables in Model One: Early Persistence Phase

Variable Name	NELS:88 Variable	Description
sch_id10	F1SCH_ID	First follow-up school identification code
public*	G10CTRL2	School classification*
urban*	G10URBAN	Location of school district, diocese, or county
transit*	F1C18A	HS transition, 9-12 or 10-12
dept90*	F1C37	Faculty departmentalized
fac_stab*	F1C91B	Emphasis on stable staff/reduce transfer
teachq90	F1C92C-D	% good/excellent teachers
smsch90*	F1SCENRL	School enrollment less than 1000 students
p90_lunc*	F1C30A	50+% students receive free/reduced-price lunch
Att_90	F1C95A	Climate (factor): absences are a problem (Loading of 0.843)
	F1C95B	Climate (factor): tardies are a problem (Loading of 0.857)
	F1C95C	Climate (factor): class-cutting is a problem (Loading of 0.832)
Safe_90	F1C95D	Climate (factor): physical conflicts are a problem (Loading of 0.703)
	F1C95E	Climate (factor): gangs are a problem (Loading of 0.677)
	F1C95F	Climate (factor): robbery and theft are a problem (Loading of 0.603)
	F1C95J	Climate (factor): weapons are a problem (Loading of 0.754)
	F1C95M	Climate (factor): racial conflicts are a problem (Loading of 0.677)
honorach	F1C91F	Extrinsic: recognize academic achievement
Intrins90	F1C93B	Intrinsic (factor): students place high priority on learning (Loading of 0.815)
	F1C93G	Intrinsic (factor): student morale is high (Loading of 0.726)
	F1C93L	Intrinsic (factor): easy to motivate students (Loading of 0.732)
diff90	Composite variable	Difficulty: # of efforts (F1C73E3, H3, P3, Q3, 82, 91D3, 91H)
	F1C73E3	Difficulty: interdisciplinary teaching
	F1C73H3	Difficulty: cooperative learning strategies
	F1C73P3	Difficulty: strategies to address adolescence prob.
	F1C73Q3	Difficulty: alternative school programs
	F1C82	Difficulty: dropout program
	F1C91D3	Difficulty: staff development activities
	F1C91H	Difficulty: monitoring student progress
attendp*	F1C23	Incongruence: school attendance policy
disc90*	F1C93A	Incongruence: discipline emphasized
Incong90	F1C93C	Incongruence (factor): classroom activities highly structured (Loading of 0.650)
	F1C93D	Incongruence (factor): emphasize student achievement (Loading of 0.839)
	F1C93E	Incongruence (factor): expected to do homework (Loading of 0.811)
	F1C93J	Incongruence (factor): encourage academic classes (Loading of 0.680)
homeroom*	F1C73G3	Isolation: homeroom/advisory period

Isolat90	F1C93F	Isolation (factor): teacher morale is high (Loading of 0.817)
	F1C93K	Isolation (factor): positive attitudes about students (Loading of 0.817)
tranprog*	Dummy variable	Adjustment: more than 3 8th grade transition activities (F1C18B-G, I-K)
	F1C18B	Transition: HS students give info to MS students
	F1C18C	Transition: MS students visit HS for assembly
	F1C18D	Transition: MS students attend classes at HS
	F1C18E	Transition: MS parents visit HS when child in MS
	F1C18F	Transition: MS parents visit HS fall orientation
	F1C18G	Transition: summer meetings at HS
	F1C18I	Transition: MS and HS teachers meet
	F1C18J	Transition: MS and HS administrators meet
	F1C18K	Transition: MS and HS counselors meet
transinv*	Dummy variable	Adjustment: at least 1 high school transition activities (F1C18H L, M)
	F1C18H	Transition: buddy or big brother/sister program
	F1C18L	Transition: no activities until students arrive
	F1C18M	Transition: other school initiatives

Capitalized variables: variables starting with a capital letter are factors
** indicates a dummy-coded variable*

