School Engagement: Testing the Factorial Validity, Measurement, Structural and Latent Means Invariance between African American and White Students

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Abstract

This study was designed to accomplish three main objectives. The first objective was to test the hypothesis that school engagement is a multidimensional construct with three factors: behavioral, emotional, and cognitive or academic engagement. The second objective was to test for invariance of the measurement and factorial structures of school engagement across white and African-American students. And the third objective of the study was to test for invariance of the latent mean structures of school engagement across white and African-American students.

In order to accomplish the objectives of the study a step by step approached, using structural equation modeling, was followed. First, the best fitting model of school engagement for both white and African American students were identified. Second, invariance of the number of underlying factors of school engagement across white and African-American students was tested. Third, invariance of factor loadings across the two racial/ethnic groups was tested. Fourth, invariance of the factor variances and covariances was tested. Fifth, latent mean structures of school engagement between white and African-American were compared. Finally, the results of the calibrating sample were cross-validated with the second half of the sample.

Results from this study produced consistent support for a three-factor model of school engagement and without cross-loadings to other dimensions of school

engagement. However, some parameters including factor loadings, factor variances and latent means were found non-invariant across white and African American students. African American students rated themselves statistically significantly higher on emotional engagement than white students. In addition, weaknesses in the measurement model especially the reliability coefficients of observed indicators and variance accounted for by the latent factors were identified. Cognitive engagement proved to be the most difficult to measure among all three dimensions of school engagement. Finally, analysis of the cross-validating sample produced some important differences which included one additional non-invariant factor loading, one factor covariance, and one additional latent mean difference between white and African American students.

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[1] W=white; B=African American

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CHAPTER ONE

INTRODUCTION

This dissertation presents a validation study of the construct of school engagement. The study was designed to accomplish three main objectives. The first objective was to test the hypothesis that school engagement is a multidimensional construct with three factors (instead of two or one): behavioral, emotional, and cognitive[2] or academic engagement. The second objective was to test for invariance of the measurement and factorial structures of school engagement across white and African American students. And the third objective of the study was to test for invariance of the latent mean structures of school engagement across white and African American students.

The study was based on self-reported measures of school engagement from students of five high schools in a mid-sized central city's school district in the State of Virginia who participated in the 2004 High School Survey of Student Engagement (HSSSE). The HSSSE contains indicators of school quality including the extent students find academic work challenging, degree to which they are active learners, the extent and quality of student/teacher interactions, peer relations, the richness of out of classroom experiences, school climate, and the exposure to diverse cultural experiences (Indiana University, 2005). The HSSSE provides the largest national database on school engagement, using a single instrument across various types of high schools in different settings (Indiana University, 2005).

This first chapter provides broad definitions of school engagement, presents the background of the study, specifies the problem and significance of the study, and presents an overview of the methodology. The chapter concludes by describing the delimitations

[2] In this study, cognitive and academic engagements are used as synonymous.

of the study, providing a summary and defining the special terms used in this study.

School Engagement Defined

A broad definition describes school engagement as "a student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Newmann, Wehlage, & Lamborn, 1992). Newmann and his colleagues (1992) further elaborated that engagement involves more than willingness to complete assigned school tasks (behavioral engagement) and acquiring good grades (engagement outcome). Engagement includes "an inner quality of concentration and effort to learn," that should be viewed "on a continuum from less to more, not as a dichotomous state of being either engaged or unengaged" (Newmann et al., 1992). Newmann et al. (1992) argued that using behavioral engagement alone could be misleading because students can be attending class, turning in assignments, or performing school procedures and routines, without being committed to mastering knowledge, skills, and crafts.

Connell (1990) defined school engagement as patterns of actions reflecting acceptance of and commitment to the goals of learning and successful school performance. According to Connell's definition, school engagement is made up by three distinct facets or dimensions: behavioral, emotional, and cognitive engagement. Yet another definition of school engagement was provided by Skinner & Belmont (1993) as follows:

> Engagement includes both behavioral and emotional components. Children who are engaged show sustained behavioral engagement in learning activities accompanied by positive emotional tone. They select tasks at the border of their

> competencies, initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity, and interest.

Based on the definitions described above, this study postulated that school engagement involves both the observable behavior (behavioral engagement), and the psychological experience of the student. The latter encompasses an affective (emotional engagement) and a cognitive component (Fredricks, Bluemenfeld, & Paris, 2004). Therefore, as evidenced by these definitions and according to theory, school engagement is more than academic or cognitive engagement. In addition to encompassing academic engagement, school engagement also includes students' feelings about their school, their sense of belonging, attachment and membership within the social fabric of the school, and also a willingness to adhere to school rules, get involved in learning tasks, showing up, paying attention in class and participating in extracurricular activities (Johnson, Crosnoe, & Elder, 2001). In other words, academic engagement is only one component of a multifaceted construct called school engagement.

Background of the Study

In the current educational environment, U.S. public schools are expected to graduate all students with academic skill levels equivalent to that of a college-bound student, including economically disadvantaged and not disadvantaged students, minority and non-minority students, students with and without disabilities, and English Language Learners status. Public schools are expected to create an environment that provides equal

educational opportunities for success and the necessary supports for all students to achieve the new educational goals (Jimerson, Campos, & Greif, 2003). Under Title I of the No Child Left Behind Act (Public Law 107-110, January 8, 2002), schools that do not meet the required standards of excellence, fail to make adequate yearly progress (AYP) towards these standards, or do not make AYP to eliminate the achievement gap among student subgroups, will be identified as schools needing improvement and will be held accountable for their students' educational achievement, or lack thereof.

As a result of increased focus on accountability – meaning standardized test scores – most research on school effectiveness has focused on academic achievement (Fullarton, 2002) and less attention has been paid to how schools motivate and engage their students in the learning process and in school life. However, school engagement has been consistently associated with, and is presumed to be a precursor of, student achievement (Boekarts, Pintrich, & Zeidner, 2000; Fredricks et al., 2004; Voelkl, 1997) and, therefore, should be evaluated with the same commitment.

As a result in recent years the concept of school engagement has been receiving increased attention from researchers, policy makers and educators because they consider it an important precursor of positive school outcomes. For instance, school engagement has been positively associated with academic achievement (Connell & Wellborn, 1991; Marks, 2000; Skinner, Wellborn, & Connell, 1990), and negatively correlated with dropping out of school (Audas & Willms, 2001). Further, there is consensus among researchers that, for learning to take place, there must be a close connection between schools and students (Carini, Kuh, & Klein, 2004; Fredricks et al., 2004); in other words, even if schools offer good academic opportunities high levels of school engagement are a

prerequisite to produce important student outcomes such as academic achievement, high school graduation, and postsecondary educational aspirations. Also, research has demonstrated that school engagement is associated with other positive outcomes such as adherence to school and classroom rules, persistence, hard work, and achievement motivation. Furthermore, high levels of school engagement are believed to be a solution to problems like student alienation, misbehavior, dropout, and boredom (Fredricks et al., 2004; National Research Council & Institute of Medicine, 2004).

In addition to being an essential mechanism of learning and related to lifelong learning (Johnson et al., 2001), school engagement is presumed to be alterable and responsive to changes in school characteristics, interactions between school agents and students, and changes within the individual student. This is in contrast with students' demographic variables such as gender, race, parents' education, and socio-economic status which are inherent characteristics and cannot be manipulated by school administrators or policy makers. Though demographics are linked to readiness to learn and academic achievement among children, they cannot be changed as can school engagement.

Furlong et al. (2003) separated school context that impact school engagement into four components: the individual student, peers, teachers, and the school. Further, when examining the role of students in school engagement, Furlong et al. (2003) identified three separate components of school engagement. The first component included observable behavior of the student. The second and third components included the internal psychological experience of the student, which in turn includes affective and cognitive qualities (Furlong et al., 2003).

The Problem Statement

While several studies have emphasized the effect of school engagement on the outcomes of schooling, there are no clear and consistent theoretical and operational definitions of school engagement (Fredricks et al., 2004; Johnson et al., 2001; Norris, Pignal, & Lipps, 2003). There is little consensus among researchers about what school engagement is and its internal structure, how it is conceptually and operationally defined, and what methods and informants/subjects to use to measured it. As a result, many differences in findings among empirical research studies on school engagement simply may be due to differences in definitions and ways to assessing school engagement (Chapman, 2003). For example, Johnson et al. (2001) used three indicators of school engagement they recognized as capturing "a fairly minimal level of engagement," mainly tapping behavioral engagement. Based on these measures, they found African American students with higher levels of school engagement than white and Latino students. However, the school engagement measures they used did not differentiate students at higher levels of engagement. As a result, their finding may be interpreted as showing that African American students may be more likely to be more "minimally engaged," but not necessarily the most engaged in school. Moreover, it is quite possible that some students may be behaviorally engaged but academically disengaged in school; but it would be impossible to capture these differences if the operational definitions of school engagement do not include measures of both academic and behavioral engagement or a range of school engagement sub-types within dimensions of the construct.

Measures of School Engagement

At the present time, researchers use a variety of definitions and measures related to school engagement (Jimerson et al., 2003). School engagement has been operationally defined in many different ways, from student's effort, persistence, concentration, attention, participation in school work and their positive conduct, to their participation in extracurricular activities and the absence of disruptive behavior (Finn, 1989; Fredricks et al., 2004). Measures of emotions related to school, schoolwork, and people at school have also been used as indicators of school engagement (Fredricks et al., 2004; Furrer & Skinner, 2003; Libbey, 2004). Furthermore, school engagement has been conceptualized as psychological investment in learning and cognitive strategy used, using indicators such as preference for hard work, ways of dealing with failure, flexible problem solving, task-focus, persistence, regulating attention, relating new information to existing knowledge, and monitoring comprehension (Greene & Miller, 1996). See Appendix H for a sample of the diversity of operational definitions of school engagement in empirical research.

Methods to Measure School Engagement

In addition to diverse operational definitions, different methods have been used to measure school engagement. Self-report measures, rating scales, direct observations, work sample analysis, and case studies have been used to measure students' school engagement (Chapman, 2003; Fredricks et al., 2004). For instance, self-reported measures use survey items which ask students to report on issues like their attention in class, mental effort exerted on school tasks, and persistence. Students are also asked about their intellectual and emotional response levels during class and reactions to

learning tasks. However, the validity and reliability of the data collected through self-reported scales varies greatly with students' ability to measure their own cognitions, behaviors, and emotional responses; therefore, many times other methods such as direct observations are used to verify students self-reported ratings of school engagement (Fredricks et al., 2004).

Some researchers use work samples to measure levels of engagement or students' use of higher cognitive strategies to deal with learning tasks (Chapman, 2003). Additionally, case studies have been used when studying small groups of students, which allow researchers to measure students' interactions with teachers, peers, and staff in the classroom and school (Fredricks et al., 2004). Furthermore, there are methods for measuring experience that are classified depending on the timing of measurement: (a) "interval contingent," where participants respond to questions of a survey instrument at regular intervals, (b) "signal contingent," where participants respond to a survey instrument when signaled, and (c) "event contingent," where participants respond when an event takes place (Moneta & Csikszentmihalyi, 1996). Experience sampling method (ESM) is a signal contingent technique that measures students' location, activity, and affective and cognitive experiences at random moments (Shernoff et al., 2003). Students are given an electronic pager and after being signaled at random several times during the day, they complete an experience sampling form containing questions about their location, their thoughts, and the primary and secondary activities they were engaged. ESM may include not only students' time in school but also outside of school such as time at home, with relatives, with friends, and in solitude (Moneta & Csikszentmihalyi, 1996).

Subjects Utilized to Measure School Engagement

The subjects utilized to measure school engagement also differ. Some studies use teacher rating scales to complement the measurement of students' self-reported engagement (Skinner & Belmont, 1993). They request teachers to measure students' participation in school tasks as well as emotional reactions to these tasks. In addition, researchers use direct observations to record whether a student's behavior was present or absent at the end of a time interval. Students' behaviors are identified as engaged or disengaged when the observation takes place (Fredricks et al., 2004). However, third persons' account of students' cognitive engagement can be very unreliable because this type of engagement is not readily observable.

Study Rationale

School engagement is a theoretical construct that is not directly observable and, therefore, inferences about it must depend on observed variables that are presumably indicators of the construct (Pedhazur & Schmelkin, 1991). One must operationally define school engagement in terms of behavior(s) assumed to represent it. As such, school engagement must be linked to one or more observed indicators, in this manner making its measurement feasible. As a result, the measurement component that links observed indicators to the concept of school engagement is very important.

In addition, to be scientifically meaningful, school engagement has to be part of a theoretical framework that explains its relationship with other constructs. But in order to test hypotheses about relationships among constructs it is necessary to relate constructs to observed phenomena (Pedhazur & Schmelkin, 1991). This is attained by means of empirical or operational definitions of constructs, and these relate constructs to their

observed indicators. Moreover, operational definitions must be related to, and must correspond with, their theoretical definitions. Therefore, if the theoretical definition of school engagement defines it as multidimensional, the operational definition should include multidimensional measures.

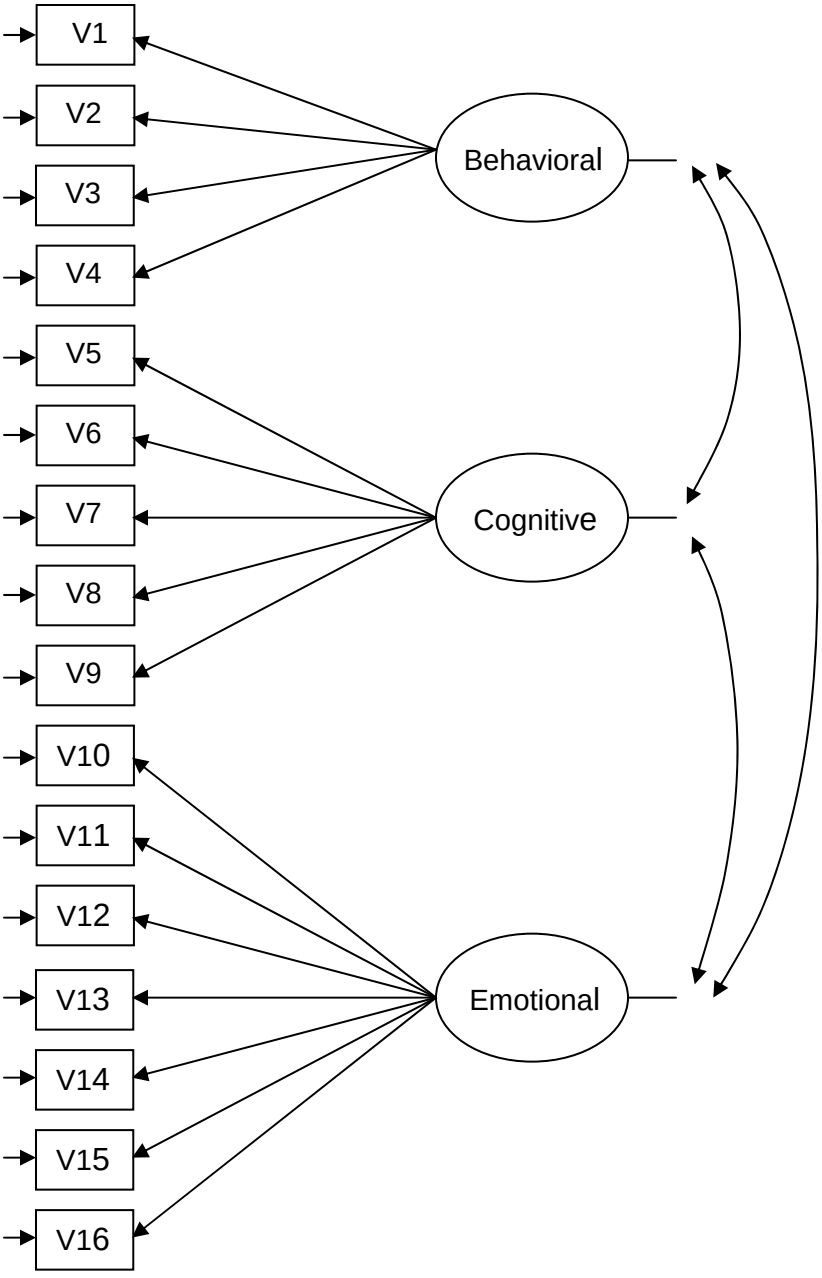
Many studies on school engagement use empirical definitions of school engagement that are not related to its theoretical definition because they utilize only one or two facets of engagement instead of three (Avenilla, 2003; Fullarton, 2002; Sirin & Rogers-Sirin, 2004); for example, measuring the influence of behavioral and emotional engagement on school achievement (Sirin & Jackson, 2001). Jimerson (2003) reports that school engagement studies rarely include affective and cognitive elements. Moreover, some studies utilize a general or unidimensional measure of school engagement by averaging different types of engagement (Fredricks et al., 2004; Fullarton, 2002; Lee & Smith, 1995; Marks, 2000). This makes it more difficult to study with precision the nature of school engagement in order to better understand the factors that enhance, constrain, and affect school engagement. Improving the operational definition of school engagement and validating its dimensions will contribute to a better understanding of school engagement, fine-tuning interventions according to students' characteristics and school context, and advancing our knowledge about this important construct (Jimerson et al., 2003).

Figure 1 shows the conceptual measurement and structural model of school engagement used in this study. In this theoretical model, there are three inter-correlated dimensions of school engagement: behavioral, emotional, and academic or cognitive

engagement. In addition, this hypothetical model shows four congeneric[3] variables of behavioral engagement, five congeneric indicators of cognitive engagement, and seven indicators of emotional school engagement.

Figure 1

Conceptual Three-Factor Model of School Engagement



[3] Congeric variables are variables that are presumed to be indicators of the same dimension

An Overview of the Methodology

This study utilized structural equation modeling (confirmatory factor analysis) to test the theoretical assumption that school engagement is a multidimensional construct composed of three dimensions: behavioral, emotional, and cognitive school engagement. The measurement model was designed to assess the pattern of relations among observed indicators and dimensions of school engagement (latent variables), and properties such as reliability and validity of the observed indicators. In addition, the invariance of the measurement, factorial, and latent mean structures of school engagement across white and African American students were tested using multiple group analysis.

Structural equation modeling (SEM) is a statistical method that takes a confirmatory approach to data analysis of a structural theory bearing on the relationships of some variables of interest (Byrne, 1998). In structural equation modeling, a researcher specifies what the pattern of relationship among variables should be, according to theory, and imposes this theory-based restrictions on the sample data, and tests how well the observed data fit the restricted structure. Therefore, hypothesis testing is feasible and can be utilized for inferential purposes. A detailed description of the methodology is provided in Chapter 3.

Delimitations of the Study

The data for this study came from five public high schools from a mid-sized central city in Virginia that self selected to participate in the HSSSE 2004 survey and, therefore, they may not be representative of the high school student population in the State of Virginia or the United States. This fact may limit the generalizability of the findings of this study to similar populations of students and schools.

In addition, this study is limited to what the HSSSE data contain, in terms of variables included, sample selection, subgroups of students represented, sample size, reliability and validity of the instrument, and methods of measurement. The HSSSE relies on students' self-reported measures of school engagement; therefore, the study may be capturing only part of the construct of school engagement (mono-method bias).

Organization of the Study

In Chapter One, an introduction to the study was presented as described in page two. The study proceeds with a comprehensive review of the literature related to school engagement in Chapter Two. In addition, a detailed explanation of the literature search process is provided before review of the theoretical literature and empirical research. The final section of Chapter Two reviews some of the limitations of current research on school engagement, such as use of inconsistent and a variety of operational definitions and measures related to school engagement, lack of conceptual clarity of the construct of school engagement, use of multiple methods and instruments to measure school engagement, use of different subjects and units of analysis, utilization of only one or two dimensions, or a general school engagement measure by combining or averaging different types of engagement dimensions. In Chapter Three, the methodology of the study is described in detail, including database used, procedures used to collect data, variable selection, measurement characteristics of the survey instrument, sampling methods, units of analysis, and procedures used to analyze the data. In Chapter Four, a description of the preliminary analysis of raw data is presented, including variable selection, decisions about the measurement scales of variables (continuous, ordinal), type of input matrix used in the analysis, and an examination of the distribution characteristics

of each and all variables used in the study. In the last section of Chapter Four the steps taken for model specification are explained, as well as model identification, model estimation, model testing, and model re-specification. In Chapter Five we present a summary and discussion of the results.

Summary

According to theory, school engagement is a multifaceted construct that encompasses three dimensions: behavioral, emotional and cognitive engagement. Emotional engagement includes students' emotional reactions toward teachers, peers, and school. Behavioral engagement includes positive conduct, involvement in learning tasks, and participation in school activities. Cognitive engagement includes students' commitment to understanding academic work, effort control, cognitive strategy use, flexible problem solving, and independent work style.

However, empirical studies are inconsistent in operationally defining school engagement. They differ not only in the number of dimensions included but also in the type of observed indicators, and methods and subjects utilized to measure school engagement. As a result, many differences in research findings may be a mere reflection of the differences in the operational definition of school engagement.

Many empirical studies have found a positive association between school engagement and academic achievement. However, this association seems to vary according to student and school characteristics. While white students consistently and persistently score higher than minority students on almost all measures of academic achievement that is not the case with school engagement. Many studies have found that

African American students are more engaged in school than white students, suggesting an attitude-achievement paradox among African American students.

Definitions of terms

Congeneric variables: A set of variables are congeneric if each variable in the set is supposed to assess the same construct or dimension in the study.

School agent: Includes teachers, administrators, guidance counselors, and any other adult that has contact with students at school.

Reflective indicator: Observed variable that is considered to be an effect of the latent variable it is hypothesized to measure.

Formative indicator. Observed variable that is considered to be the cause of a construct or latent variable.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter recounts a review of the theoretical literature and empirical research on school engagement. The first section describes the literature search process, while the second places school engagement in a nomological network that includes antecedents, correlates, and consequences of the construct. Section three focuses specifically on the definition and measurement of behavioral engagement; section four focuses on emotional engagement; and section five focuses on cognitive engagement. Finally, a summary of the chapter is provided.

Explanation of the Search Process

Broad searches of the literature on school engagement and its dimensions were carried out using several approaches. The initial literature review involved computerized searches of the Education Resources Information Center (ERIC) database, PsycINFO, Social Sciences Citation Index, Academic Search Primer, and WorldCat. The second search method was to use the World Wide Web (Google Scholar's advanced search) to search for published studies on school engagement. Keywords utilized in conducting computerized searches included: engagement, school engagement, student engagement, academic achievement, student participation, self-concept, motivation, dropping out, school adjustment, involvement, and combinations of keywords. Finally, Digital Dissertations and Electronic Thesis and Dissertations were also searched for studies on school engagement, using the same keywords mentioned above.

After the initial review stage, a number of studies were selected and compiled consisting of articles and books that were directly related to school engagement, and its dimensions, related constructs, approaches to measuring school engagement, and antecedents and outcomes. Qualitative as well quantitative studies were included. Special emphasis was placed on searching for the literature of school engagement with reference to minority groups. The next step involved an exhaustive bibliographic search based on the studies selected previously; this step included searching for specific studies cited in these articles (backward), and an electronic search for more recent articles (forward), based on the Web of Science, that cited the selected studies and authors. In addition to the review of the literature on school engagement, searches for methodology books and articles on the subject of structural equation modeling, confirmatory factor analysis and studies of construct validation were conducted.

Nomological Network of School Engagement

A nomological network may relate observed indicators of theoretical constructs to each other, theoretical constructs to observed variables, and different theoretical constructs to one another (Cronbach & Meehl, 1955). A necessary condition for a construct to have construct validity is that it occurs in a nomological network. Pedhazur and Schmelkin (1991) argued that construct validation should examine theoretical propositions about the relationships of the construct of interest and other constructs. This study focused on the relationships among observed indicators of school engagement, the relationships between dimensions of school engagement and their observed indicators, and the relationships among dimensions of school engagement. The following is a review

of the relationship of school engagement with other constructs, including antecedents, correlates and consequences.

Antecedents of School Engagement

Schools and students are part of the social ecology of their communities, neighborhoods and families (National Research Council and Institute of Medicine, 2004). Even though schools need to be connected to their communities and families, many factors that influence students' school engagement are outside of schools' control. For instance, many studies have found that students benefit from their parents involvement in their schools, which contributes to students' better performance (Steinberg, Brown, & Dornbush, 1996), reduce dropouts (Rumberger & Palardy, 2002), increase students academic self concept, motivation and positive attitude toward school (Wiest, Wong, Cervantes, Craik, & Kreil, 2001; Wong, Wiest, & Cusick, 2002).

However, schools can make a difference and exert a positive influence on students' engagement and learning by the way they structure the learning environment (National Research Council & Institute of Medicine, 2004). For instance, the National Research Council & Institute of Medicine (2004) described certain conditions for learning to take place in school:

> A challenging but individualized curriculum that is focused on understanding; knowledgeable, skilled, and caring teachers; a school culture that is centered on learning; a school community that engenders a sense of support and belonging, with opportunities to interact with academically engaged peers; strong ties linking the school with students' families and communities; an

organizational structure and services that address students' nonacademic needs; and opportunities to learn the value of schoolwork for future educational and career prospects.

Concurrent with the conditions for learning mentioned above, there are three levels of factors within schools that are believed to influence school engagement: school-level factors, classroom context, and students' individual needs. School-level factors include school size, disciplinary practices, communal organizational structure, high academic standards, student/adult ratio, and racial composition of the school (Fredricks et al., 2004; Lee & Smith, 1995; Lee & Smith, 2001). Classroom context is comprised of teacher support, peers, classroom structure, autonomy support, and learning task characteristics (Fredricks et al., 2004). Individual needs consist of need for relatedness, need for autonomy, and need for competence (Newmann et al., 1992).

School-level Factors

Schools provide a milieu of educational and social experiences for students including interactions with other students, teachers and administrators, and these interactions influence students' feelings, emotions and behaviors (Johnson et al., 2001). Quality and characteristics of schools such as school size, school composition, school organization, quality of teachers, social and academic climate of schools are very important to school engagement, over and above students' background characteristics (National Research Council and Institute of Medicine, 2004). For instance, Rumberger and Thomas (2000) estimated that only about half of the variation in dropout rates, which is a consequence of school disengagement, could be attributed to students' background

characteristics. Bryk & Thum (1989) also found that 20% of the variability in mean school attendance rates (indicator of behavioral engagement) could be attributed to background characteristics of students. Arguably, some of the remaining variance is explained by school characteristics. Furthermore, variations in dropout rates among high schools serving low income students or students from historically disadvantaged minority groups indicate that schools can have a significant impact on students' motivation, engagement, and dropout rates (National Research Council & Institute of Medicine, 2004; Sinclair, Christenson, Elevo, and Hurley, 1998). McNeely, Nonnemaker, & Blum (2002) used data from the in-school and school administrator surveys of the National Youth Survey (75,515 students, 127 schools) and hierarchical linear modeling to examine the association between school characteristics and the average connectedness in school, and found that four school attributes – classroom management climate, school size, severity of discipline policies, and rates of participation in extracurricular activities – explained a significant percentage (12%) of between school variance in school connectedness (which is related to emotional engagement). School connectedness was constructed from responses to five questions: "I feel close to people at this school," "I feel like I am part of this school," "I am happy to be at this school," "the teachers at this school treat students fairly," and "I feel safe in my school."

