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THE IMPACT OF PSYCHOSOCIAL FACTORS ON ACHIEVEMENT GAINS BETWEEN EIGHTH AND TENTH GRADE

by

Yi-Lung Kuo

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Psychological and Quantitative Foundations
in the Graduate College of
The University of Iowa

May 2011

Thesis Supervisors: Professor David F. Lohman
Adjunct Lecturer Steven B. Robbins

ABSTRACT

This study investigated the roles of the psychosocial factors (PSFs) of motivation, social control, and self-regulation, in the prediction of 10th grade academic achievement for a large sample of 8th grade students. The differential effects of PSFs for male and female students with different levels of 8th grade achievement were also examined. Of the 4,660 middle-school students in the ACT database, 1,384 8th grade students were included in the study. The Student Readiness Inventory-Middle School (SRI-MS) was used to assess three broad PSFs based on ten scales, which were named motivation (consisting of Academic Discipline, Commitment to School, and Optimism), social control (consisting of Family Attitude toward Education and Family Involvement, Relationships with School Personnel, and School Safety Climate), and self-regulation (consisting of Managing Feelings, Orderly Conduct, and Thinking before Acting). The students' EXPLORE and PLAN Composite scores served as measures of initial and later academic achievement, respectively. Multiple regression models were constructed for each PSF to test the hypotheses. Post hoc probing techniques were used if significant interaction terms were found. If no significant interaction terms were found, the effects of PSFs on achievement gains were examined using a psychosocial mediation model.

The results showed that 8th grade females demonstrated greater motivation, social control, and self-regulation than 8th grade males. Also, motivation and social control each interacted significantly with sex and 8th grade achievement when predicting 10th grade achievement. Specifically, among female students, effects were positive for females with higher prior achievement and negative for females with lower prior achievement for both motivation and social control. For male students, neither motivation nor social control added significantly to the prediction of later achievement. There were no interactions between self-regulation and either sex or prior achievement. Instead, self-regulation

partially mediated the effects of initial achievement when predicting later academic achievement.

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Graduate College
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Iowa City, Iowa

CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

Yi-Lung Kuo

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To my grandmother, Han-Jing He Kuo, my parents Chien-Sheng Kuo, Mei-Feng Tseng, and in memory of my grandfathers and grandmother, who provided me ample opportunities to learn.

Be strong and courageous. Do not be terrified; do not be discouraged, for the Lord your God will be with you wherever you go.

Jesus

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Finally, I thank my parents, my sister Yi-Ling, and the entire Kuo family for giving me endless love and supporting my realistic and unrealistic academic dreams.

It is time for me to move forward and to try to provide a better education for future generations.

ABSTRACT

This study investigated the roles of the psychosocial factors (PSFs) of motivation, social control, and self-regulation, in the prediction of 10th grade academic achievement for a large sample of 8th grade students. The differential effects of PSFs for male and female students with different levels of 8th grade achievement were also examined. Of the 4,660 middle-school students in the ACT database, 1,384 8th grade students were included in the study. The Student Readiness Inventory-Middle School (SRI-MS) was used to assess three broad PSFs based on ten scales, which were named motivation (consisting of Academic Discipline, Commitment to School, and Optimism), social control (consisting of Family Attitude toward Education and Family Involvement, Relationships with School Personnel, and School Safety Climate), and self-regulation (consisting of Managing Feelings, Orderly Conduct, and Thinking before Acting). The students' EXPLORE and PLAN Composite scores served as measures of initial and later academic achievement, respectively. Multiple regression models were constructed for each PSF to test the hypotheses. Post hoc probing techniques were used if significant interaction terms were found. If no significant interaction terms were found, the effects of PSFs on achievement gains were examined using a psychosocial mediation model.

The results showed that 8th grade females demonstrated greater motivation, social control, and self-regulation than 8th grade males. Also, motivation and social control each interacted significantly with sex and 8th grade achievement when predicting 10th grade achievement. Specifically, among female students, effects were positive for females with higher prior achievement and negative for females with lower prior achievement for both motivation and social control. For male students, neither motivation nor social control added significantly to the prediction of later achievement. There were no interactions between self-regulation and either sex or prior achievement. Instead, self-regulation

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CHAPTER 1

INTRODUCTION

In one of Aesop's fables, a tortoise challenged a hare to race. The hare accepted the invitation confident that he would win. The hare ran very fast and, after running a while, turned his head but could not see the tortoise. "Why not take a nap? I will win this race for sure," he thought, and immediately went to sleep. However, the slow-moving tortoise kept moving, passed the sleeping hare, and eventually won the race. This fable is often told to underscore how diligence can make up for a lack of ability. Stated another way, the fable illustrates how psychosocial factors (PSFs) such as diligence and motivation are central to the development of competence in any domain of non-trivial difficulty.