APPENDIX B

Table B1. Individual-Level Variables in Model Two: Late Persistence Phase

Variable Name	NELS:88 Variable	Description
id	ID	Student identification code
female*	GENDER	Gender: (1 = 0 male, 2 = 1 female)
Asian*	RACE	Ethnicity: (else = 0 other, 1 = 1Asian/P. Islander)
black*	RACE	Ethnicity: (else = 0 other, 3 = 1African Am.)
Hispanic*	RACE	Ethnicity: (else = 0 other, 2 = 1 Hispanic)
Nativeam*	RACE	Ethnicity: (else = 0 other, 5 = 1 Indian/Alaskan)
ses	BYSES	Socioeconomic status composite
heldback*	BYS74/BYP44	Student held back a grade prior to ninth grade (1/2 = 0 no, 2/1 = 1 yes)
atrisk	BYRISK	# of risk factors to dropping out of school (0-6)
lowexp8*	BYS45	Student expects to not go beyond high school (else = 0 other, 1/2 = 1 dropout/high school only)
sped*	BYHANDPR	8th grader receiving special education services (0 = 0 no, 1 = 1 yes)
year1gpa	Transcript files	Academic background: 1988-1989 GPA
hiabs9	Transcript files	Social background: more than 18 absences ('88-'89)
dropout	F1UNIV2C	Persistence status at 10th grade (0= other, 1= dropout)
out-of-grade	F1UNIV2C	Persistence status at 10th grade (0= other, 1=out-of-grade)
moved*	F2S102/F2D80A	Mobility: moved homes after 8th grade
changed1*	F2S103/F2D86	Mobility: changed schools 1x between 8th – 12th grade
changed2*	F2S103/F2D86	Mobility: changed schools 2x or more between 8th –12th
Facult12	F2S7C/F2D18C	Faculty interactions (factor): teaching is good (Loadings of 0.897/0.911)
	F2S7DF2D18D	Faculty interactions (factor): teachers are interested (Loadings of 0.897/0.911)
lowexp12*	F2S67A/F2D31	Academic engagement: expects high school only
year3gpa	Transcript files	Academic engagement: 1990-91 GPA (11th grade)
tests12	F22XCOMP	Academic engagement: 1992 std. test scores
acadprgm*	Transcript files	Academic climate: high school program (3/6 = 0 other, 1/2/4/5 = 1 academic)
Sclim12	F2S7A/F2D18A	Social climate (factor): school spirit (Loadings of 0.779/0.808)
	F2S7B/F2D18B	Social climate (factor): students friendly w/ others (Loadings of 0.779/0.808)
safe12*	F2S7E/F2D18F	Social climate: students feel safe at school
fair12*	F2S7L/none	Social climate: discipline is fair
hiabs_11*	Transcript files	Social engagement: more than 18 absences (90-91)
Misbeh12	F2S9D/F2D19D	Social engagement (factor): # times in trouble (Loadings of 0.675/0.819
	F2S9E/F2D19E	Social engagement (factor): # in-school suspension (Loadings of 0.812/0.840
	F2S9F/F2D19F	Social engagement (factor): # out-school suspensions (Loadings of 0.831/0.822)
	F2S9G/F2D19G	Social engagement (factor): # disciplinary transfer (Loadings of 0.675/0.350)
Persist2	F2RTROUT (Transcript files)	Outcome variable: (7/9/11= 1 dropout, 6 = 2 still enrolled, 5/12 = 3 certificate or GED, 1-4 = 1 diploma)