There are other studies that support the importance of school-level factors on school engagement. In a study with high risk students, Finn & Voelkl (1993) found that student participation was higher, absenteeism was lower, and the school environment was more supportive when schools were smaller. Wehlage & Smith (1992) conducted a study with 14 schools including large comprehensive inner-city schools with all-minority

populations, schools serving mainly white working- and lower-middle-class students, an alternative junior high school in a medium-sized city, alternative programs located within comprehensive high schools, and specialized alternative schools. They selected and studied schools that were effective with at-risk students and concluded that small schools provided better conditions that promote school engagement because adults in small schools have the opportunity to personalize their relations with students better and develop school membership. In another study, Bryk & Thum (1989) found significant association between school size and academic emphasis, faculty interaction with students, good environment, and fair application of school rules.

School climate. School climate is related to the norms, values, beliefs, and emotions associated with school practices and social interactions within schools (National Research Council & Institute of Medicine, 2004). Researchers have used many different terms to refer to school climate including school community and academic press. In communitarian schools, "members share common missions; staff and students interact outside the classroom; adults are responsible for students' total development, and teachers share the responsibility for students' academic success" (Lee & Smith, 2001). Academic press is the "degree of emphasis on academic excellence by members of the organization" (Shouse, 1996).

Lee and Smith (2001) used data from the National Education Longitudinal Study of 1988 (NELS:88) to study whether communally organized schools were associated with student engagement and achievement. They used hierarchical linear modeling to compare traditional "bureaucratically" organized schools with communally organized schools.

They concluded that communally organized schools have better outcomes than bureaucratic schools in terms of teachers' satisfaction, morale, absenteeism, and students' absenteeism, class cutting and dropout rates. Furthermore, Lee & Smith (2001) also found that disparities associated with ethnicity and socio-economic status was smaller in communally organized schools, and the most important predictor of student outcome differences between bureaucratic and communal schools was teachers' collective responsibility for learning. However, academic press is equally important as is a communitarian climate to increase school engagement.

Lee and Smith (1999) analyzed data from the 1994 Annenberg Institute for School Reform, which included 30,000 sixth- and eight-grade students in 304 public elementary schools, to study the effect of communally organized schools and academic press on student engagement and achievement in math and reading. They concluded that there was greater effect of social support on performance measured by standardized achievement tests in math and reading in schools with higher academic press. In other words, they found interactive and complementary effects between communally organized schools and academic press on student outcomes.

School Organization. School organization refers to the way teachers and students are sorted within schools and how instruction is delivered (National Research Council & Institute of Medicine, 2004), which conveys expectations and provides opportunities for students to experience a school climate that promotes engagement. Two organizational features used by schools to promote more personalized teaching are block scheduling, which increases instructional time for some courses to at least 90 continuous minutes, to

allow more sustained engagement, and "looping" to promote better relationships between teachers and students, as well as more individualized instruction. "Looping" creates teams of teachers that work with cohorts of students for at least two years.

Another school organizational feature is student tracking. Tracking is believed to be negatively associated with student motivation, put low-track students in disadvantage because they are more likely to get less experienced and less expert teachers, and also to have a negative effect on college expectations, absenteeism, disciplinary problems, and school engagement (National Research Council & Institute of Medicine, 2004). Lee and Smith (1995) conducted a study with the NELS:88 data set, which included 11,794 students and 830 schools, and found that students that took advanced coursework had higher levels of school engagement, after controlling for student academic and social class background. Similarly, Berends (1995) used High School and Beyond data to study the effects of stratification on school bonding. He operationalized social bonding as students' attachment, commitment, involvement, and belief in the norms, activities, and people in schools. Berends (1995) concluded that important changes in students' attitudes toward school and behaviors can be attributed to the practice of tracking. He found that students in non-academic tracks were more likely to drop out of school between the 10th and 12th grades as compared to students in academic tracks. Moreover, he estimated that the vocational track effect on college expectations and engagement was one-fifth and one-sixth of a standard deviation (negative), respectively. Bryk and Thum (1989) also found that students in schools with less curriculum differentiation were more likely to persist in school.

School Size. There are two perspectives when studying the effect of school size on student outcomes: Economic efficiency and curriculum specialization, and school communal organization. The first point of view favors larger schools because it focuses on economy of scale; that is, the larger the student body the more efficient the delivery of services, the larger the variety of course offerings, and the greater the curriculum specialization. In addition, supplies and materials to deliver services are attained at a lower cost through larger purchases (Lee & Smith, 1997). The communal organization viewpoint is that smaller school size is beneficial for students because it limits course offerings and concentrates resources on academic courses for all students, regardless of ability and socioeconomic background. This results in higher school engagement, achievement, better relationship between students and adults and higher parental involvement (Lee & Smith, 1997).

Empirical studies suggest that reducing the size of schools promotes personalized education that increases school engagement (Howley, 2002; Lee & Smith, 2001). A study by Lee and Smith (2001) that used the National Education Longitudinal Study of 1988 (NELS:88) showed a curvilinear relationship between school size and achievement, with schools of between 300 and 900 students performing better than both smaller and larger schools. Furthermore, they found that disparities in achievement based on SES were smaller in smaller schools. Other studies have shown higher levels of academic engagement for poor and working class students of color in smaller schools in comparison to their peers in larger schools (Gladden, 1998; Raywid, 1998), suggesting an interaction between socioeconomic status and school size in which larger school sizes are more harmful for low socioeconomic status students.

Racial/Ethnic Composition of Schools. Participation and level of comfort and engagement of minority students in school depend not only on students' characteristics but also on the characteristics of the schools that serve those students (Johnson et al., 2001). But studies on the effects of the racial/ethnic composition of schools are not conclusive and/or consistent. Johnson et al. (2001) conducted a study that used data from Add Health, which is a nationally representative sample of American adolescents in grades 7-12 and included 134 middle and high schools in 80 communities. One of the research questions of this study was whether characteristics of schools, especially racial-ethnic composition of the student body and the teaching staff, influenced students' attachment and academic engagement. Attachment was measured based on the extent which students agreed that, in the previous school year, they felt close to people at their schools, felt part of their schools, and were happy to be in their schools (Johnson et al., 2001). Academic engagement was measured with three survey items: in the past year, how many times the student had skipped school, had trouble paying attention in school, and had trouble completing homework.

Johnson et al. (2001) found that the effects of race/ethnicity on school attachment and engagement varied across schools. They found that, in high school, African American students are least attached to school as compared to white and Latino Americans; no statistical difference in attachment between white and Latino students was found; however, African Americans were more likely to be engaged in high school than white and Latino students. In general, Johnson et al. (2001) found that students were more attached to school when their schools have proportionally more students of their

own-race/ethnicity. However, they could not identify the characteristics of schools causing differential effects on students of different racial/ethnic backgrounds.

Finn & Voelk (1993) also conducted a study to investigate the effects of schools' racial/ethnic composition on measures of students' school engagement. The study was based on the National Educational Longitudinal Study (NELS:88) including 6,000 at-risk African American, Hispanic, and non-Hispanic white students from 800 public schools. Measures of engagement consisted of teachers' report of whether a student was frequently absent from class or tardy; teachers' report on whether a student completed homework, was inattentive and/or disruptive in class; students' report on how frequently they were absent from school, skipped classes and/or arrived late; students' report of the number of times they went to class without paper and pencil, without books, and without completed homework; students' report of the number of time they were sent to the principal's office for misbehavior.

Finn & Voelk (1993) found that percentage of minority students in school is related to teacher reported ratings of absenteeism and engagement, and student reported attendance. Greater proportions of minority students in schools were related to lower levels of school engagement. The percentage of minority students in a school was not related to students' self-reported measures of class preparedness. In addition, the percentage of African American school staff was not found to be consistently related to school engagement (participation) of students at risk.

Classroom-level Factors

It has been well documented that classroom-level factors such as teacher support, peer relations, instructional format, school subject, autonomy support, and task characteristics are important precursors of school engagement. Several studies have shown that teacher support is related to student outcomes (Klem & Connell, 2004; Wentzel, 1997). Wentzel (1996) found that when support from teachers, parents, and peers were examined simultaneously, teacher support had the highest direct influence on students' interest in school. Similarly, Skinner & Belmont (1993) found that teacher's behavior (involvement, structure, and autonomy support) were related to students emotional and behavioral engagement at two points in time (one-year study). They concluded that children that received clear expectations and strategic help from their teachers were more likely to be emotionally and behaviorally engaged in school.

In addition to teacher support, peers exert an important influence on students. Kindermann (1993) found that elementary and middle-school students selected members of their peer group based on their level of engagement in the classroom, and that engagement of a student's group members at the beginning of the school year was predictive of that student's change in motivation during the year. Being accepted by peers has been positively associated to good conduct, satisfaction with school, motivation to learn, and academic effort (Kindermann, 1993; Wentzel, 1999). Having friends at school seems to promote engagement in school-related activities (Wentzel, 1999). Similarly, Furrer & Skinner (2003) found that relatedness to peers and academic engagement were associated. However, Ryan, Stiller, and Lynch (1994) found no unique significant

association between peer relatedness and autonomy, perceived control, or school engagement, after controlling for relatedness to parents and teachers.

Another classroom context variable is classroom structure. Several studies have examined the influence of classroom structure on school engagement. Fredricks et al. (2002) found that students' perceived work norms were positively associated with all three dimensions of school engagement (behavioral, emotional, and cognitive). Skinner & Belmont (1993) reported that teachers' setting up a good classroom structure – which entails clearly communicating their expectations, offering help and support, adjusting teaching strategies to the level of the student, providing information regarding how to reach desired outcomes – was associated with student motivation; and the target motivational outcome in this study was school engagement.

Many studies have shown the importance of autonomy support and task characteristics on school engagement. Deci & Ryan (1987) suggested that autonomy is associated with intrinsic motivation, interest, higher self-esteem, better learning, and more persistence, more so than control is associated with these factors. Classrooms that support autonomy provide for choice and shared decision making, for doing schoolwork, and behaving well in school (Fredricks et al., 2004). Additionally, Marks (2000) found that authentic work explained a significant variance in school engagement for elementary, middle and high school students, and it reduced some of the negative effect of students' background characteristics on school engagement. In her study, Marks (2000) found that authentic work accounted for 18% of the variance in school engagement for elementary school students, 22% for middle school, and 21% for high school students. Authentic

work was operationally defined as student's perception that school work was academically challenging and connected to the real world.

Individual Needs

Newmann et al. (1992) argued that school engagement is a function of three factors. The first is the student's needs for competence, or their need to achieve cognitive understanding and master learning tasks. The second factor is school membership, which is the student's feeling and perception that they are part of the school community. Factors that promote students' school membership include fairness, personal support, success, and caring. And third, school engagement is influenced by authentic work. Newmann et al. (1992) defined authentic work as "tasks that are meaningful, valuable, significant, and worthy of one's efforts."

Empirical studies have found that students need to be competent, autonomous, and related to other people (Connell, 1990; Connell & Wellborn, 1991). Connell & Wellborn (1991) found elementary school students who had higher levels of connectedness were more engaged at school. Similarly, Furrer & Skinner (2003) found significant effects of relatedness to teachers, parents, and peers on academic engagement. School engagement (teacher- and student-reported) mediated the relationship between relatedness and academic achievement. The relationship between relatedness and academic achievement was non-significant after controlling for school engagement. Furthermore, relatedness accounted for 18% of the variance of teacher-reported engagement, and 52% of variance of student-reported engagement, after controlling for perceived control. In the same way, Birch & Ladd (1997) found teacher-student

relationship significantly correlated to achievement, school attitude, and school engagement.

Need for competence and need for autonomy are other individual needs that are important to school engagement. Rudolph, Lambert, Clark, & Kurlakowsky (2001) and Skinner et al. (1990) found that students' perceived competence (operationally defined as understanding and task mastery) and control beliefs are associated with school engagement (Shernoff et al., 2003). According to Newmann et al. (1992), students have strong need to develop and express competence. Additionally, Ryan & Connell (1989) conducted a study testing the correlations of several reason categories (external, internal-personal reasons) with coping with failure, anxiety, effort, and enjoyment of school, and found that the more autonomous the reason the more it was associated with effort, positive dealing with failure, and enjoyment of school. Likewise, Rudolph et al. (2001) found that students' lower perceived academic control led to academic disengagement and increased stress among students in fifth and sixth grades. Whole group instruction is perceived by students as teacher-controlled, whereas small group and individual instruction are perceived as relatively student-controlled (Marks, 2000).

Student Characteristics and School Engagement

It is well documented that there is a gap in the educational attainment and achievement of white and race/ethnic minority students in the United States. According to the National Assessment of Educational Progress (2000), compared to white students a greater proportion of African American and Latino students score at below basic in reading, math, science, writing, U.S. History, civics and geography measured by the

National Assessment of Educational Progress (NAEP). By twelfth grade, on average, African American students are four years behind white and Asian students (Thernstrom & Thernstrom, 2003). In general, minority students have more behavioral problems than white students (Finn & Rock, 1997). However, findings on school engagement of minority and white students vary depending on students' and school characteristics.

In addition, previous research (Kalin, 1999; Katz, 1999) has found that teachers and pre-service teachers across grade levels may perceive Latino and African American students as more behaviorally and affectively disengaged than other groups, regardless of similarities in actual behavior across groups (Hudley, 2003). This bias may produce a perceived unsupportive school climate for minority students and impede their school engagement (Fredricks et al., 2004) especially when teacher support appears to be very important for minority students.

Furthermore, Mickelson (1990) argued that an attitude-achievement paradox exists among African American students in the United States, consisting of a positive attitude toward education yet poor academic achievement, because African American students do not perceive education as offering them the expected results for achieving their educational goals, which discourages them from putting more effort and commitment into their school work (Mickelson, 1990). Ogbu (1978) offered a cultural ecological model and suggested that minority groups' perceptions of the opportunity structure afforded to them by social and economic institutions influence their children's academic behavior. And so exists the paradox: on one hand, African American students consistently express positive attitude toward education; on the other hand, they fail to perform in school at levels consistent with their belief that education is important.

Johnson et al. (2001) conducted a study with a national sample of schools that included middle and high school years and found that African Americans were more engaged than white and Latino students. This finding was consistent with Ainsworth-Darnell & Downey's (1998) finding that African American students report trying harder in class than white students. However, Marks (2000) found that the relationship between minority status and school engagement differed by grade level and socioeconomic status. In addition, Johnson et al. (2001) found that the relationship between race-ethnicity and school engagement was affected by school characteristics.

Conchas (2001) considered that the cultural ecological explanation of minority students' success and failure was simplistic, and offered an institutional explanation. According to Conchas (2001) institutional mechanisms mediate school engagement and through the provision of social scaffolding, high expectations, guidance and support from school agents such as peers and adult school staff, access to high quality programs and courses, improvement of racial relations and creating a sense of community can greatly affect minority students' perceptions about the opportunity structure, which leads to more optimism and higher levels of school engagement and achievement. According to Conchas (2001), school factors such as teachers' low expectations, a disconnect between school curriculum and the life experiences of minority students, and lack of institutional support systems contribute to low school engagement and academic achievement.

Outcomes of School Engagement

School engagement has attracted much attention because it is associated with academic achievement, reduction of students' boredom and disaffection, and a decrease in dropout rates (National Research Council & Institute of Medicine, 2004) for students at-risk to negative outcomes (Bullis & Yovanoff, 2002; Finn & Rock, 1997). Moreover, school engagement is considered to have positive influences not only for at-risk students but also for all students (Furlong et al., 2003).

School Engagement and Achievement

Many studies have demonstrated positive association between dimensions of school engagement and achievement. For instance, Greenwood, Horton, & Utley (2002) and Skinner et al. (1990) found positive correlation between school engagement and achievement measures such as standardized tests and grades across all grade levels. Finn and Pannozzo (1995) and Finn & Rock (1997) found that discipline problems at school (measures of school disengagement) are associated with lower achievement. Voelkl (1997) also demonstrated that measures of emotional engagement, like value and school belonging, were positively associated with achievement measures for white students but not for African American students. Other measures of emotional engagement, such as interest and value, show positive correlation with achievement as well (Pintrich & De Groot, 1990). Measures of cognitive engagement – such as use of metacognitive strategies – also have shown to be positively associated with achievement (Boekarts et al., 2000).

Finn & Rock (1997) studied the association of school engagement and academic achievement within a sample of minority-students from low socio-economic status. A

sample of 1,803 minority students (African American and Latino) who participated in the three waves of data collections of the U.S. Department of Education's National Educational Longitudinal Study of 1988 (NELS:88) were selected through a two-stage stratified sampling design. In addition to SES, students were classified into three groups based on outcomes such as grades, test scores, and persistence from grade eight through grade twelve; the persistence classifications were academically successful school completers (they called this group "resilient"), school completers with poor academic performance ("non-resilient completers"), and non-completers ("dropouts").

Measures of achievement for the study came from NELS:88 administered achievement tests taken by all participants in reading comprehension, mathematics, science and history. Three sets of engagement measures were used. The first set was comprised of three measures of student engagement as reported by teachers. They included ratings of whether the student usually worked hard for good grades (WORK HARD), the frequency the student was absent or arrived late (ABSENT-TARDY), and the extent to which the student completed homework, was attentive in class, and was not disruptive (ENGAGE).

The second set was comprised of three students' self-reported measures. The first reflected how often the student missed school, was late at school, or cut classes (ATTEND). The second was related to the frequency the student got into fights, got into trouble for not following rules, or parents were contacted for behavior problems (TROUBLE). The third set was related to the frequency the student arrived at school prepared for classes, with paper and pencil, required books, and with homework completed (HOMEWORK); the number of school based activities the student

participated (SPORTS), and the number of other extracurricular activities such as band or academic clubs the student participated (EXTRACURRICULAR).

Finn & Rock (1997) used a series of MANOVAS and MANCOVAS with "resilience" group, race, and gender as factors of classification. Differences among resilience groups were examined on the psychological characteristics (self-esteem and locus of control, also included in the NELS:88). The main hypothesis was tested by comparing groups on each set of engagement measures and on engagement after controlling for self-esteem and locus of control. Additionally, each of the analysis was rerun controlling for SES and family composition as covariates.

Results of this study showed that a substantial number of African American and Latino students from low income homes received reasonable grades from eighth to twelfth grade, and graduated on time. Even though these students differed from their lower achieving peers on home-related variables like family structure, parents' education and income, the primary contribution to academic performance was school engagement.

Specifically, engagement indicators such as coming to class and school on time, being prepared for and participating in class, completing assignments and homework, and not being disruptive in class, significantly contributed to differences between "resilient" and "non-resilient" students. Moreover, the magnitude of the effect was not diminished after controlling for psychological and home background characteristics (Finn & Rock, 1997).

School Engagement and Dropping out of School

School engagement is negatively associated with dropping out of school. Many studies suggest that engagement in academic and extracurricular activities by students

and parents is very important in a student's academic success, and for some students, it is the factor that distinguishes between dropping out and graduating (Audas & Willms, 2001). In addition to protecting students from dropping out of school, Resnick et al. (1997), using the National Adolescent Longitudinal Study, found that youngsters reporting positive connections to school had lower rates of negative developmental outcomes. Moreover, Resnick et al. (1997) identified school connectedness as the only school-related variable that was protective of eight health risk factors among adolescents.

Sinclair et al. (1998) studied the efficacy of a sustained dropout prevention program that included monitoring and school engagement strategies. The sample consisted of 94 students with learning and emotional/behavioral disabilities who received interventions in grades seven and eight; half of the students (n=47, treatment group) were randomly selected (stratified sampling) to continue receiving interventions in grade nine. More than half of the students were African American (59%), males (68%), and students who participated in the free and reduced lunch program (71%). The average age of students at the beginning of the study was 13 years and 4 months.

One component of the dropout prevention project consisted of continuous assessment of student's levels of school engagement. Engagement (or disengagement) measures included: a) tardiness, b) skipping classes, c) absenteeism, d) behavior referrals, e) detention, f) suspensions, g) course failures, and h) accrual of credits. The other component consisted of two levels of interventions, basic and intensive. When students were identified as high risk, reflected by low levels of school engagement, they immediately received interventions to reconnect them to school.

The effectiveness of the project was assessed by running a series of t-tests and chi-squares comparing treatment and control groups. Measures of participation in school showed that students in the treatment group were more engaged in school. The treatment students were more likely to be enrolled in school at the end of the year than students in the control group (91% vs. 70%; $\chi^2_{(1)}=6.87$, $p<0.05$), more likely to persist in school than students in the control group (85% vs. 64%; $\chi^2_{(1)}=5.60$, $p<0.05$), and more likely to complete course assignments than control students ($t_{(47)}=2.79$, $p<0.05$).

Similarly, school performance measures indicated that treatment students were significantly more engaged. Students in the treatment group earned significantly more credits during the first year of high school than students in the control group. In addition, treatment students were more likely to be on track to graduate in four or five years than control students. Furthermore, special education teachers rated treatment students as more academically competent than control students.

Definitions and Measurement of School Engagement

Even though the literature shows a pattern in the way school engagement is conceptualized, there are still many variations and inconsistencies in the definition of school engagement (Jimerson et al., 2003). In many studies, the definition of school engagement can only be inferred from the items used to measure school engagement. Therefore, operational definitions of school engagement in empirical studies are very inconsistent.

Behavioral Engagement

The behavioral dimension of school engagement includes students' interactions and responses in the classroom, school, and places where extracurricular activities take place (Furlong et al., 2003). Finn (1989) described four increasing levels of behavioral ("participatory") engagement. The first level is exhibited in students' complying with classroom and school rules. Fredricks et al. (2004) called this level positive conduct. The level-two participation includes student initiating questions and dialogue with the teacher, spending extra time in the classroom, and doing more coursework. This level also includes effort, persistence, concentration, attention, asking questions, and contributing to class discussion (Finn et al., 1995; Skinner & Belmont, 1993). The third level is exhibited by students' participation in social, extracurricular, and athletic activities in school. Finally, the level-four participation involves participating in school governance. In addition, student's self-report measures, teachers' checklists and report scales, direct observations, and case studies have been used to measure behavioral engagement (Chapman, 2003). In this study, behavioral engagement was operationally defined as completing homework assignments.

Emotional Engagement

Indicators of emotional engagement include students' feelings about the school, teachers, and peers (Lee & Smith, 1995). Other researchers include affective reactions such as boredom, happiness, sadness, and anxiety in the classroom (Skinner & Belmont, 1993). Finn (1989) defined emotional engagement as identification with school which includes feelings of being important to the school and appreciation of success in school.

The National Research Council & Institute of Medicine (2004) used the terms engagement and motivation as synonymous. Yet other researchers (Furlong et al., 2003) include affect, interest, identification with school, and belonging as indicators of emotional engagement. McNeely et al. (2002) and Newmann et al. (1992) defined emotional engagement as emotional connectedness to school and teachers. The Rochester School Assessment Package included positive and negative emotions like being happy, interested, bored, frustrated, and angry (Connell & Wellborn, 1991; Skinner & Belmont, 1993). Others measure emotional engagement by asking students pertaining to their feelings about their teachers and their school (Valeski & Stipek, 2001), identification with school (Finn, 1989; Voelkl, 1997), and student-teacher relations and values (Finn, 1989). In this study emotional engagement was defined as a student's sense of emotional connectedness to school, teachers, and peers.

Cognitive Engagement

One definition of cognitive engagement is related to being strategic or self-regulating (Fredricks et al., 2004). According to this definition, there are three components of self-regulated learning that are important for classroom performance (Pintrich & De Groot, 1990). First, self-regulated learning includes students' meta-cognitive strategies for planning, monitoring, and modifying their learning (Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1988). The second component includes students' management and control of their effort on learning/academic tasks. The third component includes the cognitive strategies students use to learn, remember, and understand learning tasks (Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons,

1988). The line of reasoning is that students who are more academically engaged use deeper strategies, apply more mental effort, create more connections between ideas, and attain greater understanding (Fredricks et al., 2004).

Another approach to define cognitive engagement is related to motivation to learn (Fredricks et al., 2004); as mentioned above, sometimes cognitive engagement and motivation are used as synonymous (National Research Council & Institute of Medicine, 2004). A student motivated to learn values learning and do their best for mastering learning tasks. Students that espouse learning instead of performance goals focus on learning, understanding, and mastering challenging learning goals. Intrinsically motivated students are persistent when faced with difficulties (Fredricks et al., 2004).

A third approach to define cognitive engagement emphasizes on investment in learning, willingness to go beyond the requirements, and preference for challenge (Fredricks et al., 2004; Newmann et al., 1992). Students respond to survey items designed to measure cognitive engagement by providing information on their attention in class, the mental effort they exert on learning tasks, and task persistence (Chapman, 2003).

Items used to measure cognitive engagement conceptualized as psychological investment in learning are similar to those used to measure intrinsic motivation. Harter (1981) developed a self-report scale to measure intrinsic versus extrinsic motivation toward learning and mastery. She constructed items to measure preference for challenge versus preference for easy work ("Does child like hard, challenging work?"), curiosity/interest versus teacher approval ("Does child work to satisfy own interest and curiosity?"), independent mastery attempts versus dependence on the teacher ("Does child prefer to work, figure out problems on his/her own?"), independent judgment versus

reliance on teacher's judgment ("Does child prefer and feel capable of making judgments about what to do?"), and internal versus external criteria for success/failure ("Does child know when she/he has succeeded/failed on assignments or tests?") (Harter, 1981). Connell & Wellborn (1991) created items related to flexible problem solving, preference for hard work, independent work styles, and forms to deal with perceived failure to measure cognitive engagement.

Researchers that conceptualize cognitive engagement as self-regulation assess school engagement with measures of students' strategy use (Fredricks et al., 2004). Students are asked to respond to questions about their knowledge and use of cognitive and metacognitive strategies (Pintrich & De Groot, 1990). For instance, they are asked about how they set learning goals, organize study efforts, how they plan, self-instruct, monitor and adjust their cognition (Fredricks et al., 2004; Pintrich & De Groot, 1990). Students may also be asked about their persistent effort and deep strategy use (Meece, Blumenfeld, and Hoyle, 1988; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Pintrich & De Groot, 1990). In this study cognitive engagement was operationally defined as integrative learning measures selected from a deep learning scale developed by the National Survey of Student Engagement (NSSE Annual Report 2004).

Summary

Even though there are many neighborhood, community and family factors that exert influence on students' school engagement and are beyond the control of school administrators, there are other factors that schools can manipulate to increase school engagement to promote positive school outcomes and avert some of the negative

consequences of school disengagement. School size, climate, academic expectations, school organization, student/teacher and student/student relationships are some of the factors that are believed to have influence on school engagement. Furthermore, these school, classroom, and student level factors are presumed to influence school engagement, which in turn is associated with increased academic achievement and reduction of dropping out of school. Unfortunately, there is no consensus among researchers regarding what school engagement is, how to operationalize it, how to measure it, and how many facets school engagement comprises.

CHAPTER THREE

METHODOLOGY

Introduction

This study was designed to accomplish three main objectives. The first objective was to test the hypothesis that school engagement is a multidimensional construct with three factors: behavioral, emotional, and cognitive or academic engagement. The second objective was to test for invariance of the measurement and factorial structures of school engagement across white and African American students. And the third objective of the study was to test for invariance of the latent mean structures of school engagement across white and African American students. This chapter provides a description of the survey instrument and sample selection, exploratory factor analysis, explanation of data screening procedures, description of data analysis and parameter estimation, and procedures for hypotheses testing.