The study of how learners move from little to substantial competence in a domain is modeled in theories of expertise (Ericsson, Krampe, & Tesch-Romer, 1993), and of the development of abilities (Horn & Masunaga, 2006). As in the fable, studies of expertise show that deliberate, well-structured practice is required to develop and maintain high levels of skill (Ericsson et al., 1993). Further, practice must extend over many years. Simon and Chase (1973) estimated that it requires at least ten years of continuous training in a domain of non-trivial complexity to develop expertise. Thus, long-term academic achievement is in part a product of sustained effort.

In contemporary education, PSFs such as motivation, social interaction skills, and environmental support have been widely acknowledged as being important for academic success (Clouder et al., 2008; Lee & Shute, 2010). Additionally, PSFs can be used to assess student risk for academic failure (Lee & Shute, 2010; Zins, Bloodworth, Weissberg, & Wallberg, 2004). PSFs can even be viewed as important outcomes of education.

Although many educational policies and interventions stress the improvement of academic achievement, some, more comprehensive educational models have been proposed that describe a broader range of educational outcomes. The goal of these models is to prepare children both for success in school and as life-long learners through the integration of academic learning and social-emotional development (Bellanca & Brandt, 2010; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Merrell & Gueldner, 2010; Sparks, 2011; Zins et al., 2004). For example, state-wide policies in Illinois, Alaska, Missouri, and New Jersey describe the need to incorporate psychosocial skills into educational programs to improve students' academic performance. These programs use grade-appropriate psychosocial standards, guidelines, curriculum modules, checklists, and more (Lantieri, 2008). The integration of PSFs changes the meaning of educational accountability from a focus on achievement testing to helping students become life-long, autonomous learners.

Predictive Validity of PSFs

PSFs are predictors of and mediators for later academic achievement in both K-12 and higher education settings (Dymnicki, 2004; Kyllonen, Walters, & Kaufman, 2005; Lounsbury, Welsh, Gibson, & Sundstrom, 2005; Payton et al., 2008; Robbins, Oh, Le, & Button, 2009). Several studies have shown that PSFs such as self-efficacy, motivation, locus of control, attitude toward learning, attention, persistence, use of learning strategies, and learning flexibility add incremental validity to cognitive factors, such as ability and prior achievement, in predicting future academic achievement (Grigorenko et al., 2009; Yen, Konold, & McDemott, 2004). Similarly, a review of social and emotional learning in elementary school found that self-awareness, self-management, social awareness, relationship skills, and responsible decision making improve students' academic performance (Payton et al., 2008). Using a large cohort of students from 7th and 8th grade through early high school, Casillas et al. (in press) proposed a comprehensive assessment

model combining PSFs (such as motivation, social control, and self-regulation), behavioral indicators (e.g., absenteeism, being held back), and prior academic achievement with demographic and school context variables to predict academic success. Results of their analyses show that PSFs add modest incremental validity in the assessment model.

PSFs also impact school completion. Over 25% of students who entered public high school in 9th grade in 2003-2004 did not stay on track to graduation four years later (Snyder, 2010). Rumberger and Lim (2008) reviewed studies of dropouts conducted over the past 25 years and found that PSFs such as attitude and characteristics of family and school personnel, along with prior academic achievement and learning behaviors, can differentiate between students who graduate and those who drop out of high school. In studies of college students, Robbins, Allen, Casillas, Peterson, and Le (2006) used a combination of PSFs including academic discipline, social activity, self-regulation, prior academic performance, and achievement test scores to predict the retention of first-year college students. Robbins et al. found that PSFs added incremental validity (about 3.5% of variance) to the prediction model. Similarly, in studies of graduate students, PSFs such as personality and attitudinal factors added incremental validity to college GPA and standardized exams (e.g., Graduate Record Examinations) in the prediction of attrition and time to degree (Kyllonen et al., 2005).