Table B2. School-Level Variables in Model Two: Late Persistence Phase

Variable Name	NELS:88 Variable	Description
sch_id12	F2SCH_ID	Second follow-up school identification code
public92*	G12CTRL1	School classification (0 = other, 1 = public)
urban92*	G12URBN3	Location of school district, diocese, or county (0 = other, 1 = urban)
trans92*	F1C18A	HS transition (0 = other, 1 = 9-12 or 10-12)
dept92*	F2C30	Faculty departmentalized (0 = no, 1 = yes)
smsch92*	F2SCENRL	School enrollment less than 1000 (0 = 1000 or more, 1 = under 1000)
p92_lunc	F2C25A	50+% students receive free/reduced-price lunch (0 = 50% or less, 1 = more than 50%)
acadsch*	F2C49	School offers AP course(s) (0 = no, 1 = yes)
Att_92	F2C47A	Climate (factor): absences are a problem (Loading of 0.876)
	F2C47B	Climate (factor): tardies are a problem (Loading of 0.849)
	F2C47C	Climate (factor): class-cutting is a problem (Loading of 0.858)
Safe_92	F2C47D	Climate (factor): physical conflicts are a problem (Loading of 0.744)
	F2C47E	Climate (factor): gangs are a problem (Loading of 0.722)
	F2C47F	Climate (factor): robbery and theft are a problem (Loading of 0.747)
	F2C47J	Climate (factor): weapons are a problem (Loading of 0.782)
gradtest	F2C42	Extrinsic: test required for HS diploma (0 = no, 1 = yes)
Intrin92	F2C56B	Intrinsic (factor): students place high priority on learning (Loading of 0.787)
	F2C56H	Intrinsic (factor): student morale is high (Loading of 0.714)
	F2C56I	Intrinsic (factor): easy to motivate students (Loading of 0.745)
diff92	Composite variable	Strategies: Number of reform efforts (F2C53C, D, F, G)
	F2C53C	Difficulty: changes in ability grouping
	F2C53D	Difficulty: changes in instructional methods
	F2C53F	Difficulty: interdisciplinary teaching
	F2C53G	Difficulty: changes in assessment
Disc92*	F2C56A	Discipline emphasized (0 = no, 1 = yes)
Incong92	F2C56C	Incongruence (factor): classroom act. highly structured (Loading of 0.502)
	F2C56D	Incongruence (factor): emphasize student achieve. (Loading of 0.746)
	F2C56F	Incongruence (factor): expected to do homework (Loading of 0.717)
	F2C56L	Incongruence (factor): encourage academic classes (Loading of 0.700)
Isolat92	F2C56G	Isolation (factor): teacher morale is high (Loading of 0.784)
	F2C56E	Isolation (factor): positive attitudes about students (Loading of 0.784)
progeff*	Dummy variable	Special programs: more than 4 programs (F2C18A-I)
	F2C18A	Adjustment: community work training

	F2C18B	Adjustment: project alert
	F2C18C	Adjustment: truancy/dropout program
	F2C18D	Adjustment: workplace learning
	F2C18E	Adjustment: adult mentorship
	F2C18F	Adjustment: basic computer training
	F2C18G	Adjustment: computer programming
	F2C18H	Adjustment: principal scholarship program
	F2C18I	Adjustment: motivational program
workeff*	Dummy variable	Work efforts: more than 3 support efforts (F2C15A-F)
	F2C15A	Work transition: interest inventories
	F2C15B	Work transition: job fairs
	F2C15C	Work transition: letters of recommendation
	F2C15D	Work transition: practice interviews
	F2C15E	Work transition: arrange interviews
	F2C15F	Work transition: job placement courses
colleff*	Dummy variable	Higher education support: more than 4 (F2C12A-F)
	F2C12A	College transition: encourage college visits
	F2C12B	College transition: contact parents regarding college
	F2C12C	College transition: assist with college applications
	F2C12D	College transition: assist with financial aid forms
	F2C12E	College transition: contact colleges for students
	F2C12F	College transition: write letters of recommend.
voceff*	Dummy variable	Vocational services: more than 4 programs (F2C9A-H)
	F2C9A	Vocational services: job placement
	F2C9B	Vocational services: employment transition counseling
	F2C9C	Vocational services: cooperative education program
	F2C9D	Vocational services: work experience program
	F2C9E	Vocational services: voc interest/ability assessments
	F2C9F	Vocational services: tech-prep programs
	F2C9G	Vocational services: vocational ed. sex bias elimination
	F2C9H	Vocational services: vocational student organizations