Instrumentation, Measures and Sampling

Instrument

Based on theory, operational definitions used in empirical studies, and exploratory factor analysis, indicators of behavioral, cognitive, and emotional engagement were selected from the 2004 High School Survey of Student Engagement (HSSSE). The HSSSE contains indicators of school engagement, including the extent to which students find academic work challenging, the degree to which they are active learners, the extent of student/teacher interactions, the richness of classroom experiences, the overall school environment, and the exposure to diverse cultural experiences (Indiana University, 2005).

The High School Survey of Student Engagement provides the largest national database on student engagement, using a single instrument across various types of high schools in different settings (Indiana University, 2005).

Even though a construct validity study has not been conducted, and it was not possible to find information about the psychometric properties of the instrument, the HSSSE was pilot tested with more than 7,200 students in the spring of 2003. After reviewing the instrument based on the pilot test's results, the HSSSE was completed by more than 90,000 students in 2004.

The HSSSE is based on the National Survey of Student Engagement (NSSE). Therefore, according to Dr. Carol Watson, Associate Director of the HSSSE, the psychometric properties of the HSSSE "should be similar" to those of the NSSE because they share the majority of survey items (personal communication, 2005). However, the NSSE is based on college students' measures of engagement and studying school engagement with college students is likely to differ from high school students (Jimerson et al., 2003).

Benchmarking is the process of measuring an institution against other high performing institutions to help identifying weaknesses and to guide and monitor improvement. NSSE includes five clusters of effective educational practice that research studies have shown are linked to desired schooling outcomes (NSSE 2003 Annual Report): Level of academic challenge (preparing for class: studying, reading, writing rehearsing; reading and writing; using higher-order thinking skills; working harder than students thought they could to meet an instructor's standards; an academic environment

that emphasizes studying and academic work), active and collaborative learning (asking questions in class or contributing to class discussions; making class presentations; working with students on projects during class; working with classmates outside of class to prepare class assignments; tutoring or teaching other students; participating in community-based projects as part of a regular course; discussing ideas from reading or classes with others), student/faculty interaction (discussing grades or assignments with an instructor; talking about career plans with a faculty member of advisor; discussing ideas from readings or classes with faculty members outside of class; working with faculty members in activities other than coursework; getting prompt feedback on academic performance; working with a faculty member on a research project), enriching educational experiences (talking with students with different religious beliefs, political opinions, or values; talking with students of a different race or ethnicity; an institutional climate that encourages contact among students from different economic, social, and racial or ethnic backgrounds; using electronic technology to discuss or complete assignments; participating in internships or fieldtrips, community service or volunteer work, foreign language coursework, study abroad, independent study or self-designed major, co-curricular activities, a culminating senior experience), and supportive school environment (helps students succeed academically; helps students cope with non-academic responsibilities; helps students thrive socially; supports supportive relations between students and their peers, faculty members and administrative personnel and offices). A combination of theory and empirical analysis (principal components analysis with oblique rotation) were used to create the benchmarks. Only cases that were part of the National Norms were included in institutional benchmarks.

Sample

Two samples were drawn from five high schools in a mid-sized central city public school district in the State of Virginia that participated in the 2004 High School Survey of Student Engagement (HSSSE). Participation was voluntary and free of charge for schools in the initial year of the HSSSE. Sample one was comprised of 1,587 white students in grades 9–12, which represented 31% of the total population of students. Sample two included 2,571 African American students that represented 50% of the student population. Approximately 50% of the students in each sample were randomly selected and used as calibrating samples in the analysis. Another sample comprising 50% of the students were randomly selected and used for cross-validation purposes. Table 1 shows some characteristics of students in the calibrating sample. The school district has a total student population of 36,250, teacher FTE of 2,596, student/teacher ration of 14.0, with a percentage of high school students in free and reduced lunch ranging from 38% to 56% (with an average of 43%), and a majority African American high school student population ranging from 52% to 87% in the five schools included in this study.

Table 1

Student Characteristics

	N	Gender		Grade Level			
		% M	% F	% 9th	% 10th	% 11th	% 12th
White	822	48	52	32	29	20	19
African American	1260	44	56	33	27	22	18

Measures

The HSSSE has approximately 139 items, some intended to measure school engagement, disengagement, and students' self-reported academic achievement (see Appendix A). Other items were included to gather background and demographic information, such as socio economic status, race, father's educational attainment, mother's educational attainment, number of siblings, etc. Therefore, a systematic process to select school engagement variables was undertaken. First, variables with "face validity" to measure school engagement were selected. Second, variables that were deemed to be intended to measure engagement, as opposed to disengagement, were selected. Third, variables were further selected based on existing literature and empirical studies. Fourth, exploratory factor analysis (EFA) was used to identify the underlying structure of the items and reduce the number of observed indicators of school engagement (see table 2). Fifth, highly correlated items were combined by averaging them to form composite variables. As a result of this selection process, 16 observed variables were used in this study (see descriptive statistics in table 3A and 3B). Four variables were hypothesized to be measuring behavioral engagement, seven variables to measure emotional engagement indicators, and five variables to measure cognitive engagement indicators.

Exploratory Factor Analysis

HSSSE is an instrument containing a broad range of variables. Therefore, a preliminary selection of items measuring behavioral, cognitive and emotional engagement, based on face validity, was carried out. Following, the selected variables were submitted to exploratory factor analysis and only the "best" items, with high

loadings and clustering in the same factors (presumed to be behavioral, cognitive and emotional engagement), were selected for the final analysis.

Factor analysis is a statistical technique intended to discover simple patterns in the relations of observed variables. The goal is to examine the covariation among a set of observed variables in order to determine the nature and number of underlying latent constructs. There are two types of factors analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Exploratory Factor Analysis is used when the relations between observed and latent variables are uncertain (Byrne, 1998) and when researchers don't have a hypothesis about the nature of the underlying factor structure of their measures. One basic question in exploratory factor analysis is whether the covariances among observed variables can be represented by a smaller number of common factors that presumably underlie the covariances. It is assumed that the observed variables are correlated because they share one or more latent constructs.

Exploratory factor analysis is based on the common factor model (Fabrigar, Wegener, MacCallum, & Strahan, 1999). The common factor model assumes that each of a set of observed variables is a linear function of one or more common factors and one unique factor. Common factors are unobservable latent variables and are presumed to account for the covariances among the observed variables. Unique factors are latent variables presumed to influence only one of a set of observed variables. Unique factors comprise two components: a specific factor component, and a measurement error component. The objective of exploratory factor analysis is to understand the structure of the covariances among observed variables (Fabrigar et al., 1999).

Behavioral Engagement Measures

All indicators of behavioral engagement were measures of student conduct: completing homework and complying with school rules. These indicators were measured on a five-point rating scale (1=zero assignments per week to 5=7+ assignments per week). Responses to these variables were based on Question 12 of the HSSSE: "In a typical week, how many assignments do you complete in the following subjects?"

Emotional Engagement Measures

Indicators of emotional engagement included emotional reactions to school and teachers ("I feel supported and respected by teachers"; "I feel supported and respected by 'school personnel'"), utility value ("I value the rewards - grades, awards, etc. - that I get at school for my work"; "I think the things I learn at school are useful"), emotional reaction to school ("The support I get at school encourages me to learn more"), identification with school ("If I could select my high school, I would go to the same school again"; "I care about my school"), and interest ("I am excited about my classes"; "My school work makes me curious to learn about other things"). Indicators of emotional engagement were measured by using a five-point rating scale (1=strongly disagree to 5=strongly agree). Responses to these variables were based on Question 15 of the HSSSE: "Fill in the boxes that come closest to how you feel about each of the following statements."

Cognitive Engagement Measures

Observed indicators of cognitive engagement were selected based on a deep learning scale created by the NSSE (National Survey of Student Engagement. Annual Report 2004). The NSSE created a deep learning scale by combining experimental items

with existing items from the NSSE survey. These items were intended to represent three clusters: higher order learning, integrative learning, and reflective learning. However, EFA indicated that some HSSSE's higher order learning items ("memorizing facts or ideas from your courses and readings so you can repeat them in similar form – recoded," "understanding information and its meaning," "applying information to practical problems or in new situations," "examining ideas or experiences in depth") had low reliability and did not load on cognitive engagement or on the same factor that integrative learning indicators were loading. Additionally, the 2004 HSSE did not contain reflective (reflection) learning indicators. As a result, all observed indicators of cognitive engagement represent integrative learning. These items were measured by using a four-point rating a scale (1=never to 4=very often).

Data Analysis and Model Estimation

Descriptive Statistics and Data Screening

Prior to conducting confirmatory factor analysis, a preliminary data screening was conducted to ensure that the observed indicators were normally distributed, and without excessive skewness and kurtosis. In addition, measures of central tendency (mean) and dispersion (standard deviation) were calculated, both in aggregate and by sub-samples of white and African American students. Preliminary item analysis was carried out and the reliability coefficients of the school engagement scale – as a whole and within each dimension of school engagement – were estimated. Also, bivariate correlations among observed indicators were calculated and examined in order to do a preliminary assessment of the correlation pattern. For instance, correlations among congeneric

indicator variables were expected to be higher than the correlations among variables hypothesized to load on different dimensions of school engagement

Structural Equation Modeling

Byrne (1998) described structural equation modeling (SEM) as a statistical method that takes a confirmatory approach to analyze a structural theory of the relationships of some variables of interest. Theory represents causal relationships among variables that generate the observed relationships (Bentler, 1988). The causal relationship among variables is represented by a series of structural equations (regression equations), and the relationships are represented in a model. Next, the goodness of fit between the theory-based model and the observed data is tested statistically. If the goodness of fit is adequate then the postulated model is plausible and consistent with the data; a poor goodness of fit means that the probability of the proposed model is not plausible and is rejected or re-specified (Byrne, 1998).

Three types of relationships can be defined in structural equation modeling (Mustafa, 1999). One is association that indicates a non-directional relation, where links between latent exogenous factors can be depicted without causal direction. The second type is directional relationships, where a variable directly affects another variable. And the third type is indirect effect that describes the effect of one variable on another through one or more intervening variables (Hoyle, 1995). Structural equation modeling combines measurement models with structural models. In SEM, researchers are interested in both the causal relationship between latent variables and observed variables, which is called

the measurement model, and the relationship among latent variables, which is called the structural model.

Structural equation models can be developed in five steps (Bollen & Long, 1993) that uses one or all three types of relationships mentioned above (association, direct and indirect effects). These steps are: 1) model specification, 2) model identification, 3) model estimation, 4) testing model fit, and 5) re-specification of the model. Models are specified based on theory or as a result of a literature review of empirical studies that generate a statistical representation about the relationships among latent and observed variables. In the measurement model, both dependent (observed indicators) and independent latent variables are specified (Mustafa, 1999). Because latent variables cannot be directly measured, they are inferred from observed/measurable variables. The measurement model identifies which observed variables define a latent variable. The structural model stipulates the relationships among latent variables and between latent variables and observed variables that are not indicators of latent variables (Schumacker & Lomax, 2004).

The measurement model in structural equation modeling links observed variables to latent constructs. Therefore, the measurement model specifies which observed variables load (λ) on specific latent factors. However, the measurement process starts with the concept (Bollen, 1989), and latent constructs are the representations of these concepts. Once a concept is conceived, there are four steps in the measurement process: (1) give meaning to the concept by developing a theoretical definition of the concept; (2) identify the dimensions and/or latent variables that represent the concept; (3) develop

measures by following the operational definition that describes the procedures to follow for constructing measures of the latent variables; (4) specify the relations between observed and latent variables (Bollen, 1989). Only the latter step is what is known as the measurement model in SEM.

Identification of a model is demonstrated by showing that the unknown parameters are functions only of the identified parameters and that these functions lead to a unique solution (Bollen, 1989). "Identified" parameters are population characteristics of the distribution of the observed variables such as their sample estimators of their variances/covariances. The unknown parameters are from the SEM (Bollen, 1989).

Structural models may be just-identified, over-identified, or under-identified (Byrne, 1998). In a just-identified model, the number of data variances/covariances is equal to the number of parameters to be estimated. Therefore, it has zero degrees of freedom and can never be rejected. In an over-identified model, the number of parameters to be estimated is less than the number of variances and covariances of the observed variables. Consequently, there are positive degrees of freedom that allow rejection of the model. Finally, in an under-identified model, the number of parameters to be estimated is more than the number of variances and covariances. Hence, there is not enough information from the variances and covariances of the observed variables to attain a unique solution for one or more parameters in the model.

Once we have specified and ascertained that the model is identified, the next step is to estimate model parameters. The main focus of the estimation process is to yield parameter values such that the discrepancy between the sample covariance matrix and the

population covariance matrix implied by the model is minimal. The three most commonly used estimation models are: Maximum Likelihood, Generalized Least Squares, and Asymptotic Distribution Free (Mustafa, 1999).

The next step after estimating model parameters is to test the model. Model fit is tested by comparing the predicted model covariance with the sample covariance matrix. A model is deemed fit if the hypothesized population covariance matrix is similar to the sample covariance matrix.

The last step in structural equation modeling is model re-specification, if the researcher is interested in model generation. Jöreskog (1993) described three purposes for testing structural equation models: strictly confirmatory, alternative models, and model generating. In strictly confirmatory case, the researcher postulates a model based on theory, collects data, tests the fit of the hypothesized model to the sample data, and rejects or fails to reject the model. No more modifications to the model are made. In alternative models, the researcher proposes several alternative models and, after analyzing the data, selects one model that better fits the sample data. Finally, in model generating mode, the researcher, after rejecting the model based on poor fit, proceeds in an exploratory way to modify and re-estimate the model (Byrne, 1998).

Construct Validity

Construct validity refers to the degree to which inferences can legitimately be made about constructs based on the operational definitions made in one's study (Pedhazur & Schmelkin, 1991). Construct validity is related to generalizing. But, unlike

external validity that involves generalizing from one's study to other people, places, and times, construct validity involves generalizing from one's measures to the *concept* of one's measures (Trochim, 2002).

When someone claims that his measures have construct validity, he is basically claiming that he knows and understands how the constructs and observed indicators operate in theory and, therefore, can provide empirical evidence that these measures behave in practice the way he hypothesized, by showing that the variance/covariance (observed pattern) of the observed measures corresponds with the hypothesized theoretical pattern. The objective of the confirmatory factor analysis is to assess the goodness of fit between the theory-based model of school engagement and the observed data.

Hypotheses Testing

The main issue in this study was the plausibility of a multidimensional structure of school engagement. Although many researchers argue that school engagement comprises three dimensions (behavioral, emotional, and cognitive), many empirical studies only use two dimensions (commonly including behavioral and emotional engagement) or one general school engagement measure by combining behavioral, emotional, and cognitive engagements. In an effort to clarify this disparity, our objective was to test the hypothesis that school engagement has a three-factor structure against the two alternative hypotheses: a) school engagement has a two-factor structure, and b) school engagement has a one-factor structure (general school engagement) with no distinction between behavioral, emotional and cognitive engagements.

Hypothesis I: School engagement has a three-factor structure. To test hypothesis one, CFA was used to assess whether a three-factor, two-factor, or one-general factor represented a better fitting model of school engagement. Therefore, the general strategic framework for testing the structure of school engagement was alternative models (Jöreskog, 1993).

In the initial model, the following hypotheses were tested:

1. Students' self-rating scales on school engagement can be better explained by three latent factors or facets: behavioral, emotional, and cognitive engagement;
2. Each observed indicator has a nonzero loading (λs) on the facet of school engagement (ξs) it is hypothesized to measure and zero loading on the two other facets;
3. The three latent factors are correlated (Φ);
4. Errors of measurement of the observed variables are uncorrelated (δs).

The model in structural equation modeling notation is[4]

$x_g = \Lambda_g \xi_g + \delta_g$

$x_g = (x_1, x_2, \ldots x_{16})$ are the observed indicators of school engagement

Λ is the matrix Λ_x of the general model

$\xi_g = (\xi_1, \xi_2, \xi_3)$ are latent variables (dimensions of school engagement)

$\delta_g = (\delta_1, \delta_{2,\ldots.} \delta_{16})$ are error variables

[4] Path diagram was shown in Figure 1

Because the initial model did not fit the data well, modification indices, theory, and empirical findings were used to re-specify the model in order to find a better fit to the data. In short, residuals were examined to determine the degree of similarity/dissimilarity between the observed covariance matrix and the predicted (hypothesized) covariance matrix, and made adjustments to the model. At the end of the model re-specification process, the final model was cross-validated with an independent sub-sample (second half of the sample) in order to ensure we did not over-fit the model to the sample data.

Multiple goodness-of-fit statistics were used to assess the fit between the sample covariance and fitted covariance matrices (McCallum, 1996). The following indices of fit were used to assess model fit: 1) chi squared (χ^2); 2) Root Mean Squared Error of Approximation (RMSEA); 3) Expected Cross-Validation Index (ECVI); 4) Standardized Root Mean Residual (SRMR); 5) Goodness-of-Fit Index (GFI); 6) Adjusted Goodness-of-Fit Index (AGFI) and; 7) Comparative Fix Index (CFI).

The χ^2 test simultaneously tests the extent all residuals in the difference between the unrestricted covariance matrix and the restricted covariance matrix, $\Sigma - \Sigma(\theta)$, are equal to zero (Bollen, 1989). Therefore, the higher the probability of finding a χ^2 value that exceeds the χ^2 when the null hypothesis is true ($\Sigma - \Sigma(\theta)$), the closer the fit between the hypothesized model and the perfect fit (Bollen, 1989). However, the χ^2 test assumes that the observed variables are normally distributed (no kurtosis), the covariance matrix is analyzed, the sample size is large, and that the null hypothesis ($\Sigma - \Sigma(\theta)$) holds exactly (Bollen, 1989), which in practice one or more of these assumptions do not hold. On one hand, the analysis of covariance structures are grounded on large sample theory to attain

good parameter estimates and approximate an asymptotic χ^2 distribution; on the other hand, with large sample size the power of the statistical test is increased and trivial discrepancy between the sample and the hypothesized matrix can be found significant. As a result, the χ^2 test by itself may not be a good estimate of model fit (Byrne, 1998; Hu & Bentler, 1995; McCallum et al., 1996). Consequently, multiple goodness-of-fit statistics were used in this study as described below.

The RMSEA is a measure of the average standardized residual per degree of freedom; values less than 0.05 indicate good fit, and values as high as 0.08 are considered fair (Byrne, 1998); values between 0.08 and 0.10 indicate mediocre fit, and values higher than 0.10 indicate poor fit (McCallum et al., 1996). The ECVI evaluates the difference between the fitted covariance matrix in the analyzed sample, and the expected covariance matrix that would be attained in another sample of similar size (Byrne, 1998). The hypothesized model's ECVI is compared to the saturated model (just-identified model) and the independence model (correlations among variables are zero). The model with the smallest ECVI value has the greatest potential for replication (Byrne, 1998). The SRMR is the average value of all standardized residuals, and ranges from 0.00 to 1.00. A value of 0.05 or lower indicates good fit. Values close to 1 for the GFI and AGFI represent good fit. Finally, the CFI is a measure of the comparison of a hypothesized model with the independence model, and its value ranges from 0.00 to 1.00; values of >0.90 indicate good fit. In addition to testing the measurement model by reviewing the pattern of relations among observed indicator variables and facets of school engagement, properties such as reliability and validity of the observed indicators were also examined (Jöreskog & Sörbom, 1989).

Hypothesis II: The measurement and factor structure of school engagement are invariant across white and African American students. Hypothesis II was tested by evaluating the measurement and structural models of school engagement for white and African American students. Specifically, the test involved whether the observed variables measuring school engagement operate equivalently (pattern of loadings) for white and African American students. In addition, the equivalence of the relations among facets of school engagements (variance/covariance of latent variables, Φ) for white and African American students was evaluated.

Because many times survey instruments operate differently between groups, prior to conducting factorial invariance testing between groups, separate baseline models for white and African American students was estimated. These models represent the best fitting, most parsimonious and substantively meaningful model to the data. This process was accomplished while testing hypothesis I. Because the χ^2 goodness-of- fit statistic and its degrees of freedom are additive, the sum of the white and African American model's χ^2s represents how well the model of the factor structure fits the data across groups (Byrne *et al.*, 1989).

Consequently, in order to assess group invariance between groups, data from white and African American students were stacked to simultaneously estimate parameters within groups in order to obtain efficient estimates (Bollen, 1989; Jöreskog & Sörbom, 1996). Goodness-of-fit statistics were evaluated to determine the plausibility of the equality constraints across groups. First, to test whether school engagement is best described by a three-factor structure for both white and African American students, the

two groups were combined and the parameters of each group were simultaneously estimated. Second, to test for invariant pattern of factor loadings, the entire matrix of factor loadings was specified invariant or equal between the two groups. After assessing model fit, equality constraints between groups were imposed gradually to test group invariance of specific factor loadings (λs). Third, to test for invariant factor variances/covariances (Φ), the entire factor variance/covariance matrix was constrained equal across white and African American students. After assessing model fit, specific parameters of the factor variance/covariance matrix were gradually specified to be invariant. Parameters that were invariant across groups were constrained equal while proceeding with further tests of both measurement and structural parameters.

Hypothesis III: The latent mean structures of school engagement for white and African American students are invariant across groups. In order to test this hypothesis covariance and mean structures were used to assess whether there are differences in latent mean structures of behavioral, emotional and cognitive engagement between white and African American students. To do this analysis with Linear Structural Relations (LISREL) program, dummy variables were utilized to estimate the observed variable means (Tau - τ) and factor means (Kappa - κ). The set of factor intercepts (κs or latent means) for African American students were set to zero (dummy coding) and used it as reference group to compare the latent means of white students. To set the unit of measurement for the factors, the factor loading of one of each congeneric indicator (λ) was fixed to one (1).

Summary

The methodology of the study as outlined in this chapter will be implemented in chapter four to test the multidimensional nature of school engagement, as well the measurement and factorial invariance of covariance and means structures of school engagement across white and African American students. In addition, the measurement properties of the model will be analyzed and reliability coefficients calculated.

CHAPTER FOUR

ANALYSIS AND RESULTS

Introduction

This chapter reports the results of data analysis and hypothesis testing. The first section presents the results of exploratory factor analysis, descriptive statistics and data screening of all study variables, individually and by dimensions of school engagement. In addition, patterns in the correlation matrices of the observed indicators were examined, and reliability coefficients (Cronbach's alpha), by dimensions of school engagement and as a whole, were calculated. It also presents results of t-tests comparing African American and white students on indicators of school engagement. The second section reports the structural equation modeling analysis, including the measurement models within each racial/ethnic group, tests of invariant measurement, structure and latent means' of school engagement across African American and white students.

Exploratory Factor Analysis

HSSSE is a broad school engagement instrument, containing numerous indicators. Therefore, The extraction method used in this EFA was principal axis factoring, and the rotation method was direct oblimin with Kaiser normalization. Based on the information provided in the initial extraction (scree plot) three factors were selected and rotated. The results of the final exploratory factor analysis are presented in Table 2.

Table 2

Results of Exploratory Factor Analysis

Observed Indicators	Factor		
	Emotional Engagement	Behavioral Engagement	Cognitive Engagement
Number of English assignments in a typical week	-.021	.769	.026
Number of math assignments in a typical week	-.014	.705	.007
Number of science assignments in a typical week	.006	.745	.002
Number of history assignments in a typical week	.013	.736	-.036
Worked on a paper or project using information from multiple sources	.086	.079	.379
Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	-.045	.004	.516
Put together ideas or concepts from different subjects when completing assignments or during class discussions	.002	-.006	.607
Discussed ideas from your readings or classes with teachers outside of class	.031	-.026	.519
Discussed ideas from your readings or classes with others outside of class	.001	-.018	.627
I value the rewards that I get at school for my work + I think it is important to make good grades	.474	.093	.135
I feel supported and respected by teachers	.714	.012	-.089
I feel supported and respected by counselors, administrators, secretaries, administrative assistants	.715	.020	-.113
I think the things I learn at school are useful	.578	.000	.055
The support I get at school encourages me to learn more	.744	-.035	.008

Observed Indicators	Factor		
	Emotional Engagement	Behavioral Engagement	Cognitive Engagement
If I could select my high school I'd go to the same school again + I care about my school	.566	-.026	.040
I am excited about my classes + my school makes me curious to learn about other things	.674	-.051	.150

Descriptive Statistics and Data Screening

Descriptive statistics for each of the study variables, including sample size, mean, standard deviation, skewness and kurtosis for white students are shown in Table 3A; similar information for African American students is shown in Table 3B. The valid or effective sample sizes after listwise deletion for white and African American students were 660 and 913, respectively. Listwise deletion is also known as "complete analysis" because it only uses cases (students) with valid observations on all variables. These samples sizes are used throughout the confirmatory factors analyses and latent means structures analysis. As shown in Tables 3A and 3B, the study variables are within acceptable values of skewness and kurtosis, and they show only a few indicators with standard deviations less than one, suggesting there was no range restriction on these variables. According to Curran et al. (1996), problems arise with univariate skewness of 2.0 and kurtosis of 7.0. Univariate values of skewness and kurtosis of the variables in this study are well below those values. One composite variable ("I value the rewards that I get at school for my work + I think it is important to make good grades") is negatively skewed (-1.04) because most students strongly agreed with these statements. Furthermore, an examination of the distribution of all the variables (histograms) in this

study exhibited acceptable approximations to normal distributions. A normal distribution has values of zero (0.0) skewness and zero (0.0) kurtosis (Curran et al., 1996).