Statement of the Problem

A combination of prior academic achievement and PSFs can predict students' later achievement (ACT, 2008), but interactions between academic achievement and PSFs are not yet fully understood. Although the incremental contributions of PSFs in the prediction of achievement at the middle school level have been addressed in previous research (Casillas et al., in press; Lounsbury, Sundstrom, Loveland, & Gibson, 2003), there are still many questions that need to be investigated. Specifically, it is unclear how

student psychosocial factors interact with prior academic achievement and sex when predicting subsequent academic achievement. For example, it is unknown whether PSFs have different effects for students who differ in academic achievement or sex. Some PSF's may be more important in predicting academic success for low-achieving students, whereas other PSF's may be more important for predicting the continued academic success of high-achieving students. Similarly, some PSF's may play a more significant role for female students than for male students.

The purpose of this study was to investigate the roles played by PSFs in predicting later achievement among 8th grade students. Further, the differential effects of PSFs for students who differed in academic achievement and sex were examined.

CHAPTER 2

REVIEW OF THE LITERATURE

Overview of PSFs: Motivation, Social Control, Self-regulation

Psychosocial factors (PSFs), such as motivation, social control, and self-regulation, play key roles in classroom learning (Zins et al., 2004). Students need to be highly motivated to learn well in school, to recognize and use the social supports that can facilitate their learning, and to regulate their behaviors and manage their feelings. Some researchers have used the word “non-cognitive” as an umbrella term that includes these sorts of PSFs and other non-ability factors (e.g., Duckworth, 2009; Kyllonen, 2005). For example, Duckworth’s (2009) definition of the term “non-cognitive” includes capacity and propensity dimensions when predicting achievement. Take self-control as an example, capacity indicates that self-control is “measured as the ability to delay gratification”, whereas propensity indicates that self-control is “measured by self-report or informant ratings of behavior” (Duckworth, 2009, p.279). Many psychological studies, including this one, focus on the propensity dimension, where psychological characteristics are measured by self-report inventories.

Other non-cognitive factors measured by these instruments include an individual’s demographic characteristics and life history (biographical data), as well as PSFs. These PSFs include motivation, social engagement, self-regulation, and other factors which are influenced by educational programs and in turn influence students’ educational outcomes (Heckman & Rubinstein, 2001; Kyllonen, 2005; Le, Casillas, Robbins, & Langley, 2005; Schmitt et al., 2009). However, instead of using the broad term “non-cognitive,” this study and the following section focus on three specific PSFs: motivation, social control, and self-regulation.

Achievement motivation

The term "motivation" in this study refers to motivation to achieve academic outcomes in educational settings via certain personality characteristics and attitudes. Although the earliest scientific studies of human motivation date back to Freud's work in the late 19th century (Atkinson, 1964; McClelland, 1961), it is believed that research-based theories of achievement motivation using clinical approaches were derived from Murray's concept of motives and grounded in experimental studies conducted by McClelland and his colleagues (Dweck, 2000; McClelland, Atkinson, Clark, & Lowell, 1953). Murray (1938) defined *n Achievement* (need for achievement), as the need "to overcome obstacles, to exercise power, to strive to do something difficult as well and as quickly as possible" (p. 80). Instead of providing a precise definition of achievement motivation, McClelland et al. (1953) described achievement motivation in terms of "affect in connection with evaluated performance" (p. 79). Specifically, they argued that children were more likely to show higher achievement motivation when they felt the need to conform to external standards of excellence, typically imposed by their parents and the surrounding culture (McClelland et al., 1953). In addition, Maslow (1954) proposed a basic need hierarchy consisting of physiological needs, safety needs, belongingness and love needs, esteem needs, and self-actualization needs. The esteem needs include the desire for achievement, mastery, and competence (Maslow, 1954). These various theories of achievement motivation were widely studied until the beginning of the 1970s (Elliot, 1997).

In the 1970s, trait-based approaches to understanding need achievement were criticized for failing to incorporate goals and cognitions (e.g., beliefs and attributions) (Dweck, 2000). In response to these criticisms, studies of educational achievement changed from a trait paradigm to a social-cognitive paradigm that focuses on the relationship between antecedents, mental representations, and consequences (Olson & Dweck, 2008). Achievement motivation was described in terms of psychological

mechanisms, environment, and interventions, rather than as a trait (Olson & Dweck, 2008). For example, Dweck (2000) argued that people have personal theories in which they view abilities either as fixed (an entity theory) or as a malleable (an incremental theory). Those who hold an entity theory of ability view their intelligence as an unchangeable trait. However, those who hold an incremental theory view their intelligence as something that can be developed through effort and education. As might be expected, students with an incremental perspective show better performance when facing challenging tasks (Dweck, 2000; 2008). Attributing setbacks and failures in learning to a lack of effort rather than to a lack of ability results in greater persistence in learning (Dweck, 2000; Weiner, 1985).