APPENDIX C

Table C1. Transcript File Variables

Variable Name	*NELS:88 Variable*	*Description*
absent9	F2RAB88	Number of days absent 88-89
hiabs88	Dummy variable	Social engagement: *absent9* >18 days
absent10	F2RAB89	Number of days absent 89-90
hiabs89	Dummy variable	Social engagement: *absent10* >18 days
absent11	F2RAB90	Number of days absent 90-91
hiabs90	Dummy variable	Social engagement: *absent11* >18 days
absent12	F2RAB91	Number of days absent 91-92
hiabs91	Dummy variable	Social engagement: *absent12* >18 days
persist2	F2RTROUT	1992 educational outcome reported on transcripts
acadprgm*	F2RTRPRG	Course-taking data reflects academic program
id	STU_ID	Student identification codes
year	F2RYEAR	School year in which course was taken
credit	F2RSCRED	Standardized credit, in Carnegie units
lettergr	F2GRADE	Standardized course grade

(Restricted Access only)

Student Record File

The student record section of the transcript file provided a more accurate account for student absences, graduation status, and curricular track. From this school-reported data, dummy coded variables were created for students who were absent for more than 18 days per school year (10 percent of the 180 days, an estimate for the average school calendar year). In addition, information on students' course-taking patterns was categorized into several curricular programs. In turn, a dummy coded variable was created to reflect whether a student belonged in an academic track or not. Lastly, the outcome variable for the second model was extracted from the transcript file. As stated before, this is the most accurate and preferred means for reporting students' graduation status.

Course Data File

Although seven items were originally selected from the course data section of the transcript file which is only available on the "Restricted Access" file (permission was granted from NCES in February 2003)[1], only four were needed to compute the total number of credits earned and the cumulative grade point average for each year of high school. Although the majority of sample members had transcript information, some were missing information.

Because some of the students were not promoted to the tenth grade during the 1989-1990 school year, the school year, *year*, in which a course was taken, was used to isolate the desired student records instead of student grade levels. Course records helped calculate students' credits and grade point averages for the first through fourth year of high school. According to Ingles et al. (1995), a Carnegie unit is a standard measurement used in secondary education to represent the completion of a course that meets one period per day per one year. To compute to the total number of credits earned for each school year, cases were first selected by the desired year and then aggregated for each individual. For example, to calculate the credits earned during 1988-1989 school year, set *year* to equal 88. Next, since each course is listed separately, the data needed to aggregated by the students' identification code. By setting aggregate function to SUM, a new file was created with the each student id and the total number of credits earned in 1988-1989.

A similar, but slightly more creative, method was used to compute students' grade point averages (GPA). The grade point averages for each school year were calculated separately. First, course grades were recoded into a four-point grading scale (4 points for

A+, A, and A-, 3-points for B+, B, B-, etc.). Pass, unsatisfactory/no pass, withdrawal, and incomplete grades were not given a numerical value. The second step consisted of deleting the credits for a "pass" grade as these credits are not averaged into student GPA's. By multiplying a dummy variable (0 = pass grade, 1 = letter grades) to the Carnegie unit earned for each course and then aggregating the data, the total number of credits used to compute the GPA was obtained. Since schools vary in the number of terms per school year, the Carnegie units awarded for each course also varied. Therefore, the fourth step was to weight each letter grade according to its Carnegie unit. The sum of these weighted grades were then divided by the total (letter grade) credits earned to obtain the GPA for that school year. An example of this process is given below.