Table 3A

Descriptive Statistics for Study Variables – White Sample

Variable	N	Mean	Standard Deviation	Skewness	Kurtosis	% Missing
V1. Number of English assignments in a typical week	789	3.21	1.02	.21	-.60	1.5
V2. Number of math assignments in a typical week	759	3.45	1.09	-.21	-.71	6.7
V3. Number of science assignments in a typical week	735	3.31	1.12	-.03	-.79	6.9
V4. Number of history assignments in a typical week	769	3.32	1.08	.01	-.73	4.7
V5. Worked on a paper or project using information from multiple sources	792	2.73	.86	-.02	-.80	0.5
V6. Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	794	2.72	.97	-.19	-.99	0.4
V7. Put together ideas or concepts from different subjects when completing assignments or during class discussions	792	2.41	.84	.25	-.51	1.0
V8. Discussed ideas from your readings or classes with teachers outside of class	794	1.75	.83	.95	.34	0.7
V9. Discussed ideas from your readings or classes with others outside of class	791	2.47	.92	.15	-.82	0.9
V10. I value the rewards that I get at school for my work + I think it is important to make good grades	787	4.05	.90	-1.04	.89	1.5
V11. I feel supported and respected by teachers	790	3.60	1.06	-.61	-.07	1.1
V12. I feel supported and respected by counselors, administrators, secretaries, administrator assistants	781	3.27	.98	-.19	-.32	1.9
V13. I think the things I learn at school are useful	792	3.45	.99	-.55	-.04	1.1
V14. The support I get at school encourages me to learn more	792	3.06	1.05	-.13	-.44	1.1
V15. If I could select my high school I would go to the same school again + I care about my school	786	3.34	1.13	-.41	-.61	2.1
V16. I am excited about my classes + my school makes me curious to learn about other things	785	3.09	.95	-.22	-.19	1.7
Valid N (listwise)	660					20

Table 3B

Descriptive Statistics for Study Variables – African American Sample

Variable	N	Mean	Standard Deviation	Skewness	Kurtosis	% Missing
V1. Number of English assignments in a typical week	1237	3.31	1.15	.05	-.96	2.6
V2. Number of math assignments in a typical week	1177	3.42	1.15	-.10	-1.04	7.1
V3. Number of science assignments in a typical week	1135	3.38	1.16	-.11	-.97	12
V4. Number of history assignments in a typical week	1175	3.42	1.16	-.12	-.98	9.0
V5. Worked on a paper or project using information from multiple sources	1251	2.94	.87	-.28	-.84	1.4
V6. Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	1239	2.56	1.01	.01	-1.10	2.0
V7. Put together ideas or concepts from different subjects when completing assignments or during class discussions	1246	2.47	.88	.16	-.68	1.8
V8. Discussed ideas from your readings or classes with teachers outside of class	1248	1.92	.94	.76	-.35	1.7
V9. Discussed ideas from your readings or classes with others outside of class	1249	2.49	.98	.13	-.99	1.6
V10. I value the rewards that I get at school for my work + I think it is important to make good grades	1237	4.33	.71	-1.29	2.11	2.7
V11. I feel supported and respected by teachers	1247	3.71	1.08	-.68	-.06	1.6
V12. I feel supported and respected by counselors, administrators, secretaries, administrator assistants	1222	3.58	.10	-.50	-.12	4.1
V13. I think the things I learn at school are useful	1250	3.85	.10	-.78	.35	1.3
V14. The support I get at school encourages me to learn more	1246	3.51	1.06	-.44	-.31	1.4
V15. If I could select my high school I would go to the same school again + I care about my school	1238	3.21	1.19	-.23	-.85	2.4
V16. I am excited about my classes + my school makes me curious to learn about other things	1233	3.23	.94	-.37	-.03	3.3
Valid N (listwise)	913					27.5

Inter-item correlations of school engagement indicators

The correlations among all school engagement variables are shown in Table 4. As expected, correlations among congeneric indicators (all significant at $p<0.01$) are higher than the correlations among variables hypothesized to measure different dimensions of school engagement. Even though there are many significant correlations between variables across dimensions, in most cases the correlations among congeneric indicators are larger than the correlations among cross-dimensional variables. For instance, while the correlations among indicators of behavioral engagement ranged from 0.45 to 0.56, the correlations of behavioral engagement indicators and other variables ranged from 0.05 to 0.18. Similarly, correlation coefficients within emotional engagement measures are higher than their correlations across dimensions. However, differences in the correlations within cognitive engagement and between cognitive and emotional engagement are smaller or less distinctive. As anticipated, the correlations among indicators of school engagement are all positive. Similar patterns can be seen in the African American student sample (Appendix B).

Table 4
Inter-Item Correlations Between School Engagement Variables for White Students (N= 660)

	V1. English assignments in a typical week (#)	V2. Math assignments in a typical week (#)	V3. Science assignments in a typical week (#)	V4. History assignments in a typical week (#)	V5. Worked on a paper or project using info. from multiple sources	V6. Considered views of diff. races, religions, genders, political beliefs in class discussions or assignments	V7. Put together ideas or concepts from diff. subjects when completing assign or during class discussions	V8. Discussed ideas from your readings or classes with teachers outside of class
V1. English assignments in a typical week	1							
V2. Math assignments in a typical week	0.50**	1						
V3. Science assignments in a typical week	0.53**	0.45**	1					
V4. History assignments in a typical week	0.50**	0.46**	0.51**	1				
V5. Worked on a paper or project using information from multiple sources	0.13**	0.15**	0.17**	0.12**	1			
V6. Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	0.08*	0.10*	0.03	0.06	0.28**	1		
V7. Put together ideas/concepts from different subjects when completing assign. or during class discussions	0.14**	0.12**	0.15**	0.11**	0.31**	0.37**	1	
V8. Discussed ideas from your readings or classes with teachers outside of class	0.11*	0.14**	0.13**	0.08	0.24**	0.22**	0.37**	1

Table 4, Continued
Inter-Item Correlations Between School Engagement Variables for White Students (N= 660)

	V1. English assignments in a typical week (#)	V2. Math assignments in a typical week (#)	V3. Science assignments in a typical week (#)	V4. History assignments in a typical week (#)	V5. Worked on a paper or project using info. from multiple sources	V6. Considered views of diff. races, religions, genders, political beliefs in class discussions or assignments	V7. Put together ideas or concepts from diff. subjects when completing assign or during class discussions	V8. Discussed ideas from your readings or classes with teachers outside of class
V9. Discussed ideas from your readings or classes w/others outside of class	0.16**	0.16**	0.11**	0.07	0.31**	0.27**	0.35**	0.43**
V10. I value the rewards I get at school for my work + I think it is important to make good grades	0.14**	0.18**	0.14**	0.12**	0.27**	0.22**	0.22**	0.25**
V11. I feel supported and respected by teachers	0.10**	0.17**	0.14**	0.08*	0.22**	0.19**	0.19**	0.17**
V12. I feel supported and respected by school staff	0.10*	0.12*	0.14**	0.09*	0.19**	0.08*	0.19**	0.18**
V13. I think the things I learn at school are useful	0.06	0.12**	0.10*	0.06	0.19**	0.19**	0.22**	0.26**
V14. The support I get at school encourages me to learn more	0.08*	0.09*	0.13**	0.08*	0.20**	0.16**	0.27**	0.27**
V15. If I could select my hs I'd go to the same hs again + I care about my school	0.06	0.09*	0.08	0.06	0.19**	0.19**	0.16**	0.20**
V16. I'm excited about my classes + my sch. makes me curious to learn about other things	0.09*	0.07	0.08	0.04	0.21**	0.29**	0.32**	0.33**

Table 4, continued

Inter-Item Correlations Between School Engagement Variables for White Students (N=660)

	V9. Discussed ideas from your readings or classes with others outside of class	V10. I value the rewards that I get at school for my work + I think it is important to make good grades	V11. I feel supported and respected by teachers	V12. I feel supported and respected by school staff	V13. I think the things I learn at school are useful	V14. The support I get at school encourages	V15. If I could select my high school I'd go to the same school again + I care about my school	V16. I am excited about my classes + my sch makes me curious to learn about other things
V9. Discussed ideas from your readings or classes with others outside of class	1							
V10. I value the rewards that I get at school for my work + I think it is important to make good grades	0.25**	1						
V11. I feel supported and respected by teachers	0.18**	0.48**	1					
V12. I feel supported and respected by school staff	0.16**	0.40**	0.62**	1				
V13. I think the things I learn at school are useful	0.20**	0.47**	0.44**	0.40**	1			
V14. The support I get at school encourages me to learn more	0.23**	0.47**	0.53**	0.53**	0.59**	1		
V15. If I could select my high school I'd go to the same school again + I care about my school	0.22**	0.33**	0.41**	0.38**	0.35**	0.43**	1	
V16. I am excited about my classes + my school makes me curious to learn about other things	0.35**	0.44**	0.47**	0.41**	0.55**	0.60**	0.57**	1

*p<0.05, **p<0.01

The correlations among indicators of behavioral engagement for white and African American students are shown in Table 5, with African American inter-item correlations in parenthesis. These correlations are positive, high, and all are significant at $p<0.01$. In this sample, the highest inter-item correlation was between the number of English assignments and the number of science assignments students reported completing in a typical week.

Table 5

Inter-Item Correlations of Indicators of Behavioral Engagement for White (and African American) Students

	V1. Number of English assignments in a typical week	V2. Number of math assignments in a typical week	V3. Number of science assignments in a typical week	V4. Number of history assignments in a typical week
V1. Number of English assignments in a typical week	1			
V2. Number of math assignments in a typical week	0.50** (0.61**)	1		
V3. Number of science assignments in a typical week	0.53** (0.62**)	0.45** (0.56**)	1	
V4. Number of history assignments in a typical week	0.50** (0.60**)	0.46** (0.57**)	0.51** (0.61**)	1

*p<0.05, **p<0.01

The correlations among indicators of cognitive engagement are shown in Table 6. Even though the correlations between indicators of cognitive engagement are fairly high (r between 0.23 and 0.39) and significant at $p<0.01$, these correlations are lower than the inter-item correlations within behavioral and emotional engagement. This finding is consistent with previous research that shows the complicated nature of measuring cognitive engagement, as cognition is not easily observable and it must be inferred from other measures (Fredricks et al., 2004).

Table 6

Inter-Item Correlation of Indicators of Cognitive Engagement for White (and African American) Students

	Worked on a paper or project using information from multiple sources	Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	Put together ideas or concepts from different subjects when completing assignments or during class discussions	Discussed ideas from your readings or classes with teachers outside of class	Discussed ideas from your readings or classes with others outside of class
V5. Worked on a paper or project using information from multiple sources	1				
V6. Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	.28** (0.18**)	1			
V7. Put together ideas or concepts from different subjects when completing assignments or during class discussions	.31** (0.26**)	.37** (0.34**)	1		
V8. Discussed ideas from your readings or classes with teachers outside of class	.24** (0.22**)	.22** (0.19**)	.37** (0.31**)	1	
V9. Discussed ideas from your readings or classes with others outside of class	.31** (0.25**)	.27** (0.28**)	.35** (0.33**)	.43** (0.40**)	1

*p<0.05, **p<0.01

The correlations among indicators of emotional engagement are shown in Table 7. These correlations are similar to the correlations within behavioral engagement; that is, high, positive, significant, and higher than across dimensions. The strongest inter-item correlation within emotional engagement was between students' perceived support and respect from teachers and other school personnel (counselors, administrators, secretaries/administrative assistants). Due to the important influence teachers exert on students' school engagement (Furrer & Skinner, 2003), this study was particularly

interested in investigating the similar/dissimilar influence of perceived teacher support and respect on emotional engagement of African American and White students. Therefore, in spite of being highly correlated (0.62) this variable was not added to the composite variable containing students' perceived support and respect from other school personnel.

Table 7

Inter-Item Correlations of Indicators of Emotional Engagement for White (and African American) Students

	I value the rewards that I get at school for my work + I think it is important to make good grades	I feel supported and respected by teachers	I feel supported and respected by counselors, administrators, secretaries/ adm assistants	I think the things I learn at school are useful	The support I get at school encourages me to learn more	If I could select my high school I'd go to the same school again + I care about my school	I am excited about my classes + my school makes me curious to learn about other things
I value the rewards that I get at school for my work + I think it is important to make good grades	1						
I feel supported and respected by teachers	0.48** (0.35**)	1					
I feel supported and respected by counselors, administrators, secretaries/adm assistants	0.40** (0.35**)	0.62** (0.57**)	1				
I think the things I learn at school are useful	0.47** (0.30**)	0.44** (0.31**)	0.40** (0.28**)	1			
The support I get at school encourages me to learn more	0.47** (0.32**)	0.53** (0.40**)	0.53** (0.40**)	0.59** (0.52**)	1		
If I could select my high school I'd go to the same school again + I care about my school	0.33** (0.31**)	0.41** (0.33**)	0.38** (0.36**)	0.35** (0.29**)	0.43** (0.39**)	1	
I am excited about my classes + my school makes me curious to learn about other things	0.44** (0.33**)	0.47** (0.39**)	0.41** (0.42**)	0.55** (0.45**)	0.60** (0.55**)	0.57** (0.54**)	1

*p<0.05, **p<0.01

Reliability Coefficients

Classical test theory's reliability coefficients (Cronbach's alpha) for white and African American samples are shown in Tables 8A&B, respectively. Consistently, across white and African American samples, the cognitive engagement scale has the lowest reliability coefficient. More specifically, the variable "worked on a paper or project using information from multiple sources" showed the lowest corrected item-total correlation (r=0.267); however, if this item is deleted, the reliability coefficient of the scale does not improve. With the exception of the cognitive engagement scale – especially for African Americans – the scale as a whole and scales by dimensions show high levels of internal consistency.

Table 8A

Reliability Coefficients (α) for Total Scale and Subscales for White Students

	Cronbach's Alpha	Number of Items	Number of Cases*
School Engagement Scale – total	0.83	16	649
Behavioral Engagement Subscale	0.87	4	697
Cognitive Engagement Subscale	0.70	5	782
Emotional Engagement Subscale	0.86	7	756

*Listwise deletion

Table 8B

Reliability Coefficients for Total Scale and Subscales for African American Students

	Cronbach's Alpha	Number of Items	Number of Cases*
School Engagement Scale – total	0.79	16	928
Behavioral Engagement Subscale	0.85	4	1024
Cognitive Engagement Subscale	0.65	5	1222
Emotional Engagement Subscale	0.81	7	1165

*Listwise deletion

Differences on Observed Indicators of School Engagement across White and African American Students

The mean of white and African American students' responses to the observed variables were compared using a series of one-way ANOVAs. African American students reported a significantly higher number of English assignments completed in a typical week than white students, $F = 4.357$ (1, 2024), $p < .037$, $\eta^2 = .002$, but there were no significant differences between African American and white students on any other indicators of behavioral engagement. In addition, within indicators of cognitive engagement, while African American students scored significantly higher than white students on the statements "worked on a paper or project using information from multiple sources," $F = 28.99$ (1, 2041), $p < .000$, $\eta^2 = .014$, and "discussed ideas from your readings or classes with teachers outside of class," $F = 16.68$ (1, 2040), $p < .000$, $\eta^2 = .008$, white students reported higher mean score on the item "considered views of

different races, religions, genders, or political beliefs in class discussions or assignments," $F = 13.31$ (1, 2031), $p < .000$, $\eta^2 = .007$.

With the exception of one composite indicator of emotional engagement ("If I could select my high school I would go to the same school again + I care about my school"), African American students scored significantly higher than white students on all indicators of emotional engagement, with p-values ranging from .000 to .027, and η^2 values from .002 to .042. It should be kept in mind that with large sample sizes almost all mean differences are statistically significant, but not necessarily of practical importance.

Structural Equation Modeling Analysis

Analysis of the covariance structure of the data (LISREL 8.72) (Jöreskog & Sörbom, 2005) was carried out in three main steps. First, the best fitting model for the data was established separately for the white and African Americans samples. Second, the measurement and structural invariances of school engagement across white and African American students were tested. And third, invariance of school engagement factor means between white and African American student was also tested.

Multidimensional Structure of School Engagement

Three-Factor Model

Statistical identification. There were 16 variables in this study and, therefore, there were 16*(*16+1)/2 or 136 independent data points in the variance/covariance matrix among the study variables. On the other hand, there were 35 parameters to be estimated

(13 factor loadings; 6 factor variance/covariances; 16 error variances) in the initial model. Hence, we had an over-identified model with 101 degrees of freedom (df).

Using multiple criteria to assess model fit, as explained in chapter three, the models were re-specified and re-estimated in an exploratory fashion until the final best-fitting model for each racial/ethnic group was obtained. Even though the initial model was acceptable, as shown in Table 9, based on the largest modification index and substantive justification, one modification to the initial model was made – freeing correlated errors ($\theta_{12, 11}$) between the variables "I feel supported and respected by teachers" and "I feel supported and respected by counselors, administrators, secretaries, and administrative assistants". It was logical to expect the errors of these two variables to be correlated because students were responding to the same root question with the only difference being the object of the response (teachers versus other school personnel). A statistically significant drop in χ^2 was found when these error/uniqueness variances were allowed to covary. The best fitting models are shown in Figures 2 & 3 for white and African American students, respectively. Table 9 summarizes the results of this analysis and shows adequate fit to the data for both white and African American students' school engagement models (Hoyle, 1995). The chi-squares to degrees of freedom ratios for both white and African American samples were between 1.0 and 5.0; the values of the CFI, GFI and AGFI were ≥ 0.94. In addition, values of the Standardized Root Mean Residual (SRMR) and the Root Mean Squared Error of Approximation (RMSEA) were below 0.05. Consequently, it was concluded that Model 2 was the most plausible 3-factor baseline model for white and African American students. Appendix D shows the

maximum likelihood parameter estimates, standard errors, and t-values for the three factor model.

Table 9

Three Factor Model

	χ^2	df	$\Delta\chi^2$	df	χ^2/ df	SRMR	RMSEA (90% CI)	GFI	AGFI	CFI
White										
1. 3-Factor Model $\theta_i\theta_j=0$	300.32 **	101	-	-	2.97	0.041	0.055 (.05-.06)	0.95	0.93	0.97
2. $\theta_{12,11}$ free	244.21 **	100	56.11 **	1	2.44	0.039	0.047 (.04-.05)	0.96	0.94	0.98
African American										
1. 3-Factor Model $\theta_i\theta_j=0$	465.45 **	101	-	-	4.61	0.043	0.064	0.94	0.92	0.95
2. $\theta_{12,11}$ free	299.38 **	100	166.07 **	1	3.00	0.038	0.047 (.04-.05)	0.96	0.95	0.97

*p<0.05; **p<0.01. Dashes mean not applicable

Figure 2

Final Maximum Likelihood Estimation Measurement Model (completely standardized solution) – White

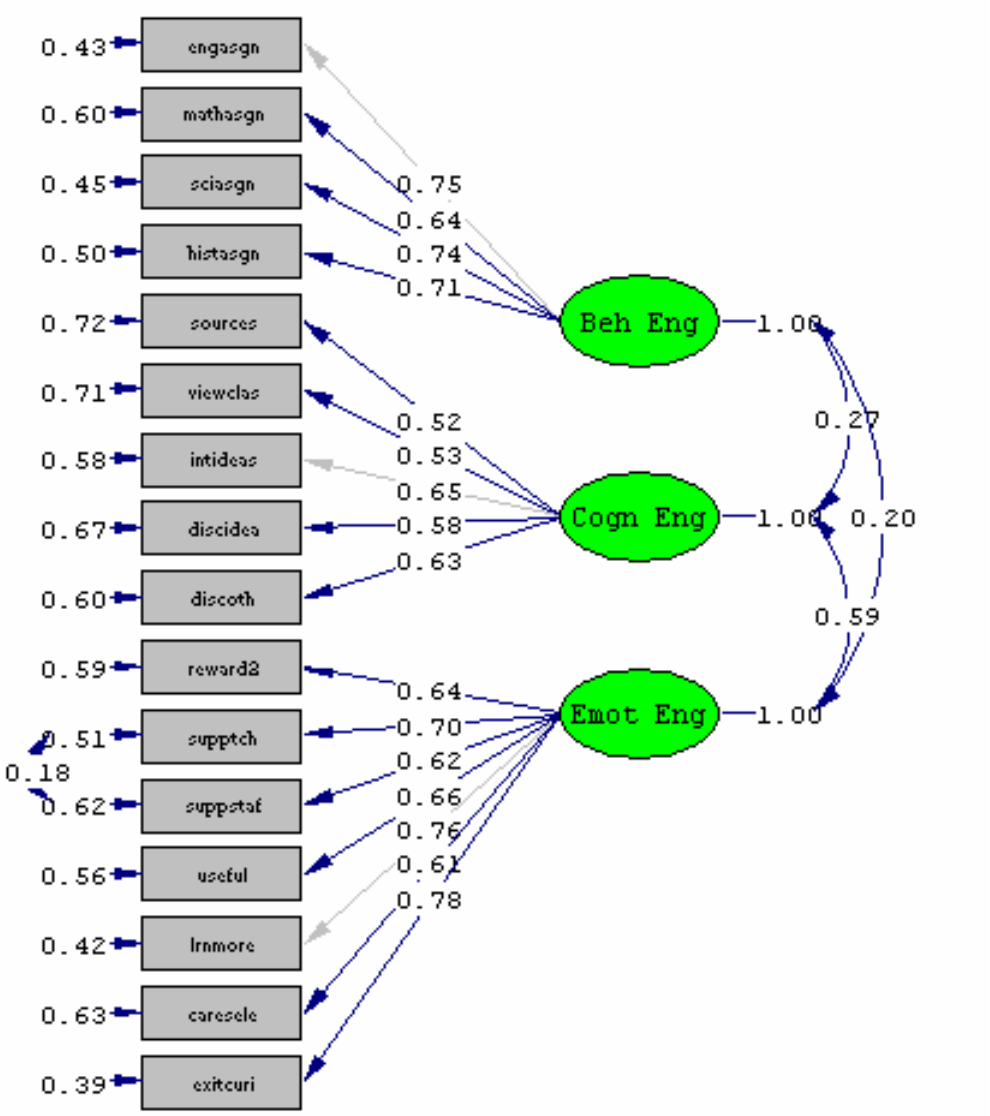
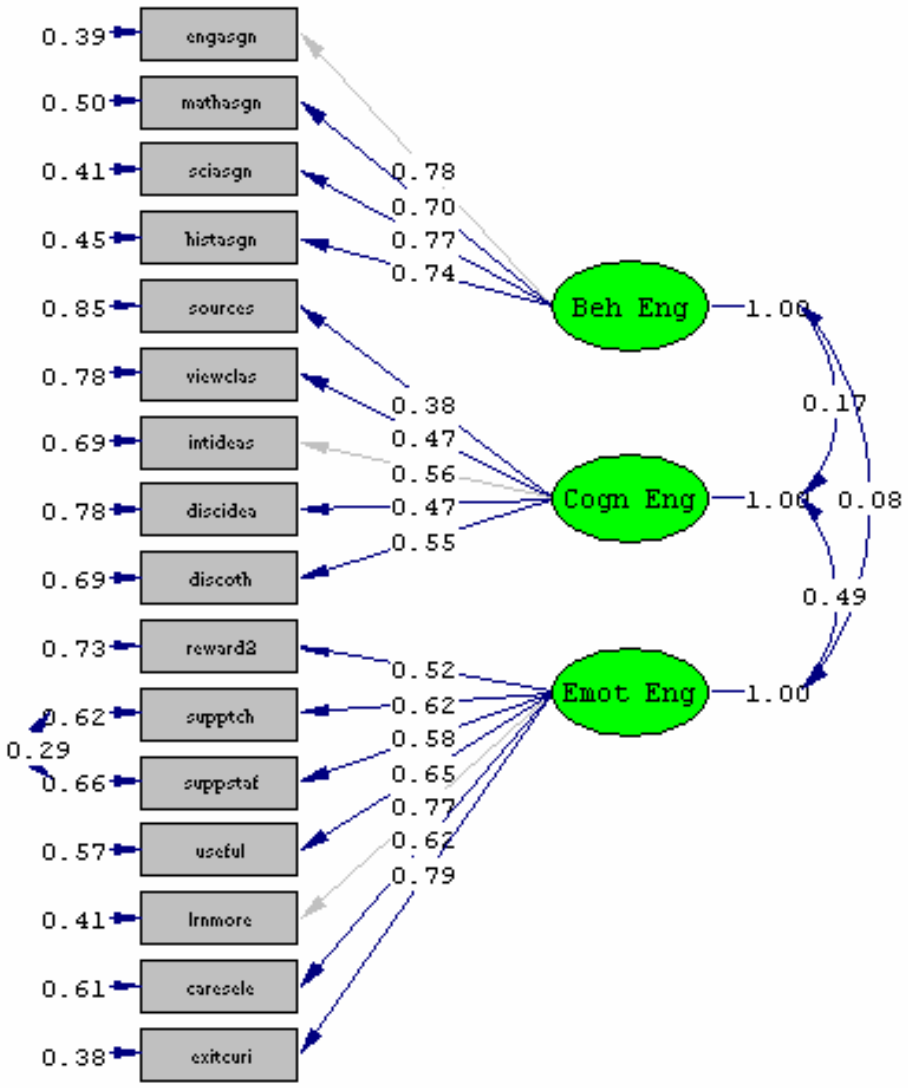


Figure 3

Final Maximum Likelihood Estimation Measurement Model (completely standardized solution) – African American



Two-Factor Model

The hypothesized two-factor model was generated based on theory and empirical analysis. The majority of studies on school engagement use one or two factors, usually including behavioral and emotional engagement (Jimmerson et al. 2003). Moreover, Finn

& Voelkl (1993) defined school engagement as having a behavioral component called participation, and an emotional component called identification. In addition, analysis of the three-factor model of school engagement showed that the emotional and cognitive factors are correlated much highly (0.59) than the behavioral engagement factor with any other factor. Moreover, inter-item correlations showed that indicators of emotional and cognitive engagement were more correlated than other items across dimensions. As a result, the two-factor model was defined as behavioral engagement as the first factor, and a combination of emotional and cognitive engagement indicators previously used in the three-factor model as the second factor.

Statistical identification. There were 16 variables in this study and, therefore, there were 136 independent data points in the variance/covariance matrix. There were 33 parameters to be estimated (14 factor loadings; 3 factor variance/covariances; 16 error variances) in the initial model. Thus, we had an over-identified model with 103 degrees of freedom.

The results of the measurement model analysis of school engagement with two factors are presented in Table 10. After the initial model was rejected, the model was re-specified and re-estimated in an exploratory mode; based on the highest modification index four error variances were allowed to covary, one at a time. In every case, the error variances that were allowed to covary belonged to congeneric indicators and a statistically significant drop in χ^2 or improvement in model fit was found.

Table 10

2-Factor Model – African American and White Students

	χ^2	df	$\Delta\chi^2$	df	χ^2/ df	SRMR	RMSEA	GFI	AGFI	CFI
White										
1. 2-Factor Model $\theta_i\theta_j=0$	580.4	103	-	-	5.64	0.068	0.095	0.88	0.84	0.93
2. $\theta_{7,6}$ free	497.4	102	83.02**	1	4.88	0.064	0.084	0.90	0.87	0.94
3. $\theta_{12,11}$ free	430.8	101	66.57**	1	4.27	0.061	0.078	0.91	0.88	0.95
4. $\theta_{9,8}$ free	367.0	100	63.84**	1	3.67	0.059	0.069	0.93	0.90	0.96
5. $\theta_{14,13}$ free	337.1	99	29.92**	1	3.40	0.057	0.065	0.93	0.91	0.96
African American $\theta_i\theta_j=0$										
1. 2-Factor Model	718.1	103	-	-	6.98	0.064	0.086	0.90	0.87	0.91
2. $\theta_{12,11}$ free	544.2	102	173.89**	1	5.34	0.060	0.074	0.92	0.90	0.94
3. $\theta_{7,6}$ free	460.9	101	83.31**	1	4.56	0.056	0.065	0.94	0.91	0.95
4. $\theta_{9,8}$ free	389.5	100	71.44**	1	3.89	0.052	0.057	0.95	0.93	0.96
5. $\theta_{14,13}$ free	345.6	99	43.88**	1	3.49	0.050	0.053	0.95	0.94	0.96

*p<0.05; **p<0.01. Dashes mean not applicable

One-Factor Model

Statistical identification. There were 16 variables in this study and, therefore, there were 136 independent data points in the variance/covariance matrix. There were 32 parameters to be estimated (15 factor loadings; 1 factor variance; 16 error variances) in the initial model. Thus, we had an over-identified model with 104 degrees of freedom.

After the initial model was rejected, previously constrained parameters were gradually relaxed based on the largest modification index. The results of model estimation for both white and African American samples are shown in Table 11. In the model re-specification and re-estimation process, five error variances were allowed to covary.