In more recent studies (Casillas et al., in press; Le et al., 2005; Robbins et al., 2004), Robbins and his colleagues used the term “motivation” to capture the broad concept of motivation in educational environments. They described motivation in terms of students’ personal characteristics that elicit and maintain their drive in goal-oriented learning activities and that foster their academic success. These personal characteristics at the secondary-school and college levels include, but are not limited to, academic discipline, commitment, optimism, conscientiousness, goal focus, and academic self-confidence (Casillas et al., in press; Le et al., 2005).

Social control

The term “social control” in this study refers to students’ perception of their family’s engagement, particularly family members’ attitudes regarding the value of education and their involvement in school activities, and their relationships with school personnel. It also includes perceptions of school safety. Social control was first defined as “the ability of social groups or institutions to make norms or rules effective” (Reiss, 1951, p. 196), and this definition of social control has been used to explain delinquency as, in part, a failure of the individual to perceive or accept social controls from their

environment (Hirschi, 1969; Reiss, 1951). The main idea of social control in a control theory of delinquency is that when individuals perceive expectations from and have relationships with people or social groups in the surrounding environment, they have a lower likelihood of breaking social norms (Hirschi, 1969). In particular, the notion of attachment, a key element of social bonds, includes the relationships between students and both their family members and school personnel (Hirschi, 1969; Wiatrowski, Griswold, & Roberts, 1981). Therefore, from a sociological perspective, family members' attitudes towards education and their involvement in their child's education as well as the student's relationships with school members are all embedded within social control theory and are consequently related to children's delinquent behaviors (Hirschi, 1969; Reiss, 1951).

Social control also can be construed as students' perception of personal and physical resources in the social environment that would support them in their learning (Robbins et al., 2009). For example, students who perceive school personnel or family members as providing higher levels of support in school activities are more likely to seek out teacher support and other learning resources in school. On the other hand, students who disengage from educational support social groups, such as family and school, have fewer opportunities to achieve learning goals. Further, when students perceive their school as having a safe climate, they are less likely to show deviant behaviors and are more likely to engage in learning activities (Goldstein, Young, & Boyd, 2008; Sprague & Walker, 2005).

Self-regulation

The term "self-regulation" in this study refers to the degree to which students appropriately regulate and express their feelings and behaviors, as well as how they think about the consequences of behavior in school contexts. In contrast to social control, self-regulation is more aligned with the concept of personal control, which is defined as "the

ability of the individual to refrain from meeting needs in ways which conflict with the norms and rules of the community" (Reiss, 1951, p.196). As in Reiss's (1951) theory, some self-regulation studies have emphasized how to regulate deviant behavior and maintain appropriate behavior by focusing on avoiding disruptive and anti-social behavior (Rothman, Baldwin, & Whertel, 2004; Schunk, 2005).

In addition to investigating the regulation of behavior, other self-regulation studies specifically address regulating emotions and feelings, which researchers have described as emotion regulation, emotion-related regulation, or emotional control (Cole, Martin, & Dennis, 2004; Eisenberg & Spinrad, 2004; Gross, 1998; Robbins et al., 2009). Gross (1998) broadly defined emotional regulation as the process by which individuals alter the emotions they have, when they have them, and how they experience and express them. Eisenberg and Spinrad (2004) described emotional self regulation as "emotion as regulated," (Cole et al., 2004) thereby including goal-directed behavior. They defined emotion-related self regulation as:

> …the process of initiating, avoiding, inhibiting, maintaining, or modulating the occurrence, form, intensity, or duration of internal feeling states, emotion-related physiological, attentional processes, motivational states, and/or the behavioral concomitants of emotion in the service of accomplishing affect-related biological or social adaptation or achieving individual goals. (p.338)

When achieving a goal is made more difficult by emotional reactions and feelings, some students will be better able to regulate these emotions and thus more likely to attain their goals.