Table C2. Sample Calculations of Student GPA

Student 1	Carnegie	Grade	Pass Grade	GPA Credit	Letter Grade	Weighted
English	1	C+	1	1	2	2
Mathematics	1	A-	1	1	4	4
Social Studies	1	B	1	1	3	3
Science	1	C-	1	1	2	2
Foreign Language	1	B+	1	1	3	3
Computers	0.5	D	1	0.5	1	0.5
Physical Education	0.5	Pass	0	0		
Totals	6			5.5		14.5
			GPA	**2.6363636**		

APPENDIX D

Model One: Early Persistence Phase "Unweighted" Descriptives

	N	Mean	SD	Min	Max
School Level					
School structures					
Public	1018	0.81	0.39	0.00	1.00
Urban	1018	0.36	0.48	0.00	1.00
Transition school	1018	0.92	0.27	0.00	1.00
Departmentalized	1018	0.94	0.23	0.00	1.00
Student composition					
Small school (<1000)	1018	0.48	0.50	0.00	1.00
50%+ on free/reduced	1018	0.31	0.27	0.00	1.00
School climate					
Faculty stability	1018	0.72	0.44	0.00	1.00
Teacher quality	1018	80.16	14.96	0.00	100.00
Attendance problems	1018	0.00	1.00	-2.07	2.40
Safety problems	1018	0.00	1.00	-1.22	5.82
Academic support					
Honor achieve. (extrinsic)	1018	0.92	0.26	0.00	1.00
Student mot. (intrinsic)	1018	0.00	1.00	-3.92	1.99
Social support					
Difficult/strategies	1018	3.65	1.40	0.00	7.00
Attendance policy	1018	0.70	0.45	0.00	1.00
Incongruence/high expect.	1018	0.00	1.00	-4.11	1.49
Homeroom	1018	0.31	0.45	0.00	1.00
Isolate/teacher attitudes	1018	0.00	1.00	-4.37	1.47
Transition involvement	1018	0.67	0.47	0.00	1.00
Transition programs	1018	0.36	0.48	0.00	1.00
Student Level					
Student demographics					
Female	13177	0.51	0.50	0.00	1.00
Asian	13177	0.06	0.23	0.00	1.00
African American	13177	0.09	0.29	0.00	1.00
Hispanic	13177	0.11	0.31	0.00	1.00
Native American	13177	0.01	0.10	0.00	1.00
Socioeconomic status	13177	-0.01	0.79	-2.97	2.56
Academic background					
Previously held back	13177	0.13	0.34	0.00	1.00
Changed schools	13177	1.09	1.36	0.00	5.00
At-risk	13177	0.61	0.90	0.00	6.00
Low expectations at 8th	13177	0.10	0.30	0.00	1.00
Special education	13177	0.03	0.18	0.00	1.00

Eighth grade GPA	13177	2.99	0.73	0.50	4.00
Eighth grade test scores	13177	52.03	10.06	30.93	75.81
Academic engagement					
Faculty interactions	13177	0.00	1.00	-3.70	2.32
Low expectations at 10th	13177	0.03	0.17	0.00	1.00
Ninth grade GPA	13177	2.65	0.69	0.00	4.00
Tenth grade test scores	13177	51.74	9.85	30.31	71.82
Social engagement					
Positive peer relations	13177	0.19	0.40	0.00	1.00
Social climate of school	13177	0.00	1.00	-3.67	1.92
Feels safe at school	13177	0.90	0.29	0.00	1.00
Fair discipline	13177	0.68	0.47	0.00	1.00
No participation in act.	13177	0.34	0.47	0.00	1.00
High absences in 9th	13177	0.05	0.22	0.00	1.00
Misbehaviors in 10th	13177	0.00	1.00	-0.90	16.00