Table 11

One-Factor Model

	χ^2	df	$\Delta\chi^2$	Δdf	χ^2/ df	SRMR	RMSEA	GFI	AGFI	CFI
White										
1. Null Model	6656.9	120	-	-	55.5					
2. 1-Factor Model $\theta_i\theta_j$=0	1315.2	104	-	-	12.6	0.12	0.15	0.76	0.68	0.81
3. $\theta_{3,1}$ free	1082.6	103	232.6**	1	10.5	0.11	0.13	0.81	0.74	0.85
4. $\theta_{4,2}$ free	950.4	102	132.2**	1	9.3	0.10	0.12	0.84	0.87	0.87
5. $\theta_{7,6}$ free	868	101	82.4**	1	8.6	0.10	0.11	0.86	0.81	0.88
6. $\theta_{12,11}$ free	801	100	67.0**	1	8.0	0.10	0.10	0.87	0.82	0.89
7. $\theta_{9,8}$ free	738	99	63.0**	1	7.5	0.10	0.10	0.88	0.84	0.90
African American										
1. Null Model	7063.2	120	-	-	58.9					
2. 1-Factor Model $\theta_i\theta_j$=0	2918.7	104	-	-	28.1	0.19	0.23	0.58	0.45	0.59
3. $\theta_{12,11}$ free	2453.8	103	464.9**	1	23.8	0.19	0.21	0.64	0.52	0.66
4. $\theta_{16,14}$ free	2067.2	102	386.6**	1	20.2	0.18	0.18	0.70	0.61	0.72
5. $\theta_{16,15}$ free	1903.8	101	163.4**	1	18.8	0.18	0.17	0.72	0.62	0.74
6. $\theta_{15,14}$ free	1707.5	100	196.3**	1	17.1	0.17	0.16	0.76	0.67	0.77
7. $\theta_{14,13}$ free	1542.9	99	164.6**	1	15.6	0.17	0.15	0.77	0.68	0.79

*p<0.05; **p<0.01. Dashes mean not applicable

Model Comparison

Table 12 demonstrates that the three-factor model fits the observed data better than the two- and one-factor models. The three-factor model fits the data better in all goodness-of-fit statistics calculated as compared to the two- and one-factor model: the 3-

factor χ^2 value is smaller (244. 21 vs. 337.06 vs. 738.0), and also has smaller values of ECVI, SRMR, RMSEA, AIC, and CAIC (see below), and significant differential chi-square value: Three-factor vs. two factor model ($\Delta \chi^2_{(1)} = 92.9$; $p < 0.01$), and three- vs. one-factor model ($\Delta \chi^2_{(1)} = 493.8$; $p < 0.01$). In addition, the CFI is higher for the three-factor model than for the two-factor model. As a result, it was concluded that school engagement is a three-factor construct with correlated but distinct dimensions (behavioral, emotional, and cognitive engagement).

Table 12

Three-Factor versus Two-Factor versus One-Factor Model Fit Statistics

	χ^2	df	ECVI	SRMR	RMSEA	AIC	CAIC	CFI
White								
1. Null Model	6656.9	120	10.15			6688.9	6776.8	
2. 3-Factor Model	244.2	100	0.48	0.04	0.05	315.6	513.3	0.98
3. 2-Factor Model	337.1	99	0.68	0.06	0.07	448.0	651.2	0.96
4. 1-Factor Model	738.0	99	1.19	0.10	0.10	782.7	985.9	0.90
African American								
1. Null Model	7063.2	120	7.78			7095.2	7188.3	
2. 3 Factor Model	299.4	100	0.41	0.038	0.047	377.5	586.9	0.97
3. 2 Factor Model	345.6	99	0.47	0.050	0.053	430.4	645.7	0.96
4. 1-Factor Model	1542.9	99	2.49	0.17	0.15	272.0	2483.2	0.79

Measurement Properties of the Three-Factor Model – White and African American Samples

A detailed analysis of the measurement properties of the three-factor model including un-standardized and standardized factor loadings, t-values, squared multiple correlations, observed indicators and composite reliabilities, and error and factor variances are presented in Table 13. All the standardized factor loadings for behavioral engagement and almost all loadings for emotional engagement, with the exception of item 10 ("I value the rewards that I get at school for my work + I think it is important to make good grades"), are higher than the minimum recommended level of 0.60 (Hatcher, 1994). However, all standardized factor loadings for cognitive engagement are below 0.60. In addition, an examination of the variance extracted for each school engagement factor reveals that a large portion is attributable to error rather than the latent constructs.

The squared multiple correlation (R^2) shows the percentage of indicators' variances that can be explained by the latent factors. Examination of Tables 13 and 14 shows that observed variables are moderate indicators of the latent factors. On average, behavioral engagement variables are stronger indicators of their construct, and cognitive engagement measures are comparatively weaker indicators of their construct. R^2 values for emotional engagement variables are between behavioral and emotional engagement values.

Table 13

Measurement Properties of the Three-Factor Measurement Model – White Sample

Construct/ Indicator	Un-standardized Loading	Standardized Loading	t-value	R^2	Reliability[5]	Error Variance	Variance[6] Extracted
Behavioral Engagement					0.80[7]		.51
V1	1.00	.75	-	.57	.57	.43	
V2	0.91	.64	14.40	.40	.40	.60	
V3	1.08	.74	16.33	.55	.55	.45	
V4	0.97	.71	15.77	.50	.50	.50	
Cognitive Engagement					0.72		.34
V5	0.80	.52	10.52	.28	.28	.72	
V6	0.91	.53	10.68	.29	.29	.71	
V7	1.00	.65	-	.42	.42	.58	
V8	0.87	.58	11.30	.33	.33	.67	
V9	1.03	.63	11.99	.40	.40	.60	
Emotional Engagement					0.86		.47
V10	0.73	.64	15.73	.41	.41	.59	
V11	0.96	.70	17.28	.49	.49	.51	
V12	0.79	.62	15.04	.38	.38	.62	
V13	0.82	.66	16.33	.44	.44	.56	
V14	1.00	.76	-	.58	.58	.42	
V15	0.88	.61	14.90	.37	.37	.63	
V16	0.92	.78	19.27	.61	.61	.39	

[5] Item reliability = $\lambda^2_{ij} / (\lambda^2_{ij} + \theta ii)$ (Fornell and Larcker, 1981)
[6] Variance extracted = $(\Sigma\lambda^2_{ij}) / ((\Sigma\lambda^2_{ij}) + (\Sigma\theta ii))$ (Fornell and Larcker, 1981)
[7] Construct reliability = $(\Sigma\lambda i)^2 / ((\Sigma\lambda i)^2 + \Sigma\theta ii)$ (Fornell and Larcker, 1981)

Table 14

Measurement Properties of the 3-Factor Measurement Model – African American Sample

Construct/ Indicator	Unstandardized Loadings	Standardized Loadings	t-value	R^2	Reliability	Error Variance	Variance Extracted
Behavioral Engagement					0.84		.56
V1	1.00	.78	-	.61	.61	.39	
V2	0.90	.70	19.99	.50	.50	.50	
V3	1.04	.77	21.57	.59	.59	.41	
V4	0.99	.74	21.02	.55	.55	.45	
Cognitive Engagement					0.61		.24
V5	0.69	.38	8.05	.15	.15	.85	
V6	0.99	.47	9.22	.22	.22	.78	
V7	1.00	.56	-	.31	.31	.69	
V8	0.90	.47	9.23	.22	.22	.78	
V9	1.13	.55	10.09	.31	.31	.69	
Emotional Engagement					0.84		.43
V10	0.45	.52	14.76	.27	.27	.73	
V11	0.83	.62	17.57	.38	.38	.62	
V12	0.71	.58	16.52	.34	.34	.66	
V13	0.79	.65	18.72	.43	.43	.57	
V14	1.00	.77	-	.59	.59	.41	
V15	0.89	.62	17.84	.39	.39	.61	
V16	0.92	.79	22.50	.62	.62	.38	

Unstandardized Validity Coefficient (λ)

One important indication of validity is the magnitude of the direct structural relation between an observed indicator and the latent factor it is hypothesized to be measuring, which is the unstandardized coefficient that links them (Bollen, 1989). If an observed indicator measures and depends on a latent factor it is expected that changes in the latent factor lead to changes in the observed indicator. Therefore, a factor loading is interpreted as the expected change on an observed indicator for a one-unit change in the latent factor that it is supposed to cause it. Moreover, the unstandardized factor loadings are useful for comparing samples from different populations because they are less

influenced by differences in population variances (Bollen, 1989). Table 13 and 14 also show the unstandardized factor loadings for white and African American students, respectively. As expected, all factor loadings were positive, statistically significantly different from zero, and at least four times larger than their standard errors (see Appendix D for factor loadings, standard errors, and t-values). The majority of factor loadings are comparable across white and African American students. However, there are some differences. The largest factor loading difference between the two groups was lambda 10, 3 ("I value the rewards that I get at school for my work + I think it is important to make good grades" on emotional engagement). The factor loading for white students was 0.73 and 0.45 for African Americans.

Standardized Residuals

In addition to assessing model fit (indicated by goodness-of-fit statistics), standardized residuals were examined to detect a possible misfit in the three-factor model. Standardized residuals represent the discrepancy between the hypothesized covariance matrix and the observed covariance matrix, in standard deviation units. Values >2.58 are deemed to be large (Fredricks et al., 2004). A well-fitted model is represented by standardized residuals with values distributed symmetrically around zero (Jöreskog, 1993).

Figures 4 and 5 show the stem-and-leaf plots of standardized residuals for white and African American students, respectively. As shown in these figures, standardized residuals in both samples have a median value of zero, symmetrically distributed and a few large values above and below zero. The stem-and-leaf plot for white students shows 17 residuals larger than ± 2.58 indicating possible misfit in the model. The African

American stem-and-leaf plot shows 23 residuals larger than ± 2.58. Tables 15 and 16 identify the standardized residual values larger than ± 2.58 for white and African American students mentioned above (refer to Appendix C for observed variance/covariance matrix among study variables). As shown in Tables 15 and 16, the largest standardized residual is the discrepancy of the covariance between "the support I get at school encourages me to learn more" and "I think the things I learn at school are useful" for both the white and African American samples (4.96 and 6.64).

Figure 4

Standardized Residuals' Stem and Leaf Plot – White Sample

```
- 4|1
- 3|5
- 3|20
- 2|9855
- 2|2110
- 1|9998655555555
- 1|44422221000
- 0|88876666555
- 0|4444433322111000000000000000000000
  0|11122344
  0|55566667777888999
  1|0011112222234
  1|58
  2|00333
  2|68
  3|01234
  3|7
  4|
  4|58
  5|0
```

Figure 5

Standardized Residuals' Stem and Leaf Plot – African American Sample

- 5|2
- 4|100
- 3|
- 2|8876666311000
- 1|988555444433311000
- 0|888877666555544333322222110000000000000000000
  0|1112334445666688888999
  1|0111122233455677899
  2|11133668
  3|01355
  4|23
  5|
  6|06

Table 15

Largest Standardized Residuals – White Sample

Indicators	Standardized Residuals
Residual for discidea and viewclas	-3.54
Residual for suppstaf and viewclas	-3.17
Residual for lrnmore and viewclas	-2.86
Residual for lrnmore and intideas	-2.96
Residual for lrnmore and discoth	-2.81
Residual for caresele and useful	**-4.09**
Residual for viewclas and sources	2.98
Residual for intideas and viewclas	4.45
Residual for discoth and discidea	3.70
Residual for reward2 and engasgn	2.63
Residual for reward2 and mathasgn	2.83
Residual for reward2 and sources	3.39
Residual for reward2 and discoth	3.23
Residual for lrnmore and suppstaf	3.15
Residual for lrnmore and useful	**4.96**
Residual for exitcuri and discidea	3.27
Residual for exitcuri and caresele	**4.81**

Table 16

Largest Standardized Residuals – African American Sample

Covariances	Standardized Residuals
Residual for sciasgn and mathasgn	-2.63
Residual for histasgn and engasgn	-2.63
Residual for discidea and viewclas	-2.82
Residual for discoth and histasgn	-2.60
Residual for discoth and intideas	-2.71
Residual for lrnmore and mathasgn	-2.60
Residual for lrnmore and histasgn	-3.98
Residual for lrnmore and viewclas	-4.15
Residual for lrnmore and reward2	-3.95
Residual for caresele and useful	**-5.25**
Residual for caresele and lrnmore	-2.76
Residual for mathasgn and engasgn	3.04
Residual for histasgn and sciasgn	3.14
Residual for intideas and viewclas	4.35
Residual for discoth and discidea	4.24
Residual for reward2 and engasgn	3.47
Residual for reward2 and sources	2.60
Residual for reward2 and discoth	3.47
Residual for supptch and reward2	2.77
Residual for suppstaf and reward2	3.27
Residual for lrnmore and useful	**6.64**
Residual for exitcuri and sciasgn	2.62
Residual for exitcuri and caresele	**6.04**

Factorial Structure of School Engagement

In this study all three dimensions of school engagement were considered exogenous latent variables and no causal relations among the factors were hypothesized. Therefore, only variances and covariances of the factors were estimated. Table 17 shows factor variances and covariances, and Table 18 provides factor correlation coefficients. As expected, all three dimensions of school engagement are positively and statistically significantly correlated among each other. It is noteworthy that the covariance between emotional and cognitive engagement (0.26) is twice as large as the covariance between

behavioral and cognitive (0.12), and behavioral and emotional engagement (0.12). See Appendix E for complete factor variance/covariance, standard errors, and t-values.

Table 17

School Engagement Factor Variance/Covariance

	White Students			African American Students		
	Behavioral	Cognitive	Emotional	Behavioral	Cognitive	Emotional
Behavioral	.61			.74		
Cognitive	.12	.31		.07	.23	
Emotional	.12	.26	.62	.06	.19	.68

Table 18

School Engagement Factor Correlations

	White Students			African American Students		
	Behavioral	Cognitive	Emotional	Behavioral	Cognitive	Emotional
Behavioral	1.00			1.00		
Cognitive	.27	1.00		.17	1.00	
Emotional	.20	.59	1.00	.08	.49	1.00

Factorial Invariance of School Engagement Across African American and White Students

Four hypotheses were considered while testing for factorial invariance of school engagement across white and African American students: 1) that the number of underlying factors is equivalent, 2) that the pattern of factor loadings is equivalent, 3) that the structural relations among the three factors of school engagement are equivalent, and 4) that the school engagement factor means for white and African American students are invariant. These hypotheses are discussed below.

The Number of Underlying Factors is Equivalent Across Groups

There were 136 pieces of information (16x17)/2 for each group and, given that parameters for the two groups were estimated simultaneously, there were 272 total

independent pieces of information. On the other hand, there were 72 parameters to be estimated. Therefore, we had an over-identified model with 200 degrees of freedom.

In this model equality constraints were not imposed on parameters; it only specified that the number of factors is the same across white and African American students. Goodness-of-fit statistics for this model showed that the overall fit is quite adequate, with χ^2 (200, N=1573) = 543.59, SRMR = 0.038, RMSEA = 0.047, GFI = 0.96, CFI = 0.97). As a result, it was concluded that school engagement is best described by a three factor structure for both white and African American students. This model was used as the baseline model for the following test.

The Pattern of Factor Loadings is Invariant across White and African American Students (H_0: $\Lambda_W = \Lambda_B$)[8]

Even though the previous test suggested that school engagement has a three-factor structure for both white and African American students, it does not necessarily mean that the factor loadings are equal across the two racial/ethnic groups. In order to test for invariant factor loadings across white and African American students, all factors loadings (λ) were simultaneously constrained to be equal across groups, and the resulting χ^2 value was compared to the baseline model in which only the number of factors were constrained equal. Because the difference in χ^2 ($\Delta \chi^2_{(13)} = 36.01$) was statistically significant at $p<0.01$, the hypothesis of invariant factor loadings was rejected. This result implied that some or all the factor loadings were non-invariant across white and African American students. The next step was to determine which factor loadings were invariant/non-invariant across groups. Therefore, each factor loading was individually constrained equal across groups and tested for statistical significance. Table 19 shows

[8] W=white; B=African American

that only one factor loading was non-invariant across white and African American students: The loading of "I value the rewards that I get at school for my work + I think it is important to make good grades" on emotional engagement ($\lambda_{10,3}$).

After rejecting the null hypothesis that all factor loadings were invariant across the two groups, each lambda was individually tested for invariance across groups, as described above. In addition, a second method for testing factor loading invariance across white and African American was used. Instead of starting by testing individual lambdas, sets of factor loadings by dimension were constrained equal. Individual factor loadings were tested for invariance only if the pattern of all factor loadings by dimension was untenable. The results of this method were exactly the same as the first method.

Table 19

Steps in Testing Invariance of Factor Loadings

Equality Constraint Between B&W Samples	χ^2	df	$\Delta\chi^2$	p-value
1. EQ lambda 2 1	543.60	201	0.01 ns	.90 < p < .95
2. EQ lambda 3 1	543.77	202	0.17 ns	.50 < p < .75
3. EQ lambda 4 1	543.99	203	0.22 ns	.50 < p < .75
4. EQ lambda 5 2	544.90	204	0.91 ns	.25 < p < .50
5. EQ lambda 6 2	545.92	205	1.02 ns	.25 < p <.50
6. EQ lambda 8 2	546.10	206	0.18 ns	.50 < p < .75
7. EQ lambda 9 2	546.72	207	0.62 ns	.20 < p < .50
8. EQ lambda 10 3	572.58	208	25.86**	p < .005**
9. EQ lambda 11 3	550.06	208	3.34 ns	.05 < p < .10
10. EQ lambda 12 3	550.07	209	0.01 ns	.90 < p < .95
11. EQ lambda 13 3	550.17	210	0.10 ns	.50 < p < .75
12. EQ lambda 15 3	550.77	211	0.60 ns	.20 < p < .50
13. EQ lambda 16 3	551.30	212	0.53 ns	.25 < p < .50

** p<0.005; Baseline model: $\chi^2_{200} = 543.59$

Factor Variances/Covariances are Invariant across White and African American Students (H_0: $\Phi_W = \Phi_B$)

The first step in testing for invariant factor variances and covariances was to test for the equivalence of the entire factor variance/covariance matrix. In order to accomplish that, all the factor loadings, except for $\lambda_{10,3}$, were constrained equal in addition to all the factor variances and covariances. The result of the estimation of this model resulted in a χ^2 (218, N=1573) = 569.06. The difference in χ^2 between this model and model 13 in Table 19 was statistically significant at $p<0.01$, with $\Delta \chi^2$ (6, N=1573) = 17.76; therefore, the hypothesis of invariant factor variances and covariances was rejected. Consequently, each factor variance/covariance parameter was gradually constrained equal across groups and compared to either model 13 or model 13 plus any prior factor variance/covariance parameter found invariant. Table 20 shows that the variance of behavioral engagement was found non-invariant across white and African American students, with a $\Delta \chi^2$ (1, N=1573) = 4.08, at $p<0.05$. All of the other factor variances and covariances were invariant across white and African American students.

Table 20

Steps in Testing Invariant Factor Variances and Covariances

Equality Constraint	χ^2	df	$\Delta \chi^2$	p-value
1. EQ phi 1 1	555.38	213	4.08*	$p < .05$
2. EQ phi 2 1	553.67	213	2.37 ns	$.10 < p < .25$
3. EQ phi 3 1	554.76	214	1.09 ns	$.25 < p < .50$
4. EQ phi 3 2	558.42	215	3.66 ns	$.05 < p < .10$
5. EQ phi 2 2	560.20	216	1.78 ns	$.10 < p < .25$
6. EQ phi 3 3	563.10	217	2.90 ns	$.05 < p < .10$

*$p<0.05$; Model 13: $\chi^2_{212} = 551.30$

The Latent Mean Structures of School Engagement for White and African American Students are Invariant across Groups (H_0: $\mu_W = \mu_B$)

In testing invariance of factor means, restrictions must be imposed on observed indicators' means, therefore, the analysis involves both the covariance and mean structures (Byrne, Shavelson, & Muthén, 1989). Before testing for invariant latent means a separate baseline model for each group was established, and equality constraints were imposed on the measures that were invariant across groups. Even though the factor mean in a single group is undefined, group differences in latent means can be estimated (Jöreskog, 1993). As stated in chapter 3, the factor intercepts (Ks or latent means) for African American students were set to zero and used as reference group to compare the latent means of white students (freely estimated). Therefore, the kappa values represent the difference between white students' latent means and zero or the reference group (African American students' latent means).

The first step in assessing the estimation of this model was to examine the overall goodness-of-fit statistics. The model fit to the observed data was adequate (χ^2 [300, N=1573] = 764.52, $p<0.01$, GFI = 0.95, CFI = 0.96, SRMR = 0.04). The second step was to examine the kappa values (see Table 21). Because the kappa parameters were estimated for the white sample, the negative values of kappa indicates that the latent means of school engagement for white students are lower than for African American students. However, only the latent mean of emotional engagement was statistically significant; the other values of kappa were not statistically different from zero.

Table 21

Difference in Latent Means between White and African American Students

	Behavioral Engagement	Cognitive Engagement	Emotional Engagement
Kappa	-0.08	-0.04	-0.28
Standard Error	0.05	0.03	0.05
t-value	-1.85	-1.27	-6.18

Summary of SEM Analyses

After preliminary data screening and descriptive statistics, the three main objectives of this study were investigated. It was established that a three-factor model for the construct of school engagement fits the data better than a two- or one-factor model. A three-factor structure of school engagement is tenable for both white and African American students. With the exception of one factor loading ("I value the rewards that I get at school for my work + I think it is important to make good grades" on emotional engagement - $\lambda_{10,3}$) and the variance of one latent factor (behavioral engagement), all the measurement and structural parameters of school engagement were invariant across white and African American students. And finally, there was statistically significant difference in the latent mean of emotional engagement between white and African American students. African Americans students had statistically significantly higher latent emotional engagement mean than white students. LISREL syntax for all the analyses are provided in Appendix E.

Cross-Validation

Random samples consisting of 50% from both white and African American students were selected for cross-validation purposes, and several of the analyses

performed with the calibrating sample were replicated. First, the 3-factor model of school engagement was estimated with the cross-validation sample and its goodness-of-fit assessed. Second, the equivalence of the number of underlying factors between white and African American students was tested. Third, measurement and factorial structure invariance between groups were tested. And finally, invariance of latent means between white and African American students was also tested. Variance/covariance matrices and mean values for both groups are provided in Appendix G.

The goodness-of-fit indices for the 3-factor model of the cross-validation sample were comparable to the calibration sample, with a χ^2 (200, N=1577) = 511.51, $p<0.01$, GFI = 0.96, CFI = 0.98, SRMR = 0.039, RMSEA = 0.046 [.041-.05]). In addition, the number of underlying factors for white and African American students for the cross-validation sample was equivalent across groups and equal to the calibrating sample (three dimensions). Following, all factor loadings were constrained equal across groups but this hypothesis was found statistically untenable, with a $\Delta \chi^2$ (13, N=1577) = 32.88, $p<0.01$. The next step was to determine which factor loadings were invariant/non-invariant across groups. Therefore, factor loadings within each of the three dimensions of school engagement were simultaneously constrained equal across groups and tested for statistical significance. All factor loadings within behavioral {$\Delta \chi^2$ (3, N=1577) = 0.66, $p>0.05$} and cognitive engagement {$\Delta \chi^2$ (7, N=1577) = 2.05, $p>0.05$} were found invariant across groups.

However, the hypothesis that all factor loadings within emotional engagement were invariant across groups was rejected {$\Delta \chi^2$ (13, N=1577) = 32.88, $p<0.01$}. Consequently, each factor loading within this dimension of school engagement was

constrained equal one-by-one across groups and tested for statistical significance. As a result, there was one additional non-invariant factor loading ("If I could select my high school I would go to the same high school again + I care about my school" on emotional engagement, $\lambda_{15,3}$) as compared to the calibrating sample. Nevertheless, Lambda 15,3 was marginally non-invariant across groups – when the χ^2 from the previous (step) invariant factor loading was used to compare differences in χ^2 with one degree of freedom ($0.01<p<0.05$). However, $\lambda_{15,3}$ was found invariant across groups when the χ^2 value from the test of equivalent number of underlying factor { $\chi^2(200, N=1577)=511.51$} was used as baseline.

In the structural parameters, there was one additional non-invariant parameter between the calibrating sample and the cross-validation sample. One factor covariance (emotional and cognitive, $\Phi_{3,2}$), in addition to the behavioral engagement factor variance ($\Phi_{1,1}$), was found non-invariant across groups in the cross-validation sample. As shown in the factor variance/covariance matrix in Table 17, cognitive engagement had the smallest variance among the factors (diagonal elements of the variance/covariance matrix), and it appears that this contributed to the instability of this parameter ($\Phi_{3,2}$). Finally, one additional significant latent mean difference between white and African American students was found. White students had lower mean cognitive engagement (negative kappa) than African American students, in addition to the latent mean difference of emotional engagement found in the calibrating sample.

In summary, there were three non-equivalent parameters found between the calibrating and cross-validation samples: One additional factor loading was found non-invariant ([“If I could select my high school I would go to the same high school again + I

care about my school" on emotional engagement, $\lambda_{15,3}$] as well as one additional factor covariance [emotional and cognitive, $\Phi_{3,2}$]). Finally, one additional latent mean (cognitive engagement) was found non-invariant between white and African American students.

CHAPTER FIVE

DISCUSSION AND CONCLUSIONS

Introduction

This study analyzed three competing models to assess the measurement and factorial validity of school engagement. In addition, invariance of the measurement and factorial structure of school engagement across white and African American students were tested. Finally, invariance of latent factor means of school engagement between white and African American students, given partial measurement invariance, was tested. This chapter presents the summary and discussions of the findings of this study, first within groups and finally across groups.

Summary of Research Findings

Multidimensional Structure

The three-factor model was considered the most plausible model for both samples of white and African American students. The three-factor model conceptualizes school engagement as having three distinctive but related dimensions: behavioral, emotional and cognitive engagement. With the exception of error/uniqueness of two indicators of emotional engagement ("I feel supported and respected by teachers" and "I feel supported and respected by school staff") that were allowed to covary in the model re-specification process, the final three-factor model remained as originally hypothesized, and most model fit statistics suggest that the overall model fit was good. The original 3-factor model hypothesized that the observed indicators of school engagement had nonzero

loadings on the factors they were designed to measure, and zero loadings on all other factors (there were no secondary loadings); that there were no correlated measurement errors; and, dimensions of school engagement are correlated.

In addition to the statistical fit, there were other factors that came into play to consider the three-factor model the most plausible. First, there were no cross-loadings for observed indicators across dimensions of school engagement. Second, even though as expected factors of school engagement were correlated, they were not too highly correlated that could make them indistinctive. Third, the three-factor model had fewer correlated errors than the one- or two-factor models suggesting that the latter two models were mispecified. Fourth, the three factor model was the most plausible for both the calibrating and cross-validating samples. Fifth, there were three factors underlying the variances and covariances of the observed indicators based on the scree plot of the exploratory factor analysis. Finally, based on theory, the three-factor model was the most plausible model of school engagement.

All the parameter estimates were in the right direction (positive), and were statistically different from zero at $\alpha < 0.05$. Moreover, the standard errors of the parameter estimates appeared to be within acceptable limits – without being excessively large or small. In addition, an examination of the standardized residuals revealed that these were clustered around zero and were approximately normally distributed (Jöreskog, 1993). The measurement and factorial structure of the three-factor school engagement model was, for the most part, similar across white and African American students.

Even though most of the measurement and structural properties of the three-factor model were similar, there were also some differences between white and African

American students. For white students the factor correlation between emotional and cognitive engagement was much higher (.59) than the correlation between behavioral and cognitive (.27) or behavioral and emotional (.20) engagement. A similar pattern for African American students was found, with higher correlation between cognitive and emotional engagement (0.49) than the correlation between behavioral and cognitive (0.17) or behavioral and emotional engagement (0.08). Although not statistically significant across groups, the magnitude of the factor correlations appeared to be lower for African Americans than for whites.