In a recent meta-analytic path analysis of college performance and retention, Robbins et al. (2009) used the term emotional control to describe how students manage or regulate those attitudes and feelings that directly influence their learning. Rather than separately considering two self-regulatory mechanisms, behavior regulation and emotion

regulation, Carver (2004) proposed two basic regulatory processes: the approach process and the avoidance process. Emotions are embedded into each process, both of which show feelings as poles in an affective dimension of the processes. Given an interweavement of behavior and affect control systems, individuals are more likely to demonstrate behavior with an appropriate combination of quickness (reactions) and stability (feelings) (see Carver, 2004, for discussion).

Referring to the definition of emotion-related regulation, Eisenberg, Smith, Sadovsky and Spinrad (2004) argued that individuals who show optimal emotion-related regulation should be able to demonstrate acceptable and appropriate reactions in a spontaneous manner. Further, ineffective forethought before responses often leads to dysfunctions in self-regulation (Zimemrman, 2000). Acting before thinking is a key factor in impulsivity, which is a form of behavioral disinhibition and that results in a lack of behavioral control (Dickman, 1990; Patton, Stanford, & Barratt, 1995; White et al., 1994). Dickman (1990) defined impulsivity as a general tendency to react quickly and inaccurately with limited forethought. Specifically, impulsivity includes two traits, functional impulsivity and dysfunctional impulsivity. Behaviors of functional impulsivity indicate that individuals respond to situations quickly and inaccurately when this style is optimal or beneficial, whereas behaviors of dysfunctional impulsivity often results in undesirable problems or risky behaviors (Dickman, 1990). In addition to dysfunctional impulsivity, behaviors of acting before thinking are conceptualized as motor impulsiveness (Patton et al., 1995), spontaneity (Gerbing, Ahadi, & Patton, 1987; Wu & Clark, 2003), and lack of planning (Smith et al., 2007). These impulsive or spontaneous reactive behaviors without forethought often lead to antisocial/risky behaviors and poor academic performance (Romer, 2010; Smith et al., 2007; White et al., 1994).

In sum, motivation, social control and self-regulation can be summarized as follows. Based on achievement motivation theories, motivation refers to motivation to attain academic success through personality characteristics and attitudes. Based on social

control theories, social control refers to students' perception of family members' attitudes regarding the value of education and involvement in school life and activities, as well as students' perceptions of their relationships with school personnel and of school safety. Based on theories of behavior and emotion self-regulation, self-regulation refers to the degree to which students appropriately regulate their feelings and both antisocial and impulsive behaviors in school. In the following section, studies investigating the prediction of academic achievement in K-12 settings from of PSFs are reviewed.

PSF Effects in Predicting Later Academic Achievement

The prediction of academic achievement from PSFs such as motivation, social control, and self-regulation has been studied extensively. Academic achievement is variously estimated by grade point average, standardized achievement test scores, and level of degree attained, depending on the study. In addition to relationships between PSFs and academic achievement, the links among PSFs, school-level factors, and academic achievement are also discussed in this section.

Motivation and academic achievement

Numerous studies have shown that students with higher motivation are more likely to attain better academic outcomes (Covington, 2000; Csikszentmihalyi, Rathunde, & Whalen, 1993; Deci, Vallerand, Pelletier, & Ryan, 1991; Dweck, 2000; Hustinx, Kuyper, van der Werf, & Dijkstra, 2009; Pintrich & De Groot, 1990; Steinmayr & Spinath, 2009). Martin (2009) argued that secondary school students are less likely to be motivated and engaged when compared to elementary school and college students. Less motivated students are more likely to show poor academic achievement and therefore have a greater likelihood of dropping out between grades 10 and 12 (Allensworth & Easton, 2007; Balfanz, Herzog, & Mac Iver, 2007; Neild, Balfanz, & Herzog, 2007; Rumberger & Lim, 2008). Furthermore, Heckman and Rubinstein (2001), who examined students with General Education Degrees (GEDs), found that, even though GED

recipients had higher average ability than other high-school drop outs, GED recipients demonstrated poor persistence and an inability to plan ahead when compared with peers who had not dropped out of high school. One possible explanation of relationships between motivation and academic achievement is that students who are highly motivated academically choose more stimulating learning environments where they develop better academic skills (Shiner, 2000).