APPENDIX E

Model Two: Late Persistence Phase "Unweighted" Descriptives

	N	Mean	SD	Min	Max
School Level					
School structures					
Public	1150	0.83	0.38	0.00	1.00
Urban	1150	0.35	0.48	0.00	1.00
Transition school	1150	0.83	0.38	0.00	1.00
Departmentalized	1150	0.95	0.22	0.00	1.00
Student composition					
Small school (<1000)	1150	0.47	0.49	0.00	1.00
50%+ on free/reduced	*1150*	*0.12*	*0.32*	*0.00*	*1.00*
School climate					
Attendance problems	1150	0.00	1.00	-1.88	2.30
Safety problems	1150	0.04	1.04	-1.18	5.55
AP courses offered	1150	0.81	0.38	0.00	1.00
Academic support					
Graduation test. (extrinsic)	1150	0.55	0.47	0.00	1.00
Student mot. (intrinsic)	1150	0.00	1.00	-3.11	1.68
Social support					
Difficult/strategies	1150	1.59	1.21	0.00	4.00
Incongruence/high expect.	1150	0.00	1.01	-4.11	1.49
Isolate/teacher attitudes	1150	0.67	0.47	0.00	1.00
Special program efforts	1150	0.66	0.47	0.00	1.00
Transition to work efforts	1150	0.80	0.40	0.00	1.00
Transition to college efforts	1150	0.79	0.41	0.00	1.00
Vocational program efforts	1150	0.66	0.43	0.00	1.00
Student Level					
Student demographics					
Female	12329	0.50	0.50	0.00	1.00
Asian	12329	0.06	0.24	0.00	1.00
African American	12329	0.09	0.28	0.00	1.00
Hispanic	12329	0.10	0.30	0.00	1.00
Native American	12329	0.01	0.09	0.00	1.00
Socioeconomic status	12329	0.03	0.79	-2.98	2.30
Academic background					
Previously held back	12329	0.13	0.33	0.00	1.00
Changed schools once	12329	0.09	0.26	0.00	1.00
Changed schools 2 or more	12329	0.03	0.15	0.00	1.00
Moved homes in high school	12329	0.26	0.41	0.00	1.00
At-risk	12329	0.58	0.88	0.00	5.00
Low expectations at 8th	12329	0.08	0.27	0.00	1.00

Special education at 8th	12329	0.03	0.17	0.00	1.00
Ninth grade GPA	12329	2.69	0.72	0.00	4.00
High absences in 9th	12329	0.05	0.21	0.00	1.00
Dropped out at 10th	12329	0.01	0.11	0.00	1.00
Out-of-grade at 10th	12329	0.02	0.15	0.00	1.00
Academic engagement					
Faculty interactions at 12th	12329	0.00	1.00	-3.52	1.80
Low expectations at 12th	12329	0.06	0.23	0.00	1.00
Eleventh grade GPA	12329	2.69	0.71	0.00	4.00
Twelfth grade test scores	12329	52.22	8.99	27.86	71.04
Enrolled in academic prog.	12329	0.82	0.37	0.00	1.00
Social engagement					
Social climate of school	12329	0.00	1.00	-3.45	2.02
Feels safe at school	12329	0.91	0.29	0.00	1.00
Fair discipline	12329	0.68	0.45	0.00	1.00
High absences in 11th	12329	0.13	0.26	0.00	1.00
Misbehaviors in 12th	12329	0.00	1.00	-0.77	17.14

APPENDIX F

Mathematical Equations Used in Final Analyses

Mathematical Equations used for Model One Analyses

The mathematical equations used in the analyses of the first model of the high school persistence process are given below. The sampling model, link function, and level-two equations were used to calculate log-odds of dropping out or being out-of-grade (behind or ahead of 10th grade) in relation to being in-grade (10th grade) after two years of high school.

Level-1 Sampling Model

Prob[Y(1) = 1|B] = P(dropping out)
Prob[Y(2) = 1|B] = P(in school, out-of-grade)
Prob[Y(3) = 1|B] = P(in school, in-grade) = 1 - P(dropping out) - P(out-of-grade)

Level-1 Link Function (only the first category is shown below)