The correlation between emotional and behavioral engagement within African American students is one half the magnitude of the correlation between cognitive and behavioral engagement, and one sixth of the correlation coefficient between emotional and cognitive engagement. The differences in the factor correlations appear to be less prominent for white students. Furthermore, the covariance between behavioral engagement and both cognitive and emotional engagement for African American students is approximately one half the covariances for white students. However, covariances are sensitive to units of measurement and variability within samples. As shown in the factor variance/covariance matrix in Table 17, cognitive engagement had the smallest variance among the factors (diagonal elements of the variance/covariance matrix), and it appears that this contributed to the instability of this covariance ($\Phi_{3,2}$). It may be that African American students do not translate good relationships with teachers, other school staff, peers, and feeling good about their school to more practical applications such as showing up to school, participating in class and doing homework (behavioral engagement).

Also, it appears that the range of students' responses to cognitive engagement items was more restricted than emotional and cognitive engagement indicators. The variance of the cognitive engagement factor is one half or less than the other two factors. This range restriction could be masking the true association between cognitive engagement and the other factors, and even with its observed indicators. For example, even though the correlation between emotional and behavioral engagement for African American students is significant at $\alpha < 0.05$, it is marginally significant (t=2.05).

Measurement Models

Analysis of the three-factor model within groups revealed good overall fit indices; however, some weaknesses in the measurement model of school engagement for both white and African American samples also appeared. The most important weaknesses in the measurement model were found within cognitive engagement. Three out five standardized factor loadings for cognitive engagement were lower than 0.60; they ranged from 0.52 to 0.65 for the white student sample and from .38 to .56 for the African American sample, which is less than optimal (Hatcher, 1994). Observed variables are indicators or effects of their latent construct; therefore, it is optimal when they are highly correlated as indicated by high factor loadings.

The weakness in the measurement model is also revealed in the squared multiple correlations (R^2) between the observed indicators and the cognitive engagement factor. The magnitude of the R^2 indicates whether observed variables are good indicators of the latent variables. In this study, the multiple correlations between observed indicators and latent factors were between low and moderate size. For the white student sample, the highest squared multiple correlation (0.42) for cognitive engagement indicators was for

the variable "put together ideas or concepts from different subjects when completing assignments or during class discussions;" this means that 42% of the variance of this indicator can be explained by the latent factor. The lowest R^2 (0.28) was for the variable "worked on a paper or project using information from multiple sources." The squared multiple correlations for indicators of cognitive engagement for African American students ranged from .15 to .31.

Another measurement weakness of the three-factor model – specifically for the cognitive engagement factor – is the poor internal consistency among indicators of the construct. The composite reliability coefficient for cognitive engagement was 0..72 and 0.61 for the white and African American samples, respectively. The reliabilities for indicators of cognitive engagement ranged from .28 to .42 for whites, and from .15 to .31 for African American students, which is exceedingly low. An examination of Table 6 reveals moderate correlations among indicators of cognitive engagement for white and African American students, which is one of the main causes for poor reliability of the cognitive engagement scale. According to Bollen & Lennox (1991), it is desirable to have high correlations among effect indicators of a unidimensional construct meaning that one or both indicators are highly correlated with the latent construct, which in turn increases the internal consistency of the scale. In this study, the correlation coefficients among indicators of cognitive engagement ranged from .23 to .42.

The findings mentioned above are consistent with the literature on school engagement that describes the difficulty of measuring cognitive engagement (Fredricks et al., 2004). Oftentimes, school work puts emphasis on memorization of facts and does not demand deep-level learning and strategy use from high school students. Therefore, with

self-reported questionnaires like the HSSSE students cannot relate well with items concerning cognitive engagement. For example, it is plausible that students in our sample are not required at school to use information from different sources when working on projects or papers, or they don't have the opportunity to discuss ideas from readings or classes with teachers and others outside of class. As a result, students must think hypothetically about specific tasks in the HSSSE survey and, therefore, their responses to cognitive engagement indicators have more random error and lower internal reliability.

Overall, indicators of behavioral engagement were better measures (reflective indicators with higher factor loadings) of their latent construct than emotional and cognitive engagement indicators. For white students, the item "number of English assignments in a typical week" was the best observed indicator of behavioral engagement with a standardized factor loading = .75, followed by science (.74), history (.71) and mathematics (.64). Indicators of behavioral engagement for the African American sample were as good as or better than for the white student sample, with factor loadings ranging from .70 to .78. The rule of thumb in structural equation modeling for good factor loadings is .70 (Hair et al., 1995). The selected observed indicators of behavioral engagement were measures of conduct; therefore, they were easier to measure.

Squared multiple correlations between the latent factor and indicators of behavioral engagement for both white and African American students were good, ranging from .57 to .40 (number of math assignments in a typical week) for whites, and from .61 to .50 for African American students. Furthermore, the reliability coefficient for the behavioral engagement scale was good (0.80 for whites and .84 for African Americans), and reliabilities of the individual indicators were also acceptable (0.50-0.61).

The measurement properties of the emotional engagement scale were not as good as that of behavioral engagement, with many standardized factor loading less than 0.70. For the white student sample, emotional engagement factor loadings ranged from .61 to .78 – with the lowest factor loading going to V15 ("If I could select my high school I would go to the same school again + I care about my school"). For the African American sample, V10 ("I value the rewards that I get at school for my work + I think it is important to make good grades") had the lowest standardized factor loading = 0.52, R^2=.27, and reliability = 0.27. Additionally, the remaining indicators of emotional engagement in the African American sample had standardized factor loadings ranging from 0.58 to 0.79. The reliability coefficient for the entire subscale was 0.86 for whites and 0.84 for African American students. Furthermore, the factor loading from emotional engagement onto variable 10 (V10) was found non-invariant across groups.

There is some debate about the optimal correlation coefficient among indicators of the same latent construct. According to (Bollen & Lennox, 1991), for reflective indicators it is preferred to have moderate correlations over low correlations and high correlations among indicators of the same construct would be the optimal. The latent construct is the common predictor of reflective indicators and, therefore, low correlation between indicators of the construct would suggest poor reliability. On the other hand, (Briggs & Cheek, 1986) contended that the optimal inter indicator correlation is between .20 and .40. They argued that correlations lower than .10 would not capture the complexity of the indicators, and correlations higher than .50 would be redundant. Moreover, other researchers (Catell, 1965) argued that inter-item correlations should be between .20 and .30, with the ideal being low inter-item correlations and high correlation

between indicators and the sum of all the items in a scale. As discussed above, there is a wide range of correlation coefficients among indicators of the same construct in this study but it is unclear what is best. It is clear that more empirical and conceptual studies are needed to fully understand and measure a complex construct like school engagement.

With the exception of behavioral engagement, most of the squared multiple correlations (R^2) for indicators of school engagement in this study were below 0.50. Low R^2s for indicators of latent constructs increase the probability that there is a substantial systematic component in the variance of the indicators that are not associated with the factor being measured. If that systematic component were present and shared by multiple items, it would appear as correlated error terms and it would have an impact on model fit. Even though it doesn't appear that way in this study, it may be that the systematic component in the variance of the indicators was not included in this model but it would appear in an alternative model if this incorporated measures that tap that systematic component.

In addition, it is not necessary to have high R^2s to have high reliability coefficients. For example, the reliability of a scale can be increased even with weakly correlated indicators or low R^2s by having many indicators per factor. However, low R^2s reduce power and produce more instability in parameter estimates, and most importantly it calls into question the validity of the observed indicators.

Measurement and Structural Invariance

The three-factor school engagement model was very similar in terms of the number of dimensions, relationship between dimensions, and measurement across white and African American students. In the model fitting process, the same error variances

($\lambda_{12,11}$) were allowed to covary across the two groups. This decision was based on statistical and substantive reasons. $\lambda_{12,11}$ had the largest modification index, and responses to question 12 and 11 were based on the same stimulus question ("I feel supported and respected by school staff/teachers"). Therefore, it was considered plausible that indicators 12 and 11 shared some systematic variance.

There was one statistically significant difference (non-invariance) in the factor loadings in the three-factor model for white and African American students, with $\Delta \chi^2_{(1)} = 25.86$, $p < 0.01$. The invariant factor loading was "I value the rewards that I get at school for my work + I think it is important to make good grades" on emotional engagement ($\lambda_{10,3}$), meaning this item correlates with other items of emotional engagement in the white student sample and is a stronger part of emotional engagement for white students while less strongly related to emotional engagement in the African American sample. This group invariance is important because of the alleged attitude-achievement paradox existing among African American students. The standardized factor loading for the white student sample was 0.64, and 0.52 for the African American sample. It appears that this item measures students' perceived benefits from doing well in school, and its association with emotional engagement. Even though there is a positive and significant association between this item and emotional engagement for African American students, this association is statistically significantly lower than for white students ($\Delta \chi 2$ {1, N=1573} = 25.86, $p < .01$). It is unclear what is causing this difference in factor loading between the school engagement model for white and African American students. However, it is clear that there are qualitative and quantitative differences across groups for this indicator.

Even though the best fitting model of school engagement for both white and African American students was a three-factor model, as opposed to two- or a uni-dimensional model, there was one non-invariant parameter in the structure of school engagement between groups. The factor variance of behavioral engagement was statistically significantly larger for African American as compared to white students, indicating greater variability for behavioral engagement in the African American sample.

Invariant Latent Means

It is well documented that, on average, there is an achievement gap between white and African American students. In addition, previous research has shown that school achievement is associated with school engagement (Finn, 1993; Fredricks et al., 2004; Newmann et al., 1992). Therefore, one of the main objectives of this study was to test for invariant latent mean structures between white and African American students on the three dimensions of school engagement; that is, on behavioral, emotional and cognitive engagement. Interestingly, there was only one latent mean difference between white and African American students. White students had lower latent mean emotional engagement than African Americans, with $\kappa = -0.28$, $t = -6.18$, $p < 0.05$. The African American sample was used as the reference group in this analysis; therefore, the negative value of kappa (κ) means that the white students' latent mean was lower than the reference group. This finding is consistent with previous studies (Stanton-Salazar, 1997) that suggest emotional engagement is more important for minority group students than for white students.

It is reasonable to expect that white students in majority African American schools face similar impediments as African American students do in majority white

schools; that is, they might feel less embedded in school and may face additional challenges making in-group friendships. After all, race and ethnicity are important aspects of the social and personal identity, and having similar peers contributes in feeling embedded and attached to school (emotional engagement). It appears from this study that school environments that are comprised mostly of African American students foster African American students' emotional engagement, more so than for white students.

Cross-Validation

The result of the cross-validation study highlighted some weaknesses in the measurement of school engagement. Even tough only three non-equivalent parameters were found between the calibrating and cross-validation samples, they were important parameters (factor loading, factor covariance, and latent mean). Further analysis (descriptive) showed that African American students' father educational attainment was higher than white students' but not statistically significant. On the other hand, white students' average educational expectations (how far do you think you will go in school) was higher than African American students' and statistically significant. It should be kept in mind that in this sample of schools white students are studying in majority African American schools, and it is unclear at this point what special characteristics these white students had or what effect this particular school context had on them, especially on their school engagement. Nevertheless, it was surprising to find differences between the calibrating and cross-validating samples, especially in regards to factor covariances and latent mean differences between groups because these are supposed to be less depended on sample characteristics.

Contributions of the Study

The contributions of this study to the existing body of knowledge pertaining to the construct of school engagement revolved around two areas: methodological and measurement.

Methodological Contribution

The main methodological contribution of this study is the use of structural equation modeling (SEM). This methodology permitted to specify, estimate and compare three alternative models of school engagement: one-, two-, and three-factor models. The confirmatory nature of SEM enabled to postulate, a priori, the interrelations of observed variables, relations between observed variables and latent constructs, the relationship among latent constructs, and to test the plausibility of these hypotheses. Moreover, SEM also allowed to test whether the measurement model and the structural model of school engagement were invariant across white and African American students. Furthermore, SEM made possible to test whether the latent means of school engagement were different across white and African American students.

Contribution to Measurement of School Engagement

One of the main goals of this study was to assess the psychometric properties of observed indicators of school engagement. Empirical research on school engagement is inconsistent not only in terms of the dimensions of school engagement assessed but also on the observed indicators measuring those dimensions. Confirmatory factor analysis was utilized to determine the extent to which the measurement model was effectively represented by the observed variables, to evaluate how indicators were mapped to dimensions of school engagement, and also to assess the psychometric properties of those

indicators through the estimation of their reliabilities and the variances explained by the latent factors. In addition, weaknesses in the measurement model were identified and differences in the measurement and structural models between white and African American students were determined.

Limitations of the Study

This study makes a contribution to prior research and better understanding of school engagement by examining three-, two-, and one-dimensional models of the construct within white and African American students. In addition, differences and similarities across groups were examined. However, several limitations were encountered in the conduct of this study that requires discussing. First, this study was based on secondary data. The 2004 HSSSE is a large survey containing broad information from home schooling, students' volunteer work in their communities, video game playing and television watching habits, commuting to school, to items measuring school engagement as operationally defined in this study. The intended use of this survey is also broad. The HSSSE website describes how schools can use survey data: to determine strengths and identify areas that need improvement; to document and report effective educational practices at the school level; focus resources to effective educational practices; to inform school improvement plans; to complement curricular frameworks; to aid school accreditation efforts, and improve school climate. The survey also gathered information at different units of analysis ranging from individual, teacher, classroom and school levels. Furthermore, the 2004 HSSSE did not include, with the exception of integrative learning, items measuring deep learning used in the National Survey of Student

Engagement that appear to be similar to cognitive engagement indicators. As a result, this study was limited to using the best indicators afforded by the HSSSE. This is reflected in the measurement properties of the school engagement scale and subscales (dimensions).

There are also advantages of using secondary data analysis, including generalizability of findings, timeliness, and cost. Secondary data may contain large sample sizes and may be representative of a larger population than it is affordable to most researchers; in addition, it may contain longitudinal data that could allow to measure growth over time, it may include more variables and subgroups than primary data. Secondary data is already collected and immediately available to researchers. Relative to collecting primary data, secondary data has much lower cost and Institutional Review Board (IRB) approval is relatively easier and faster.

The results of this study should be interpreted with caution and not generalized beyond the participating schools or schools with similar characteristics. The sample of schools used in this study volunteered to participate in the 2004 HSSSE; therefore, the population of students in this sample might possess unknown characteristics that make them not representative of the average student and school in the State of Virginia or the United States. However, the findings of this study may be generalizable to similar school districts. The school district used in this study had approximately 36,724 students, 58 schools, 2,586 classroom teachers, with an average school racial/ethnic composition of 64% African American and 30% white, with 43% of the students receiving free/reduced lunch, located in a midsize central city in Virginia. The size of the schools in this sample varied from 1,389 to 2,304 students.

The HSSSE relied solely on students' self-report data. Many indicators of school engagement, especially cognitive engagement, are not easily measured (Fredricks et al., 2004) and more than one method may be needed to capture the essence of the latent constructs and to cross-validate students' self-reported data with teacher's and/or researcher's observations, and use of school records. In addition, there are many factors that may influence the validity and reliability of self-reported measures such as providing socially desirable responses to survey questions, difficulty remembering past events, inaccurate account of behavior, etc.

School engagement is a multifaceted construct and the HSSSE contains a limited array of sampling facets even within each dimension of school engagement. For example, while in this study only measures of conduct were used to assess behavioral engagement there are other facets of this dimension such as participatory behavior and persistence that were not measured. Additionally, while only integrative learning indicators were used to assess cognitive engagement the deep learning scale developed for the HSSSE's college counterpart (NSSE) contains higher order learning and reflective learning as well. As a result, it was not possible to sample many facets within each of the school engagement dimensions.

Another potential limitation of the study is associated with the length of the High School Survey of Student Engagement, which contains approximately 139 items. Walker et al. (2003) found that longer surveys tend to have lower validity, especially for the second half of survey instruments. In addition, Walker et al. (2003) also found that the longer the survey the less time respondents spent on each survey item, suggesting deterioration in response quality.

Future Research

More work is needed in clarifying definitions and measures of school engagement. At the present time, there are few instruments developed specifically to measure school engagement in all its multidimensionality, including behavioral, emotional and cognitive engagement. A school engagement instrument(s) needs to be developed and validated. In addition, the use of multiple methods should be explored when developing and validating school engagement instruments.

Presently, instruments measuring school engagement combine items with different units of analysis (school, classroom, and student level), and formative and reflective indicators to measure the same underlying constructs. Therefore, these issues should be taken into consideration for future research. In addition, effort should be made to include more facets within dimensions of the construct. Furthermore, measuring cognitive engagement is especially challenging and attempts should be made to improve the quality of its measurement.

One technique that can make a great contribution to improving the measurement of school engagement in general and cognitive engagement in particular, is experience sampling methods (ESM). With ESM, it is possible to collect repeated measures on the same individuals at difference times or occasions, locations or contexts, on real time, and measure activity, and affective and cognitive experiences (Moneta et al., 1996). Previous research has demonstrated that ESM is a reliable and valid technique (Moneta et al., 1996). However, the quality of school engagement measures collected with ESM is as good as the items included in the instrument (experience sampling form).

Many studies on school engagement (Finn & Voelkl, 1993; Lee and Smith, 2002; National Research Council and Institute of Medicine, 2004; Sinclair, Christenson, Elevo, and Hurley, 1998; McNeely, Nonnemaker, & Blum, 2002; Shouse, 1996; Bryk & Thum, 1989) have shown the importance of school characteristics on school engagement, academic achievement, and other positive school outcomes. Therefore, more quantitative and qualitative studies are needed to assess the influence of school characteristics on school engagement. Methods such as hierarchical linear modeling can be used to measure the importance of antecedents of school engagement not only at the individual but also at the school level. Qualitative studies could provide researchers with richer information necessary for deeper understanding of school context and school engagement. These studies could provide information that could lead to the formulation and testing of new hypotheses about school engagement and its interrelationship (antecedents and consequences) with other variables and constructs.

REFERENCES

Ainsworth-Darnell, J., & Downey, D. B. (1998). Assessing the oppositional culture explanation for racial/ethnic differences in school performance. *American Sociological Review, 63*, 536–553.

Appleton, J., Christenson, S., Kim, D., & Reschly, A. (2006). Measuring cognitive and psychological engagement: Validation of the student engagement instrument. *Journal of School Psychology*, 44, 427–445.

Audas, R., & Willms, J. D. (2001). *Engagement and dropping out of school: A life-course perspective*: Human Resources Development Canada.

Avenilla, F. (2003). *Assessing the links between emotional and behavioral school engagement and academic outcomes among high school students* (Doctoral Dissertation, The Pennsylvania State University, 2003).

Bentler, P. M. (1988). Causal modeling via structural equation systems. In J. R. Nesselroade & R. B. Cattell (Eds.), *Handbook of multivariate experimental psychology*. New York: Plenum.

Berends, M. (1995). Education stratification and students' bonding to school. *British Journal of Sociology of Education. 16*(3), 327–351.

Birch, S. H., & Ladd, G. W. (1997). The teacher-child relationship and children's early school adjustment. *Journal of School Psychology, 31*(1), 61–79.

Boekarts, M., Pintrich, P. R., & Zeidner, M. (Eds.). (2000). *Handbook of self-regulation: Theory, research and applications*. San Diego: CA: Academic Press.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.

Bollen, K. A., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin. 110*(2), 305–314.

Bollen, K. A., & Long, J. S. (Eds.). (1993). *Testing structural equation models*. Newbury Park, CA: Sage.

Briggs, S. R., & Cheek, J. M. (1986). The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality. 54*(1), 106–148.

Bruyn, E. H. (2005). Role strain, engagement and academic achievement in early adolescence. *Educational Studies*, 31(1), 15-27.

Bryk, A. S., & Thum, Y. M. (1989). The effects of high school organization on dropping out: An exploratory investigation. *American Educational Research Journal, 26*, 353–383.

Bullis, M., & Yovanoff, P. (2002). Those who do not return: Correlates of the work and school engagement of formerly incarcerated youth who remain in the community. *Journal of Emotional & Behavioral Disorders, 10*(2), 66.

Byrne, B. M. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: Basic concepts, applications and programming*. Mahwah, NJ: Lawrence Erlbaum Associates.

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin, 105*(3), 456–466.

Caraway, K., Tucker, C. M., Reinke, W. M., & Hall, C. (2003). Self-efficacy, goal orientation, and fear of failure as predictors of school engagement in high school students. *Psychology in the Schools*, 40(4)417–427.

Carini, R. M., Kuh, G. D., & Klein, S. (2004). *Student engagement and student learning: Testing the linkages.* Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Catell, R. B. (1965). *The Scientific Analysis of Personality*. New York: Penguin Books.

Chapman, E. (2003). Alternative approaches to assessing student engagement rates. *Practical Assessment, Research & Evaluation, 8*(13).

Conchas, G. Q. (2001). Structuring failure and success: Understanding the variability in Latino school engagement. *Harvard Educational Review. 71*(3), 475–504.

Connell, J. P. (1990). Context, self, and action: A motivational analysis of the self-system processes across the life-span. In D. Cicchetti (Ed.), *The self in transition: Infancy to childhood* (pp. 61–97). Chicago: University of Chicago Press.

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. Gunnar & L. A. Sroufe (Eds.), *Minnesota symposium on child psychology* (Vol. 23). Chicago: University of Chicago Press.

Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin, 52*(4), 281–302.

Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods, 1*, 16–29.

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53*(6), 1024–1037.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*(3), 272–299.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59*, 117–142.

Finn, J. D., Pannozzo, G. M., & Voelkl, K. M. (1995). Disruptive and inattentive withdrawn behavior and achievement among fourth graders. *Elementary School Journal, 95*(5), 421–434.

Finn, J. D., & Rock, D. A. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology, 82*, 221–234.

Finn, J. D., & Voelkl, K. E. (1993). School characteristics related to school engagement. *Journal of Negro Education, 62*, 249–268.

Fornell, C., & Larcker, D.F. (1981). Evaluating structural equation models with unobserved variables and measurement error. *Journal of Marketing Research*, 18, 39-50.

Fredricks, J. A., Bluemenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 17*, 59–109.

Fredricks, J. A., & Eccles, J. (2002). Children's competence and value beliefs from childhood to adolescence: Growth trajectories in two "male" type domains. *Journal of Developmental Psychology, 38*, 519–533.

Fullarton, S. (2002). *Student engagement with school: Individual and school-level influences*. Camberwell, Victoria: Australian Council for Educational Research.

Furlong, M. J., Whiple, A. D., St. Jean, G., Simental, J., Soliz, A., & Punthuna, S. (2003). Multiple contexts of school engagement: Moving toward a unifying framework for educational research and practice. *The California School Psychologist, 8*, 99–113.

Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology, 95*(1), 148–162.

Gladden, M. (1998). A small schools' literature review. In M. Fe & J. Somerville (Eds.), *Small schools, big imaginations*. Chicago: Cross City Campaign for Urban School Reform.

Greene, B. A., & Miller, R. B. (1996). Influences on achievement: Goals, perceived ability, and cognitive engagement. *Contemporary Educational Psychology, 21*, 181–192.

Greenwood, C. R., Horton, B. T., & Utley, S. A. (2002). Academic engagement: Current perspectives on research and practice. *School Psychology Review, 31*(3), 328–349.

Hair, J. F., Anderson, R. E., Tatham, R. L., Black, W. C. (1995). *Multivariate Data Analysis with Readings. Englewood Cliffs, NJ.* Prentice Hall. 4th Edition.

Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: Motivational and informational components. *Developmental Psychology, 17*, 300–312.

Hatcher, L. (1994). *A step-by-step approach to using the SAS system for factor analysis and structural equation modeling*. Cary, NC: SAS Institute Inc.

Howley, C. (2002). Small schools. In A. Molnar (Ed.), *School reform proposals: The research evidence*. Tempe: Arizona State University, Education Policy Research Unit.

Hoyle, R. H. (1995). *Structural equation modeling: Concepts, issues and applications*. Thousand Oaks, CA: Sage.

Hu, L.T., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications*. Thousand Oaks, CA: Sage Publications.

Hudley, C. (2003). *Student engagement, school climate, and future expectations in high school.* Paper presented at the 2003 biennial meeting of the Society for Research in Child Development.

Indiana University. (2005). *High school survey of student engagement: HSSSE 2005 overview*.

Jimerson, S. R., Campos, E., & Greif, J. L. (2003). Toward an understanding of definitions and measures of school engagement and related terms. *The California School Psychologist, 8*, 7–27.

Johnson, M. K., Crosnoe, R., & Elder, G. H. (2001). Students' attachment and academic engagement: The role of race and ethnicity. *Sociology of Education, 74*(4), 318–340.

Jordan, Will J. (1999). Black high school students' participation in school-sponsored sports activities: Effects on school engagement and achievement. *The Journal of Negro Education*, 68(1), 54–71.

Jöreskog, K. G. (1993). Testing structural equation models. In K. Bollen & J. S. Long (Eds.), *Testing structural equation models*. Newbury Park, CA: Sage.

Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7: User's reference guide*. Chicago: Scientific Software International.

Jöreskog, K. G., & Sörbom, D. (1996). *LISREL 8: User's reference guide*. Chicago: Scientific Software International.

Jöreskog, K. G., & Sörbom, D. (2005). LISREL 8.7 for windows [computer software]. Lincolnwood, IL: Scientific Software International.

Kalin, W. (1999). How white teachers perceive the problem of racism in their schools: A case study in "liberal" Lakeview. *Teachers College Record, 100*, 724–750.

Katz, S. (1999). Teaching in tensions: Latino immigrant youth, their teachers, and the structure of schooling. *Teachers College Record, 100*, 809–840.

Kindermann, T. A. (1993). Natural peer groups as context for individual development: The case of children's motivation in school. *Developmental Psychology, 29*(6), 970–977.

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*(7), 262–273.

Lee, V. E., & Smith, J. B. (1995). Effects of high school restructuring and size on early gains in achievement and engagement. *Sociology of Education, 68*, 241–270.

Lee, V. E. & Smith, (1997). High school size: Which works best and for whom? *Education Evaluation and Policy Research*, *19*(3), 205–227.

Lee, V. E. & Smith, J. B. (1999). Social support and achievement for young adolescents in Chicago: The role of school academic press. *American Education Research Journal, 36*(4), 901–945.

Lee, V. E., & Smith, J. B. (2001). *Restructuring high schools for equity and excellence: What works*. New York: Teachers College Press.

Libbey, H. (2004). Measuring student relationships to school: Attachment, bonding, connectedness, and engagement. *Journal of School Health, 74*(7).

Marks, H. M. (2000). Student engagement in instructional activity: Patterns in the elementary, middle, and high school years. *American Educational Research Journal, 37*(1), 153–184.

McCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*, 130–149.

McNeely, C. A., Nonnemaker, J. M., & Blum, R. W. (2002). Promoting school connectedness: Evidence from the national longitudinal study of adolescent health. *Journal of School Health, 72*, 138–160.

Meece, J., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientation and cognitive engagement in classroom activities. *Journal of Educational Psychology, 80*, 514–523.

Mickelson, R. A. (1990). The attitude-achievement paradox among black adolescents. *Sociology of Education, 63*, 44–61.

Miller, R. B., Greene, B. A., Montalvo, G. P., Ravindran, B., & Nichols, J. D. (1996). Engagement in academic work: The role of learning goals, future consequences, pleasing others, and perceived ability. *Contemporary Educational Psychology, 21*(4), 388.

Moneta, G. B. & Csikszentmihalyi, M. (1996). The effect of perceived challenges and skills on the quality of subjective experience. Journal of Personality, 64(2), 275-310.

Mustafa, B. (1999). A brief introduction to structural equation modeling techniques: Theory and application. *ERIC Document Reproduction Service No. 438 300*.

National Assessment of Educational Progress from the National Center for Education Statistics. (2001). The Condition of Education, 2000 (Washington, D.C.: U.S. Government Printing Office).

National Research Council & Institute of Medicine. (2004). *Engaging schools: Fostering high school students' motivation to learn*. Washington, DC: National Academy Press.

Indiana University. National Survey of Student Engagement. Annual Report 2004

Newmann, F. M., Wehlage, C. G., & Lamborn, S. D. (1992). The significance and sources of student engagement. In F. M. Newmann (Ed.), *Student engagement and achievement in American secondary schools* (pp. 11–39). New York: Teachers College Press.

Norris, C., Pignal, J., & Lipps, G. (2003). Measuring school engagement. *Education Quarterly Review, 9*(2).

Ogbu, J. U. (1978). *Minority education and caste*. New York: Academy Press.

Pedhazur, E. J., & Schmelkin, L. P. (1991). *Measurement, design, and analysis: An integrated approach*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Pintrich, P. R., & De Groot, E. (1990). Motivated and self-regulated learning components of academic performance. *Journal of Educational Psychology, 82*, 33–40.

Raywid, M. A. (1998). Small schools: A reform that works. *Educational Leadership, 55*, 34–39.

Resnick, M. D., Bearman, P. S., Blum, R. W., Bauman, K. E., Harris, K. M., Jones, J., et al. (1997). Protecting adolescents from harm: Findings from the national longitudinal study on adolescent health. *Journal of the American Medical Association, 278*, 823–832.

Rudolph, K. D., Lambert, S. F., Clark, A. D., & Kurlakowsky, K. D. (2001). Negotiating the transition to middle school: The role of self-regulatory processes. *Child Development, 72*(3), 929–946.

Rumberger, R. W., & Palardy, G. J. (2002). *Raising tests scores and lowering dropout rates: Can schools do both?* Paper presented at the Annual meeting of the American Educational Research Association, New Orleans, April 1–5.

Rumberger, R. W., & Thomas, S. L. (2000). The distribution of dropout and turnover rates among urban and suburban high schools. *Sociology of Education, 73*(1), 39–67.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749–761.

Ryan, R. M., Stiller, J. D., & Lynch, J. H. (1994). Representations of relationships to teachers, parents and friends as predictors of academic motivation and self esteem. *Journal of Early Adolescence, 14*(2), 226–249.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum Associates.

Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychologist Quarterly*, 18(2), 158–176.

Shouse, R. (1996). Academic press and sense of community: Conflict, congruence, and implications for student achievement. *Social Psychology of Education, 1*, 47–68.

Sinclair, M. F., Christenson, S. L., Elevo, D. L., & Hurley, C. M. (1998). Dropout prevention for youth with disabilities: Efficacy of a sustained school engagement procedure. *Exceptional Children, 65*, 7–21.

Sirin, S., & Jackson, L. R. (2001). Examining school engagement of African American adolescents. *ERIC Document Reproduction Service No. 454 318.*

Sirin, S., & Rogers-Sirin, L. (2004). Exploring school engagement of middle-class African American adolescents. *Youth & Society, 35*(3), 323–340.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effect of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*, 571–581.

Skinner, E. A., Wellborn, J. G., & Connell, J. P. (1990). What is takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school. *Journal of Educational Psychology, 82*, 22–32.

Stanton-Salazar (1997). A social capital framework for understanding the socialization of racial minority children and youths. *Harvard Educational Review, 67,* 1–40.

Steinberg, L., Brown, B. B., & Dornbush, S. M. (1996). *Beyond the classroom: Why school reform has failed and what parents need to do*. New York: Simon and Schuster.

Thernstrom, A., & Thernstrom, S. (2003). *No excuses: Closing the racial achievement gap in learning*. New York: Simon & Schuster.

Trochim, W. M. K. (2002). Construct validity. Retrieved February 19, 2006, from http://www.socialresearchmethods.net/kb/constval.htm

Valeski, T. N., & Stipek, D. J. (2001). Young children's feelings about school. *Child Development, 72*(4), 1198–1213.

Voelkl, K. E. (1997). Identification with school. *American Journal of Education, 105*(3), 294.

Walker, A. S., Burke, B.G., McCarthy, P. M., Fuller, D., & Moffet, R.G. (2003). The effects of questionnaire length on response validity, Orlando, FL.

Wehlage, C. G., & Smith, G. A. (1992). Building new programs for students at risk. In F. M. Newmann (Ed.), *Student engagement and achievement in American secondary school*. New York: Teachers College Press.

Wentzel, K. R. (1996). Motivation in context: Social relationships and achievement in middle school. In J. Juvonen & K. R. Wentzel (Eds.), *Social motivation: Understanding children's school adjustment* (pp. 226–247). New York: Cambridge University Press.

Wentzel, K. R. (1997). Student motivation in middle school: The role of perceived pedagogical caring. *Journal of Educational Psychology, 89*(3), 411–419.

Wentzel, K. R. (1999). Social-motivational processes and interpersonal relationships: Implications for understanding motivation at school. *Journal of Educational Psychology, 91*(1), 76–97.

Wiest, D., Wong, E., Cervantes, J., Craik, L., & Kreil, D. (2001). Intrinsic motivation among regular, special, and alternativ education high school students. *Adolescence, 36*(141), 111–126.

Whitlock, J. (2006). Youth perceptions of life at school: Contextual correlates of school connectedness in adolescence. *Applied Development Science*, 10(1), 13–29.

Wong, E. H., Wiest, D. J., & Cusick, L. B. (2002). Perceptions of autonomy support, parent attachment, competence, and self-worth as predictors of motivational orientation and academic achievement: An examination of sixth and ninth-grade regular education students. *Adolescence, 37*(146), 255–266.

Zimmerman, B. J., & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology, 80*, 284–290.

Appendix A – HSSSE Survey

High School Survey of Student Engagement
2004 Codebook

Please note the following for the HSSSE data file and codebook:

- Invalid and nonresponses are coded as missing data, represented by a period.
- Some item responses may require additional coding when performing further analyses.

Item #	Variable	Description	Response Values
1.	GRADELVL	What is your grade in school?	1=9th Grade 2=10th Grade 3=11th Grade 4=12th Grade

Item #	Variable	Description	Response Values
2.	AGE	How old are you?	1=13 or younger 2=14 3=15 4=16 5=17 6=18 7=19 8=20+

Item #	Variable	Description	Response Values
3.	GENDER	Are you:	1=Male 2=Female

Item #	Variable	Description	Response Values
4a.	TRANSFER	Did you transfer to this high school?	1=No 2=Yes

Item #	Variable	Description	Response Values
4b.	TRANSGRD	If yes, in what grade did you transfer to this school?	1=9th Grade 2=10th Grade 3=11th Grade 4=12th Grade

Item #	Variable	Description	Response Values

5a.	HOMESCH	Were you home-schooled at any time during your education?	1=No 2=Yes

Item #	Variable	Description	Response Values
5b.	HOMSCHYR	If yes, in what grades?	Write-in response

Item #	Variable	Description	Response Values
6.	HMCOMPTR	Do you have a computer with Internet access at home?	1=No 2=Yes

Item #	Variable	Description	Response Values
7.	SLEEP	On average, how many hours per night do you sleep?	1=Less than 5 2=5-6 3=7-8 4=9-10 5=11+

Item #	Variable	Description	Response Values
8.	SIBLINGS	How many brothers and sisters do you have? (Please include step and half brothers and sisters who live with you.)	1=0 2=1 3=2 4=3 5=4 6=5+

Item #	Variable	Description	Response Values
9.	TRACK	Which category represents MOST of your classes? (Mark one box only)	1=Regular/General 2=Special Education 3=Courses for College Credit 4=Honors/College Prep 5=Career/Vocational 9=Don't Know

Question 10. For each of the following, how much reading [# of hours] do you do in a typical 7-day week?

Item #	Variable	Description	Response Values
10a.	READASGN	Assigned reading (textbooks or other course materials)	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
10b.	READPERS	Personal reading (books, magazines, newspapers, etc.)	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
10c.	READWEB	Personal reading online/Web	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+

Question 11. **During this school year, about how much writing have you done?**

Item #	Variable	Description	Response Values
11a.	WRITELNG	Number of written papers of **more than 5 pages**	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
11b.	WRITEMD	Number of written papers **between 3 and 5 pages**	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+

Item #	Variable	Description	Response Values
11c.	WRITESML	Number of written papers of **fewer than 3 pages**	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+

Question 12. In a typical week, how many assignments do you complete in the following subjects?

Item #	Variable	Description	Response Values
12a.	ENGASGN	English	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
12b.	MATHASGN	Math	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
12c.	SCIASGN	Science	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
12d.	HISTASGN	History/Social Studies	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
12e.	FRGNASGN	Foreign Language	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled

Question 13. In a typical week, how many homework assignments take you more than 15 minutes each to complete in these subjects?

Item #	Variable	Description	Response Values
13a.	ENGPROB	English	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
13b.	MATHPROB	Math	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
13c.	SCIPROB	Science	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
13d.	HISTPROB	History/Social Studies	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled
13e.	FRGNPROB	Foreign Language	1=0 2=1-2 3=3-4 4=5-6 5=7+ 9=Not enrolled

Question 14. At school this year, about how often have you done each of the following?

Item #	Variable	Description	Response Values
14a.	CLASDISC	Asked questions in class or contributed to class discussions	1=Never 2=Sometimes 3=Often 4=Very often
14b.	CLASPRES	Made a class presentation	1=Never 2=Sometimes 3=Often 4=Very often
14c.	PAPDRAFT	Prepared two or more drafts of a paper or assignment before turning it in	1=Never 2=Sometimes 3=Often 4=Very often
14d.	SOURCES	Worked on a paper or project using information from multiple sources (books, interviews, Internet, etc.)	1=Never 2=Sometimes 3=Often 4=Very often
14e.	VIEWCLAS	Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	1=Never 2=Sometimes 3=Often 4=Very often
14f.	PREPARED	Attended class with readings or assignments completed	1=Never 2=Sometimes 3=Often 4=Very often
14g.	CLASSGRP	Worked with other students on projects/assignments **during class**	1=Never 2=Sometimes 3=Often 4=Very often
14h.	GROUPOUT	Worked with other students on projects/assignments **outside of class**	1=Never 2=Sometimes 3=Often 4=Very often
14i.	INTIDEAS	Put together ideas or concepts from different subjects when completing assignments or during class discussions	1=Never 2=Sometimes 3=Often 4=Very often

Item #	Variable	Description	Response Values
14j.	TUTOR	Tutored or taught other students (paid or voluntary)	1=Never 2=Sometimes 3=Often 4=Very often
14k.	COMMPROJ	Participated in a community-based project as part of a regular class	1=Never 2=Sometimes 3=Often 4=Very often
14l.	WEBASGN	Used the Internet/Web to discuss or complete an assignment	1=Never 2=Sometimes 3=Often 4=Very often
14m.	EMAIL	Used e-mail to communicate with a teacher	1=Never 2=Sometimes 3=Often 4=Very often
14n.	DISCGRD	Discussed grades or assignments with a teacher	1=Never 2=Sometimes 3=Often 4=Very often
14o.	DISCIDEA	Discussed ideas from your readings or classes with **teachers** outside of class	1=Never 2=Sometimes 3=Often 4=Very often
14p.	DISCOTH	Discussed ideas from your readings or classes with **others** outside of class (students, family members, coworkers, etc.)	1=Never 2=Sometimes 3=Often 4=Very often
14q.	FEEDBACK	Received prompt feedback from teachers on assignments or other class work	1=Never 2=Sometimes 3=Often 4=Very often
14r.	DIVRSTUD	Had serious conversations with students of a different race or ethnicity than your own	1=Never 2=Sometimes 3=Often 4=Very often
14s.	DIFFSTU	Had serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values	1=Never 2=Sometimes 3=Often 4=Very often

Item #	Variable	Description	Response Values
14t.	STANDRDS	Reviewed in class local or state academic standards (graduation requirements, etc.)	1=Never 2=Sometimes 3=Often 4=Very often

Question 15. Fill in the boxes that come closest to how you feel about each of the following statements.

Item #	Variable	Description	Response Values
15a.	PRIDE	I take pride in my school work.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15b.	SKILLSAB	I have the skills and abilities to complete my work.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15c.	REWARDS	I value the rewards (grades, awards, etc.) that I get at school for my work.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15d1.	SUPPTCH	I feel supported and respected by teachers.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15d2.	SUPPCOUN	I feel supported and respected by counselors.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15d3.	SUPPADM	I feel supported and respected by administrators (principal, assistant/vice principal).	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree

Item #	Variable	Description	Response Values
15d4.	SUPPSEC	I feel supported and respected by secretaries/administrative assistants.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15d5.	SUPPSTU	I feel supported and respected by other students.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15e.	CHOICES	I get to make choices about what I will study at school.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15f.	ASKTEACH	I have many opportunities to ask teachers questions about my work.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15g.	FAIRRULS	I think school rules are fair.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15h.	IMPORTGR	I think it is important to make good grades.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15i.	HLPASSMT	I help determine how my school work is assessed.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15j.	VALLEARN	I place a high value on learning.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree

Item #	Variable	Description	Response Values
15k.	VOICE	I have a voice in classroom decisions.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15l.	EFFORT	I put forth a great deal of effort when doing my school work.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15m.	CREATIVE	I have opportunities to be creative in my school assignments.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15n.	USEFUL	I think the things I learn at school are useful.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15o.	LRNMORE	The support I get at school encourages me to learn more.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15p.	WKHARDER	I've worked harder than I expected to work in school.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15q.	BESTWORK	I am challenged to do my best work at school.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15r.	SELECTHS	If I could select my high school, I would go to the same school again.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree

Item #	Variable	Description	Response Values
15s.	CARESCHL	I care about my school.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15t.	EXCITED	I am excited about my classes.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15u.	KNOWWELL	There is at least one adult in my school who cares about me and knows me well.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15v.	CURIOUS	My school work makes me curious to learn about other things.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15w.	FITINSCH	I feel that I “fit in” at my school.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15x.	ACCEPTME	Overall, people at school accept me for who I am.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree
15y.	FEELSAFE	I feel safe in school.	1=Strongly disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly agree

Question 16. About how many hours do you spend in a typical 7-day week doing each of the following?

Item #	Variable	Description	Response Values
16a.	PREPARCL	Preparing for class (doing homework, reading, rehearsing, etc.)	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16b.	WORKPAY	Working for pay (including babysitting, cutting grass, etc.)	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16c.	EXTRACUR	Participating in school-sponsored activities (athletics, clubs, government, newspaper, etc.)	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16d.	VOLUNWK	Doing volunteer work	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16e.	WATCHTV	Watching television	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16f.	SOCIAL	Socializing with friends	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+

Item #	Variable	Description	Response Values
16g.	SURFLINE	Chatting or "surfing" online	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16h.	PHONE	Talking on the phone	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16i.	VIDEOGM	Playing video games	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16j.	EXERCISE	Exercising	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+
16k.	COMMUTE	Traveling to and from school	1=0 2=1-3 3=4-6 4=7-10 5=11-14 6=15+

Question 17. To what extent does your school emphasize each of the following?

Item #	Variable	Description	Response Values
17a.	STUDYTM	Spending significant amounts of time studying and on school work	1=Very little 2=Some 3=Quite a bit 4=Very much

Item #	Variable	Description	Response Values
17b.	SUPPSUCC	Providing the support needed to succeed in school	1=Very little 2=Some 3=Quite a bit 4=Very much
17c.	ENCDIVRS	Encouraging contact among students from different backgrounds and beliefs (race, religion, politics, etc.)	1=Very little 2=Some 3=Quite a bit 4=Very much
17d.	PREPTEST	Preparing for standardized tests	1=Very little 2=Some 3=Quite a bit 4=Very much
17e.	SCHEVENT	Participating in school events and activities (athletics, plays, etc.)	1=Very little 2=Some 3=Quite a bit 4=Very much
17f.	USECOMPT	Using computers in class work	1=Very little 2=Some 3=Quite a bit 4=Very much
17g.	HELPFDBK	Providing helpful feedback on class work or performance	1=Very little 2=Some 3=Quite a bit 4=Very much
17h.	NEWIDEAS	Encouraging students to explore new ideas	1=Very little 2=Some 3=Quite a bit 4=Very much
17i.	CONTEDUC	Continuing your education (college, career training, etc.)	1=Very little 2=Some 3=Quite a bit 4=Very much
17j.	SCHGOVER	Involving students in school governance	1=Very little 2=Some 3=Quite a bit 4=Very much
17k.	TRTFAIR	Treating students fairly and with respect	1=Very little 2=Some 3=Quite a bit 4=Very much

Question 18. To what extent has your experience at this school contributed to your knowledge, skills, and personal development in the following areas?

Item #	Variable	Description	Response Values
18a.	WKSKILL	Learning work related skills	1=Very little 2=Some 3=Quite a bit 4=Very much
18b.	WRITEEFF	Writing clearly and effectively	1=Very little 2=Some 3=Quite a bit 4=Very much
18c.	SPEAKEFF	Speaking clearly and effectively	1=Very little 2=Some 3=Quite a bit 4=Very much
18d.	THNKDEEP	Thinking deeply and critically	1=Very little 2=Some 3=Quite a bit 4=Very much
18e.	USETECH	Using computing and information technology	1=Very little 2=Some 3=Quite a bit 4=Very much
18f.	WKOTHERS	Working effectively with others	1=Very little 2=Some 3=Quite a bit 4=Very much
18g.	LEARNOWN	Learning on your own	1=Very little 2=Some 3=Quite a bit 4=Very much
18h.	UNDRPEOP	Understanding people of other racial and ethnic backgrounds	1=Very little 2=Some 3=Quite a bit 4=Very much
18i.	SOLVPROB	Solving real-world problems	1=Very little 2=Some 3=Quite a bit 4=Very much
18j.	DEVGOALS	Developing clear career goals	1=Very little 2=Some 3=Quite a bit 4=Very much

Item #	Variable	Description	Response Values
18k.	COMMBTR	Making your community a better place	1=Very little 2=Some 3=Quite a bit 4=Very much
18l.	PREPCOLL	Preparing for college	1=Very little 2=Some 3=Quite a bit 4=Very much
18m.	KNOWSELF	Understanding yourself	1=Very little 2=Some 3=Quite a bit 4=Very much
18n.	DEVELVAL	Developing personal values	1=Very little 2=Some 3=Quite a bit 4=Very much

Question 19. During the current school year, how much has your class work emphasized the following activities?

Item #	Variable	Description	Response Values
19a.	MEMORIZE	**Memorizing** facts or ideas from your courses and readings so you can repeat them in similar form	1=Very little 2=Some 3=Quite a bit 4=Very much
19b.	UNDRSTND	**Understanding** information and its meaning	1=Very little 2=Some 3=Quite a bit 4=Very much
19c.	APPLYINF	**Applying** information to practical problems or in new situations	1=Very little 2=Some 3=Quite a bit 4=Very much
19d.	EXAMNING	**Examining** ideas or experiences in depth	1=Very little 2=Some 3=Quite a bit 4=Very much

Item #	Variable	Description	Response Values
19e.	ORGNZING	**Organizing** ideas into new relationships	1=Very little 2=Some 3=Quite a bit 4=Very much
19f.	JUDGINFO	**Making judgments** about the value of information or ideas	1=Very little 2=Some 3=Quite a bit 4=Very much

Question 20. **Which of the following have you done during high school?**

Item #	Variable	Description	Response Values
20a.	STDYABRD	Studied or traveled outside the U.S.	1=No 2=Yes
20b.	STDOUTST	Studied or traveled outside the state	1=No 2=Yes
20c.	COMMSERV	Participated in community service or volunteer work	1=No 2=Yes
20d.	TAKETEST	Taken the PSAT, SAT, or ACT	1=No 2=Yes
20e.	ACTRAIN	Received special academic training or tutoring from an individual or organization outside of school	1=No 2=Yes
20f.	COLLCOUR	Taken one or more courses at a college or university	1=No 2=Yes
20g.	APCOURSE	Taken one or more Advanced Placement (AP) courses	1=No 2=Yes
20h.	WRKSTUDY	Participated in a co-op or work study program	1=No 2=Yes
20i.	INTERN	Worked as an intern outside of school	1=No 2=Yes
20j.	STUDYPLN	Prepared a personal study plan with a teacher or counselor	1=No 2=Yes
20k.	OVERNITE	Participated in an overnight school trip	1=No 2=Yes

Item #	Variable	Description	Response Values
21.	ABSENT	How many school days have you missed this year?	1=0 2=1-5 3=6-10 4=11-15 5=16+

Item #	Variable	Description	Response Values
21a.	UNEXCUSE	How many were unexcused absences?	1=0 2=1-5 3=6-10 4=11-15 5=16+

Item #	Variable	Description	Response Values
22.	TARDY	How many times have you been late/tardy for class this year?	1=0 2=1-5 3=6-10 4=11-15 5=16+

Item #	Variable	Description	Response Values
23.	GRADES	What have MOST of your high school grades been? (Mark one box only.)	1=D+ or lower 2=C- 3=C 4=C+ 5=B- 6=B 7=B+ 8=A- 9=A 10=Grades are not used 99=Don't know

Question 24. What is your racial or ethnic identification? (Mark all that apply.)

Students were given six race/ethnic categories (INDNATAM-OTHER) and asked to mark all that apply. There was also a blank space next to "Other" where students could write in their race/ethnicity if they chose to do so. Written responses were coded as REOTHR2.

Responses for Question 24 were originally coded using the variables in the chart below. Responses for students who did not answer this question were coded as missing data. Please note these percentages exceed 100% because students could mark more than one race/ethnic group.

Item #	Variable	Description	Response Values
24.	INDNATAM	American Indian or other Native American	1=Checked 0=Not Checked
	ASIANPCI	Asian American or Pacific Islander	1=Checked 0=Not Checked
	BLKAFAM	Black or African American	1=Checked 0=Not Checked
	LATINO	Hispanic, Latino, or Spanish Origin	1=Checked 0=Not Checked
	WHITE	White	1=Checked 0=Not Checked
	OTHER	Other racial or ethnic identification	1=Checked 0=Not Checked
	REOTHR2	Other racial or ethnic identification	Write-in response

For your 2004 School Report, HSSSE staff created a new RACE variable that includes a multiple race/ethnic category and eliminates the effect of duplicate responses. Here, responses for students who marked two or more race/ethnic groups were deleted from those categories, respectively, and recoded as a single response in "multiple race/ethnic identifications." Students' written responses were recoded to the appropriate race/ethnic categories using the US Census Bureau's 2002 American Community Survey code list as a guide. Responses for students who did not answer this question and written responses that did not relate to any race/ethnic classification have been coded as missing data.

HSSSE staff members recommend using the new race variable for additional data analyses you may want to perform.

Variable	Description	Response Values
RACE	HSSSE recoded race/ethnicity variable	1=Hispanic, Latino or Spanish Origin
		2=American Indian or other Native American
		3=Asian American or Pacific Islander
		4=Black/African American
		5=White
		6=Other racial or ethnic identification
		7=Multiple race/ethnic identifications

Item #	Variable	Description	Response Values
25.	ENGPRIM	Is English the primary language in your home?	1=No 2=Yes

Item #	Variable	Description	Response Values
26.	EDEXPECT	How far do you think you will go in school? (Mark one box only.)	1=Will not finish high school 2=Certificate of completion of course work without a diploma 3=High school diploma 4=2-year college degree (Associate's) 5=4-year college degree (Bachelor's) 6=Master's degree 7=PhD or other advanced professional degree (law, medicine, etc.) 9=Don't know

Question 27. What is the highest level of education that your parent(s) or guardian(s) completed? (Mark one box per column.)