Category 1: Dropping out

log[P(1)/P(3)] = B0(1) + B1(1)*(SPED) + B2(1)*(LOWEXP8) + B3(1)*(FEMALE) + B4(1)*(ASIAN) + B5(1)*(HISPANIC) + B6(1)*(BLACK) + B7(1)*(NATIVEAM) + B8(1)*(HELDBACK) + B9(1)*(NO10ACT) + B10(1)*(FAIR10) + B11(1)*(LOWEXP10) + B12(1)*(SAFE10) + B13(1)*(PUTDOW10) + B14(1)*(HIABS_88) + B15(1)*(MISBEH10) + B16(1)*(FACULT10) + B17(1)*(SCLIM10) + B18(1)*(YEAR1GPA) + B19(1)*(TESTS10) + B20(1)*(CHANGED) + B21(1)*(SES) + B22(1)*(GPA8TH) + B23(1)*(ATRISK) + B24(1)*(TESTS8)

Level-2 Model (only intercept equation shown below)

Category 1: Dropping out

B0(1) = G00(1) + G01(1)*(TRANSIT) + G02(1)*(DEPT90) + G03(1)*(URBAN) + G04(1)*(PUBLIC)+ G05(1)*(ATT_90) + G06(1)*(SAFE_90) + G07(1)*(SMSCH90) + G08(1)*(ATTENDP)+ G09(1)*(P90_LUNC) + G010(1)*(HOMEROOM) + G011(1)*(HONORACH) + G012(1)*(FACSTAB)+ G013(1)*(TEACHERQ) + G014(1)*(INCONG90) + G015(1)*(INTRIN90) + G016(1)*(ISOLAT90) + G017(1)*(DIFF90) + G018(1)*(TRANSINV) + G019(1)*(TRANPROG) + U0(1)

Mathematical Equations Used Model Two Analyses

The mathematical equations used in the analyses of the second model of the high school persistence process are given below. The sampling model, link function, and level-two equations were used to calculate log-odds of dropping out or still in school in relation to graduating on time.

Level-1 Sampling Model

Prob[Y(1) = 1|B] = P(dropping out)
Prob[Y(2) = 1|B] = P(still in school)
Prob[Y(3) = 1|B] = P(graduating) = 1 - P(dropping out) - P(still in school)

Level-1 Link Function (only the first category is shown below)

Category 1: Dropping out
log[P(1)/P(3)] = B0(1) + B1(1)*(SPED) + B2(1)*(LOWEXP8) + B3(1)*(FEMALE) + B4(1)*(ASIAN) + B5(1)*(HISPANIC) + B6(1)*(BLACK) + B7(1)*(NATIVEAM) + B8(1)*(HELDBACK) + B9(1)*(PERSIST1) + B10(1)*(YEAR1GPA) + B11(1)*(SES) + B12(1)*(ATRISK) + B13(1)*(FAIR12) + B14(1)*(NO12ACT) + B15(1)*(LOWEXP12) + B16(1)*(MISBEH12) + B17(1)*(SAFE12) + B18(1)*(FACULT12) + B19(1)*(SCLIM12) + B20(1)*(MOVED) + B21(1)*(CHANGED1) + B22(1)*(CHANGED2) + B23(1)*(YEAR3GPA) + B24(1)*(TESTS12) + B25(1)*(ACADPROG) + B26(1)*(HABSENT9) + B27(1)*(HABSEN11)

Level-2 Model (only intercept model is shown below)

Category 1: Dropping out
B0(1) = G00(1) + G01(1)*(PUBLIC92) + G02(1)*(URBAN92) + G03(1)*(DEPT92) + G04(1)*(GRADTEST) + G05(1)*(ACADSCH) + G06(1)*(DISC92) + G07(1)*(TRANS92) + G08(1)*(SMSCH92) + G09(1)*(P92_LUNC) + G010(1)*(VSMSCH92) + 011(1)*(INTRIN92) + G012(1)*(ISOLAT92) + G013(1)*(INCONG92) + G014(1)*(VOCEFF) + 015(1)*(PROGEFF) + G016(1)*(COLLEFF) + G017(1)*(WORKEFF) + G018(1)*(DIFF92) + G019(1)*(SAFE_92) + G020(1)*(ATT_92) + U0(1)