Item #	Variable	Description	Response Values
27.	FATHREDU	Father's educational attainment	1=Did not finish high school 2=Graduated from high school 3=2-year college degree (Associate's) 4=4-year college degree (Bachelor's) 5=Master's degree 6=PhD or other advanced professional degree (law, medicine, etc.) 9=Don't know
	MOTHREDU	Mother's educational attainment	1=Did not finish high school 2=Graduated from high school 3=2-year college degree (Associate's) 4=4-year college degree (Bachelor's) 5=Master's degree 6=PhD or other advanced professional degree (law, medicine, etc.) 9=Don't know

Appendix B – Inter-Item Correlation of School Engagement Variables for African American Students (N= 913)

	V1. English assignments in a typical week (#)	V2. Math assignments in a typical week (#)	V3. Science assignments in a typical week (#)	V4. History assignments in a typical week (#)	V5. Worked on a paper or project using info. from multiple sources	V6. Considered views of diff. races, religions, genders, political beliefs in class discussions or assignments	V7. Put together ideas or concepts from diff. subjects when completing assign or during class discussions	V8. Discussed ideas from your readings or classes with teachers outside of class
V1. English assignments in a typical week	1							
V2. Math assignments in a typical week	0.61**	1						
V3. Science assignments in a typical week	0.62**	0.56**	1					
V4. History assignments in a typical week	0.60**	0.57**	0.61**	1				
V5. Worked on a paper or project using information from multiple sources	0.14**	0.08*	0.16**	0.12**	1			
V6. Considered views of different races, religions, genders, or political beliefs in class discussions or assignments	0.08*	0.07*	0.08*	0.08*	0.18**	1		
V7. Put together ideas/concepts from different subjects when completing assign. or during class discussions	0.07*	0.03	0.11**	0.10**	0.26**	0.34**	1	
V8. Discussed ideas from your readings or classes with teachers outside of class	0.08*	0.05	0.09**	0.08*	0.22**	0.19**	0.31**	1

	V1. English assignments in a typical week (#)	V2. Math assignments in a typical week (#)	V3. Science assignments in a typical week (#)	V4. History assignments in a typical week (#)	V5. Worked on a paper or project using info. from multiple sources	V6. Considered views of diff. races, religions, genders, political beliefs in class discussions or assignments	V7. Put together ideas or concepts from diff. subjects when completing assign or during class discussions	V8. Discussed ideas from your readings or classes with teachers outside of class
V9. Discussed ideas from your readings or classes with others outside of class	0.11**	0.01	0.09**	0.06	0.25**	0.28**	0.33**	0.40**
V10. I value the rewards I get at school for my work + I think it is important to make good grades	0.17**	0.11**	0.13**	0.16**	0.22**	0.17**	0.21**	0.10**
V11. I feel supported and respected by teachers	0.10**	0.06	0.08*	0.04	0.16**	0.06	0.10**	0.06
V12. I feel supported and respected by school staff	0.09**	0.07*	0.06	0.10**	0.14**	0.09**	0.12**	0.07*
V13. I think the things I learn at school are useful	0.09**	0.07*	0.08*	0.08*	0.11**	0.05	0.13**	0.16**
V14. The support I get at school encourages me to learn more	0.11**	0.05	0.07*	0.07*	0.16**	0.07*	0.18**	0.19**
V15. If I could select my hs I'd go to the same school again + I care about my school	0.06	0.03	0.07*	0.08*	0.16**	0.13**	0.19**	0.10**
V16. I'm excited about my classes + my sch. makes me curious to learn about other things	0.05	0.05	0.08*	0.09**	0.23**	0.14**	0.22**	0.18**

	V9. Discussed ideas from your readings or classes with others outside of class	V10. I value the rewards that I get at school for my work + I think it is important to make good grades	V11. I feel supported and respected by teachers	V12. I feel supported and respected by school staff	V13. I think the things I learn at school are useful	V14. The support I get at school encourages	V15. If I could select my high school I'd go to the same school again + I care about my school	V16. I am excited about my classes + my sch makes me curious to learn about other things
V9. Discussed ideas from your readings or classes with others outside of class	1							
V10. I value the rewards that I get at school for my work + I think it is important to make good grades	0.22**	1						
V11. I feel supported and respected by teachers	0.13**	0.35**	1					
V12. I feel supported and respected by school staff	0.14**	0.35**	0.57**	1				
V13. I think the things I learn at school are useful	0.17**	0.30**	0.31**	0.28**	1			
V14. The support I get at school encourages me to learn more	0.16**	0.32**	0.40**	0.40**	0.52**	1		
V15. If I could select my high school I'd go to the same school again + I care about my school	0.16**	0.31**	0.33**	0.36**	0.29**	0.39**	1	
V16. I am excited about my classes + my school makes me curious to learn about other things	0.22**	0.33**	0.39**	0.42**	0.45**	0.55**	0.54**	1

Appendix C - Variance/Covariance Matrix, Means and Sample Size for White and African American Students – Calibrating Sample

Variance/Covariance Matrix and Mean – White Student Sample (N=660)

1.066
.568 1.248
.655 .570 1.272
.582 .538 .652 1.159
.072 .120 .104 .056 .728
.081 .129 .061 .100 .283 .893
.132 .144 .184 .101 .228 .351 .746
.084 .114 .102 .102 .186 .183 .261 .703
.121 .127 .118 .086 .256 .253 .303 .329 .830
.164 .175 .115 .157 .233 .207 .213 .180 .272 .808
.115 .148 .167 .166 .230 .192 .242 .220 .269 .474 1.161
.083 .108 .123 .116 .190 .093 .158 .185 .157 .381 .672 1.027
.085 .119 .114 .118 .201 .152 .178 .232 .182 .362 .448 .382 .943
.074 .088 .114 .114 .180 .158 .194 .238 .200 .437 .609 .546 .582 1.083
.083 .117 .098 .095 .148 .197 .190 .175 .219 .386 .557 .456 .354 .513 1.307
.070 .091 .079 .053 .213 .227 .274 .275 .295 .385 .521 .417 .475 .554 .580 .864
ME
3.23 3.46 3.32 3.30 2.80 2.71 2.41 1.73 2.46 4.06 3.62 3.28 3.41 3.09 3.27 3.09

Variance/Covariance Matrix and Mean – African American Student Sample (N=913)

1.215
.697 1.210
.761 .660 1.360
.705 .655 .793 1.311
.114 .052 .114 .089 .752
.126 .117 .111 .104 .145 1.023
.050 .012 .063 .078 .171 .293 .741
.047 .052 .030 -.008 .128 .148 .186 .847
.094 .036 .071 -.001 .144 .258 .224 .299 .943
.105 .045 .078 .068 .108 .112 .097 .089 .165 .510
.075 .046 .091 .027 .144 .102 .126 .130 .143 .296 1.222
.066 .014 .063 .077 .154 .105 .122 .101 .118 .267 .718 1.021
.040 .033 .107 .021 .107 .095 .124 .191 .200 .253 .416 .352 1.005
.052 -.026 .015 -.062 .170 .077 .181 .193 .193 .261 .582 .507 .622 1.149
.046 .036 .083 .035 .133 .177 .196 .095 .185 .272 .522 .437 .374 .557 1.374
.042 .033 .123 .046 .157 .140 .184 .180 .228 .272 .490 .420 .481 .612 .633 .930
ME
3.30 3.46 3.38 3.42 2.95 2.56 2.43 1.92 2.48 4.33 3.67 3.56 3.86 3.52 3.15 3.24

Appendix D – Unstandardized Factor Loadings, Standard Errors and t-values for White and African American Students

Factor Loadings	White	African American
Behavioral Engagement		
$\lambda_{1,1}$	1.00	1.00
$\lambda_{2,1}$	0.91	0.90
	(0.06)	(0.05)
	14.40**	19.99**
$\lambda_{3,1}$	1.08	1.04
	(0.07)	(0.05)
	16.33**	21.57**
$\lambda_{4,1}$	0.97	0.99
	(0.06)	(0.05)
	15.77**	21.02**
Cognitive Engagement		
$\lambda_{5,2}$	0.80	0.69
	(0.08)	(0.09)
	10.52**	8.05**
$\lambda_{6,2}$	0.91	0.99
	(0.08)	(0.11)
	10.68**	9.22**
$\lambda_{7,2}$	1.00	1.00
$\lambda_{8,2}$	0.87	0.90
	(0.08)	(0.10)
	11.30**	9.23**
$\lambda_{9,2}$	1.03	1.13
	(0.09)	(0.11)
	11.99**	10.09**
Emotional Engagement		
$\lambda_{10,3}$	0.73	0.45
	(0.05)	(0.03)
	15.73**	14.76**
$\lambda_{11,3}$	0.96	0.83
	(0.05)	(0.05)
	17.28**	17.57**
$\lambda_{12,3}$	0.79	0.71
	(0.05)	(0.04)
	15.04**	16.52**
λ_{133}	0.82	0.79
	(0.05)	(0.04)
	16.33**	18.72**

Factor Loadings	White	African American
$\lambda_{14,3}$	1.00	1.00
$\lambda_{15,3}$	0.88	0.89
	(0.06)	(0.05)
	14.90**	17.84**
$\lambda_{16,3}$	0.92	0.92
	(0.05)	(0.04)
	19.27**	22.50**

**p<0.01

Appendix E – Factor Variance/Covariance, SE and t-values for White and African American Students

White Students

	Behavioral Engagement	Cognitive Engagement	Emotional Engagement
Behavioral Engagement	0.61 (0.06) 10.15		
Cognitive Engagement	0.12 (0.02) 4.94	0.31 (0.04) 7.98	
Emotional Engagement	0.12 (0.03) 4.05	0.26 (0.03) 9.16	0.62 (0.06) 10.82

African American Students

	Behavioral Engagement	Cognitive Engagement	Emotional Engagement
Behavioral Engagement	0.74 (0.06) 12.83		
Cognitive Engagement	0.07 (0.02) 3.51	0.23 (0.03) 7.05	
Emotional Engagement	0.06 (0.03) 2.05	0.19 (0.02) 8.43	0.68 (0.05) 12.78

Appendix F – LISREL Syntax

SYNTAX – THREE FACTOR MODEL

```
TI White school engagement model with 1 modification TD(12,11)
DA NI=16 NO=660 MA=CM
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
PD
OU RS SC PT MI

TI Black school engagement with covariance matrix FR TD (12,11)
DA NI=16 NO=913 MA=CM
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
PD
OU RS SC PT MI
```

SYNTAX – THREE FACTOR STRUCTURE FOR BLACK/WHITE SIMULTANEOUS

```
!School engagement final model with FR TD(12,11)
!Group 1 = Whites
!Simulataneous run
DA NG=2 NI=16 NO=660 MA=CM
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(WHITE VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
OU
Group 2 = Blacks
DA NO=913
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(AFRICAN AMERICAN VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
OU
```

SYNTAX – EQUALITY CONSTRAINTS FOR ALL LX's WHITE SAMPLE

```
!School engagement final model with FR TD(12,11)
!Group 1 = Whites
DA NG=2 NI=16 NO=660 MA=CM
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(WHITE VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
OU
Group 2 = Blacks
DA NO=913
LA; engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(BLACK VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
EQ LX(1,2,1) LX(2,1)
EQ LX(1,3,1) LX(3,1)
EQ LX(1,4,1) LX(4,1)
EQ LX(1,5,2) LX(5,2)
EQ LX(1,6,2) LX(6,2)
EQ LX(1,8,2) LX(8,2)
EQ LX(1,9,2) LX(9,2)
EQ LX(1,10,3) LX(10,3)
EQ LX(1,11,3) LX(11,3)
EQ LX(1,12,3) LX(12,3)
EQ LX(1,13,3) LX(13,3)
EQ LX(1,15,3) LX(15,3)
```

EQ LX(1,16,3) LX(16,3)
OU

SYNTAX – EQUALITY CONSTRAINT FOR ALL PHIs

```
!School engagement combined black and white setting PHIs invariant
!Group 1 = Whites Simultaneous run
DA NG=2 NI=16 NO=660 MA=CM
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(WHITE VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
OU
Group 2 = Blacks
DA NO=913
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(BLACK VARIANCE/COVARIANCE MATRIX HERE)
MO NX=16 NK=3 PH=IN TD=SY
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
EQ LX(1,2,1) LX(2,1)
EQ LX(1,3,1) LX(3,1)
EQ LX(1,4,1) LX(4,1)
EQ LX(1,5,2) LX(5,2)
EQ LX(1,6,2) LX(6,2)
EQ LX(1,8,2) LX(8,2)
EQ LX(1,9,2) LX(9,2)
EQ LX(1,11,3) LX(11,3)
EQ LX(1,12,3) LX(12,3)
EQ LX(1,13,3) LX(13,3)
EQ LX(1,15,3) LX(15,3)
```

EQ LX(1,16,3) LX(16,3)
OU

SYNTAX – TESTING INVARIANCE OF LATENT MEANS STRUCTURE

```
!School engagement test for differences in latent means blacks as reference group
!Group 1 = Whites
!Simulataneous run
DA NG=2 NI=16 NO=660 MA=CM
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(WHITE VARIANCE/COVARIANCE MATRIX HERE)
ME
3.2242 3.4712 3.2909 3.3197 2.8 2.7076 2.4318 1.7333 2.4894 4.0803 3.6091 3.2970
3.4273
3.0894 3.3083 3.0985
MO NX=16 NK=3 TD=SY TX=FR KA=FR
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(3,1) LX(4,1) LX(5,2) LX(6,2) LX(8,2) LX(9,2) LX(10,3) LX(11,3)
LX(12,3)
FR LX(13,3) LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
OU
Group 2 = Blacks
DA NO=913
LA
engasgn mathasgn sciasgn histasgn sources viewclas intideas discidea discoth
reward2 supptch suppstaf useful lrnmore caresele exitcuri
CM SY
(BLACK VARIANCE/COVARIANCE MATRIX HERE)
ME
3.2957 3.4721 3.4085 3.4436 2.9474 2.5619 2.4326 1.9025 2.4984 4.3198 3.6692 3.5765
3.8434 3.5148 3.1665 3.2289
MO NX=16 NK=3 TD=SY TX=IN KA=FI
LK
'Beh Eng' 'Cogn Eng' 'Emot Eng'
FR LX(2,1) LX(8,2) LX(10,3) LX(11,3) LX(12,3)
FR LX(15,3) LX(16,3) TD(12,11)
VA 1 LX(1,1)
VA 1 LX(7,2)
VA 1 LX(14,3)
EQ LX(1,2,1) LX(2,1)
EQ LX(1,3,1) LX(3,1)
EQ LX(1,4,1) LX(4,1)
```

```
EQ LX(1,5,2) LX(5,2)
EQ LX(1,6,2) LX(6,2)
EQ LX(1,8,2) LX(8,2)
EQ LX(1,9,2) LX(9,2)
EQ LX(1,11,3) LX(11,3)
EQ LX(1,12,3) LX(12,3)
EQ LX(1,13,3) LX(13,3)
EQ LX(1,15,3) LX(15,3)
EQ LX(1,16,3) LX(16,3)
EQ PH(1,2,1) PH(2,1)
EQ PH(1,3,1) PH(3,1)
EQ PH(1,3,2) PH(3,2)
EQ PH(1,2,2) PH(2,2)
EQ PH(1,3,3) PH(3,3)
OU SC
```

Appendix G - Variance/Covariance Matrix, Means and Sample Size for White and African American Students – Cross-Validation Sample

Variance/Covariance Matrix and Mean – White Student Sample (N=649)

1.023
.539 1.130
.588 .518 1.192
.537 .529 .594 1.152
.111 .134 .157 .109 .721
.080 .100 .026 .063 .231 .917
.113 .102 .139 .095 .218 .294 .687
.095 .120 .116 .067 .168 .176 .250 .678
.146 .154 .113 .071 .246 .241 .270 .328 .852
.131 .173 .140 .113 .207 .186 .163 .131 .207 .808
.109 .190 .166 .091 .197 .195 .167 .153 .174 .460 1.133
.093 .126 .146 .092 .159 .077 .156 .141 .142 .350 .637 .947
.062 .126 .104 .067 .162 .183 .183 .211 .177 .417 .463 .386 .988
.087 .093 .140 .090 .173 .159 .227 .230 .219 .431 .573 .529 .599 1.049
.067 .105 .094 .075 .185 .205 .148 .188 .224 .336 .490 .412 .394 .496 1.269
.085 .072 .077 .040 .168 .261 .245 .253 .305 .370 .465 .379 .516 .573 .598 .882
ME
3.22 3.48 3.29 3.33 2.71 2.72 2.43 1.76 2.49 4.08 3.60 3.27 3.45 3.04 3.36 3.08

Variance/Covariance Matrix and Mean – African American Student Sample (N=928)

1.326
.804 1.30
.838 .744 1.36
.808 .767 .829 1.38
.142 .082 .159 .127 .765
.093 .076 .090 .093 .162 1.018
.074 .030 .109 .103 .195 .298 .754
.089 .052 .096 .083 .179 .184 .257 .903
.119 .013 .098 .072 .214 .270 .280 .367 .936
.137 .086 .109 .128 .135 .117 .126 .065 .150 .484
.126 .074 .101 .046 .151 .066 .094 .063 .133 .258 1.148
.099 .080 .069 .119 .119 .086 .101 .063 .130 .238 .598 .954
.107 .082 .091 .091 .099 .051 .116 .149 .161 .208 .337 .274 1.023
.130 .063 .078 .080 .146 .067 .164 .180 .159 .229 .435 .398 .532 1.044
.077 .047 .092 .109 .170 .160 .193 .109 .182 .255 .417 .426 .345 .481 1.434
.052 .053 .086 .105 .189 .136 .181 .164 .197 .220 .396 .391 .430 .536 .608 .901
ME
3.31 3.44 3.40 3.43 2.94 2.57 2.47 1.92 2.51 4.35 3.72 3.59 3.83 3.52 3.21 3.23

Appendix H – Operational Definitions of School Engagement

Shernoff et al. (2003) – Using experience sampling method (ESM)

1. How well were you concentrating?
2. Did you find the activity interesting?
3. Did you enjoy what you were doing?

Sirin, S., & Rogers-Sirin, L. (2004)

1. Since school started this year, how often have you had trouble getting along with teachers?
2. Since school started this year, how often have you had trouble paying attention?
3. Since school started this year, how often have you had getting homework done?
4. Since school started this year, how often have you had trouble with other students?
5. You feel close to people of your school.
6. You feel like you are part of your school.
7. You are happy to be at your school.
8. The teachers at your school treat students fairly.
9. You feel safe in your school.

Finn & Voelkl (1993)

1. ABS-TARDY – teachers' reports of whether a youngster was frequently absent from class or tardy.
2. NOT-ENGAGED – teachers' reports of whether a student rarely completed homework, was inattentive, and/or frequently disruptive in class.

3. ATTENDANCE – students' reports of the number of times they missed school, skipped classes, and/or arrived late; and of the number of times their parents were contacted about attendance problems.
4. PREPARATION – students' reports of the number of times they came to class without paper and pencil, without books, and without completed homework.
5. BEHAVIOR – students' reports of the number of times they were sent to the principal's office for misbehaving, their parents had received warnings about their child's behavior, and they had gotten into a fight with another student.
6. STUDENT-TEACHER RELATIONSHIP – students' reports of whether they got along well with teachers at their schools; whether there was "real good spirit"; whether teachers were interested in students, praised students' efforts, and listened to what students said; or whether students felt "put down" by teachers.

Whitlock, J. (2006)

School connectedness:

1. Adults at my school care about people my age
2. Adults at my school don't respect what people my age think
3. At school there is a teacher or some other adult who believes I will be a success
4. Adults in my school listen to what I have to say
5. Adults at my school push me to do my best
6. I care about the school I go to
7. I trust the adults in my school

Caraway, K., Tucker, C. M., Reinke, W. M., & Hall, C. (2003)

Ongoing engagement sub-domain:

1. I work very hard on my school work
2. I don't try very hard in school
3. I pay attention in class
4. I don't work very hard in school
5. When I'm in class I just act as if I'm working
6. How important is it to you to do the best you can in school?

Reaction to challenge sub-domain:

1. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I say the teacher didn't cover the things in the test
2. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I get angry at the teacher
3. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I say it is the teacher's fault
4. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I tell myself it didn't matter
5. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I say it wasn't important
6. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I say I didn't care about it
7. When something bad happens to me in school (like not doing well on a test or not being able to answer an important question in class), I worry that the other students will think I'm dumb

Marks, H. M. (2000)

1. In social studies/mathematics class, how often do you try as hard as you can?
2. How often do you complete your assignments for this class?
3. How often do you pay attention in this class?
4. How often do you feel bored in this class?

Bruyn, E. (2005)

Academic engagement (attentiveness) – teacher reported

1. This student shows good command of the material I taught him/her
2. This student works independently on his/her class work and homework
3. This student gives interesting and original answers to my questions in class
4. When I teach, I feel that this student really understands what I'm saying
5. This student is cooperative and enthusiastic during my class
6. This student listens to what others have to say
7. This student concentrates and works quietly
8. This student is indifferent and I have to work hard to get him/her interested

Jordan, Will J. (1999)

1. Students' participation in team sports
2. Students' participation in individual sports

Appleton, J., Christenson, S., Kim, D., & Reschly, A. (2006)

1. Overall, adults at my school treat students fairly.
2. Adults at my school listen to the students.
3. At my school, teachers care about students.
4. My teachers are there for me when I need them.

5. The school rules are fair.
6. Overall, my teachers are open and honest with me.
7. I enjoy talking to the teachers here.
8. I feel safe at school.
9. Most teachers at my school are interested in me as a person, not just as a student.
10. The tests in my classes do a good job of measuring what I'm able to do.
11. Most if what is important to know you learn in school.
12. The grades in my classes do a good job of measuring what I'm able to do.
13. What I am learning in my classes will be important in my future.
14. After finishing my schoolwork I check it over to see if it's correct.
15. When I do schoolwork I check to see whether I understand what I am doing.
16. Learning is fun because I get better at something.
17. When I do well in school it's because I worked hard.
18. I feel like I have a say about what happens to me at school.
19. Other students at school care about me.
20. Students at my school are there for me when I need them.
21. Other students here like me the way I am.
22. I enjoy talking to the students here.
23. Students here respect what I have to say.
24. I have some friends at school.
25. I plan to continue my education following high school.
26. Going to school after high school is important.
27. School is important for achieving my future goals.

28. My education will create many future opportunities for me.
29. I am hopeful about my future.
30. My family/guardian(s) are there for me when I need them.
31. When I have problems at school my family/guardian(s) are willing to help me.
32. When something good happens at school, my family/guardian(s) want to know about it.
33. My family/guardian(s) want me to keep trying when things are tough at school.
34. I'll learn, but only if my family/guardian(s) give me a reward.
35. I'll learn, but only if the teacher gives me a reward.

Johnson et al. (2001)

1. In the past year, how many times have you skipped school?
2. In the past year, how many times have you had trouble paying attention in school?
3. In the past year, how many times have you had trouble getting homework done?

Greene, B., & Miller, R. (1996)

Meaningful cognitive engagement:

1. I made a plan for achieving the grade I wanted on this exam
2. When I read for this exam I stopped to ask myself whether or not I am understanding the material
3. When learning the new material, I summarized it in my own words

Shallow cognitive engagement:

1. I tried to write down exactly what my instructor said during lectures
2. I tried to memorize answers to questions from test study guides

3. In order for me to understand what technical terms meant, I memorized the text-book definitions

Brewster, A. B., & Bowen, G. L. (2004)

1. During the past 30 days, I cut at least one class
2. During the past 30 days, I showed at school late unexcused
3. During the past 30 days, I had a fight
4. During the past 30 days, I have been suspended
5. I find school fun and exciting
6. I look forward to learning new things at school
7. I look forward to going to school

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AREAS OF EXPERTISE

- Designing and conducting quantitative research studies
- Statistical analysis of longitudinal and cross-sectional data
- School engagement, school achievement and achievement gap
- Structural Equation Modeling and Hierarchical Linear Modeling

WORK EXPERIENCE

- *Co-Manager, Analysis Design for Striving Readers grant evaluation*. Co-developed a rigorous experimental research evaluation design for the successful bidding to the FY 2005 U.S. Department of Education's Striving Readers grant program, in conjunction with Chicopee and Springfield schools districts in Massachusetts. The program and evaluation design contained three components: (1) school level strategies designed to increase reading achievement for students by improving the quality of literacy instruction across the curriculum, (2) intensive, targeted intervention for struggling readers (i.e., students who read at least two years below grade level, including limited English proficient students and students with disabilities), (3) a project evaluation that includes a rigorous experimental research evaluation of the intensive, targeted intervention for struggling readers. (November 2005-present).

- *Research Manager, MSAP Rigorous Evaluation Projects*. Developed the research design and analysis plan for the evaluation of the impact of magnet school assistance programs (MSAP) on student achievement in six school districts across multiple states. The research design and data analysis included selection of comparison/control groups, data collection plan, selection of outcome indicators, and three different types of statistical analyses including statistical significance testing, effect size estimation, and students' longitudinal academic growth modeling. (June 2005-present).

- *Survey Instrument Designer and Developer*. Provided ongoing support to the Equity and Diversity Division at the Education Alliance at Brown University, in developing and validating an instrument to measure school climate. Conducted item analysis, exploratory and confirmatory factor analysis to validate measurement and structural (subscales) properties of the instrument, convergent

and discriminant validity, in addition to calculating reliability coefficient. (Fall 2005).

- *Project Co-Leader, Holyoke Public Schools Transient Opportunity Program (TOP) evaluation*. Holyoke Public Schools was identified by the Massachusetts Board of Education as 'under-performing' and required the district to develop a turn-around plan for improving student achievement. The TOP was designed to alleviate one complex problem of the Holyoke school system: high student mobility and its impact on the classroom. The evaluation focused on TOP's first or pilot year of operation dedicated to providing services for highly mobile middle school students who entered the Holyoke, Massachusetts school system after October 1. Evaluation focused on assessment of the performance of TOP students compared to similar (demographically and academically) cohorts district students not receiving the support services of TOP and implementation of program against research-based parameters for educating highly mobile students and building family support capacities. (April 2005-February 2006).

- *Project Director, Bilingual Education program evaluations*. Works with staff of the Alliance's Equity and Diversity division and Research and Evaluation division to bring together the content knowledge and methodological expertise required to assess the implementation and impact of bilingual education programs, inclusive of ESL/ESOL, dual language, English immersion and other program options. Evaluation questions are framed with respect to program alignment, program entry/exit and access issues, integration of mainstream and program teachers/students, differential student performance indicators, teacher quality, and allocation of resources. Secondary analysis of student performance and primary data collection with respect to student, parent, teacher and administrator perspectives on program attributes are reviewed in context of policy, curriculum alignment and resource allocation analyses. (April 2005-present).

- *Alliance Research &Evaluation Specialist*. Responsible across the division for providing leadership in design, development, management and implementation of research and evaluation work that is theory-driven and professionally/practically sound. Advises and/or leads teams across projects to design and implement rigorous analysis designs, apply statistical modeling, and incorporate methodological rigor into all aspects of design, sample development, data collection activities, survey instrumentation, and statistical inquiry. (April 2005-present).

- *Research Associate, Ministry of Education, Honduras.* Responsible for data analysis, descriptive studies, teacher performance evaluation, student and school achievement research studies, multi-lingual and multi-cultural education studies. Created a uniform reporting system at department, municipal/district, and school levels that included education indicators such as school access, teacher profile, student educational and socio-economic profile, retention index, apparent and net

admission rate, student mobility, pre-school coverage, personnel structure, teacher replacement, resources by teacher and student, student retention, intra-curricular & terminal efficiency, grade promotion, retention and desertion rates; evaluation of educational achievement or progress towards meeting educational goals and objectives, defining and operationalizing educational quality and setting quality standards; creation of item bank and providing training for teachers to measure educational achievement in Mathematics, Spanish, and Natural & Social Sciences; training personnel at different school levels on data collection & implementation of data collection methods for reporting to the Ministry of Education; comparative studies of multilingual-cultural education versus total Spanish immersion for Misquito and Tawahka students; evaluation of radio teacher training project on Math, Spanish and Science; responsible for the DDE's annual report to the Honduran Ministry of Education. (April 1998-December 2001).

- *Foreign Credential Evaluator, Barry University, Miami Shores, FL*. Provided document-by-document and course-by-course foreign education evaluation, determined grade and credit equivalents in U.S. terms for university level study in other countries. (August 1991-August 1992).

- *Research Assistant in Educational Research and Evaluation Department and National Center for Research in Vocational Technical Education, Virginia Tech*. Provided secondary data analysis and statistical support to department and center staff and to research partners across range of projects. Participated in data mining and statistical analysis support for school finance studies and proposal development for assessing vertical and horizontal equity of educational funding formulas. (1990-1991).

- Instructor of agriculture and natural resources programs to help farmers implement sustainable practices and profitability of agricultural and forestry production, protecting and enhancing the quality of land and water resources. (1984-1986).

EDUCATION

Virginia Polytechnic Institute & State University, Ph.D. in Educational Research and Evaluation with cognate area in Statistics. Dissertation Entitled: School Engagement. Testing the Factorial Validity, Measurement and Structural Invariance and Latent Mean Structures Between African American and White Students.

Virginia Polytechnic Institute & State University, M.S. in Education, Major in Vocational Technical Education, 1988.

Virginia Polytechnic Institute & State University, B.S. in Education, Major in Vocational Technical Education, 1987.

Panamerican Agricultural School, Zamorano, Honduras, Agronomist, 1983.

OTHER ACCOMPLISHMENTS

Member of Alliance Research Design Team: Statistical analyst and design consultant for rigorous research and/or evaluation initiatives such as the Alliance's Northeast and Island Regional Educational Laboratory application, Striving Readers Grant proposal, New York City Curriculum Alignment impact study (with Learning Point Associates), and MSAP rigorous evaluation proposal applications.

Technical Reports: Lead author—Bilingual/ESL Evaluation Reports for East Hartford, CT, West Hartford, CT and Barnstable, MA; Lead author—Holyoke Transient Opportunities Program Evaluation for Holyoke, MA school district; Team author—Progress reports, MSAP Rigorous Evaluations for Hamilton County (TN) Public Schools, Duval County (FL) Public Schools, Jackson-Madison (TN) Public Schools, Hartford (CT) Public Schools, Winston-Salem (NC) Public Schools, and NYC Region 8 Public Schools; Team author—NYC Bilingual Evaluation and Alignment impact design.

SCHOLARSHIPS

Recipient of Central American Peace Scholarship (CAPS), 1986. United States Agency for International Development (USAID).

MEMBERSHIP AND ASSOCIATIONS

American Educational Research Association
Division D: Measurement and Research Methodology

American Evaluation Association