Not all studies support the importance of motivation in the prediction of achievement. For example, Gagné and St Pére (2001) studied female 8th graders in an all-girl high school and found motivation did not predict academic achievement after controlling for students' cognitive ability. Critics of the study suggested that the failure of observe effects for motivation reflected a restricted range of motivation in the sample, the use of an instrument lacking construct validity, a domain-unspecific measure, or a short-term study design (Hustinx et al., 2009; Steinmayr & Spinath, 2009).

Bandura (1997) described how the perceived causes of success and failure influence an individual's anticipatory cognitive motivators which, in turn, affect performance. There may be sex differences in the types of attributions students make. For example, Assouline and her colleagues found that female gifted students were more likely to attribute general school academic success to long-term effort, whereas male gifted students were more likely to attribute success to ability (Assouline, Colangelo, Ihrig, & Forstadt, 2006).

Social control and academic achievement

Students with better social skills and more involvement in extracurricular activities have better academic achievement, and earn higher salaries in their chosen field (Fredricks, Blumenfeld, & Paris, 2004; Lleras, 2008). Dropouts show less engagement with school activities and tend to have estranged relationships with teachers and peers (Renzulli & Park, 2000; Rumberger & Lim, 2008). On the other hand, students who have

strong relationships with teachers and peers are more likely to attend class (Allensworth & Easton, 2007). Also, students perform better in safer schools (Creemers, 1994; Gronna & Chin-Chance, 1999).

In addition to school environment, family plays an important role in students' learning. When students perceive support from parents, they tend to adjust better during the transition between middle school and high school (Isakson & Jarvis, 1999). Meta-analytic studies show that parent involvement, especially parental aspirations and expectations for education, predict academic achievement (Fan & Chen, 2001; Hill & Tyson, 2009). Also, Eamon (2005) argued that differential parenting practices might lead to the sex differences in achievement. Specifically, female students might receive more rules or supervision from parents, and, in turn, perform better in school. In sum, social control -- including relationships with school personnel, school safety, and family engagement in school learning -- is a significant predictor of later academic achievement.

Self-regulation and academic achievement

Self-regulation of behavior and emotion correlates significantly with academic achievement in middle school students. Antisocial behaviors and failures to regulate their emotions are related to poor academic achievement (Fredricks et al., 2004; Gumora & Arsenio, 2002; Wentzel, 1993). Similarly, Finn and Rock (1997) examined a large sample of minority, low-income students in grades 8 to 12. They found that better students were less likely to engage in disruptive behaviors. These findings are consistent with other developmental studies, which describe cascading effects of students' aggressive or disruptive behavior, emotions, and academic achievement (Masten et al., 2005; Moilanen, Shaw, & Maxwell, 2010). Along these lines, students who display behavior problems in childhood are more likely to have lower academic achievement in secondary school and have a higher likelihood of showing emotional problems in young adulthood (Masten et al., 2005). Male students are especially likely to demonstrate

disruptive behaviors (e.g., Cohn & Modecki, 2007; Zimmer-Gembeck, Geiger & Crick, 2005). Some studies also show that emotional problems, such as anger, sadness, or depression, are mildly related to poor academic achievement in 7th and 8th grades (e.g., Fredricks et al., 2004; Roeser, Eccles, & Sameroff, 2000). On the other hand, studies show that students who could regulate impulsive behaviors were more likely to have better academic achievement (Duckworth & Seligman, 2005; Hair & Hampson, 2006; Spinella & Miley, 2003).

Although many studies show linear relationships between self-regulation and academic achievement (e.g., Duckworth & Seligman, 2005; Gumora & Arsenio, 2002; Wentzel, 1993; Wolfe & Johnson, 1995), Robbins et al. (2006) found a curvilinear relationship between emotion regulation and GPA in college students. That is, too high or too low emotion regulation was associated with poor GPA in the freshman year of college.

The interplay of PSFs and academic achievement

Snow, Corno, and Jackson (1996) argued that affective (e.g., emotion), conative (e.g., motivation), and cognitive individual differences should be considered simultaneously when predicting students' scholastic performance. Some current studies attempt to use comprehensive assessment models that include a broader sampling of these constructs when investigating the incremental validity of PSFs at the K-12 level and beyond (e.g., Allen, Robbins, & Sawyer, 2010; Casillas et al., in press; Kyllonen et al., 2005; Lee & Shute, 2010; Robbins et al., 2006). For example, Robbins and his colleagues examined college students' PSFs using an assessment model that included motivational, social control, and self-regulatory factors (Le et al., 2005; Robbins et al., 2004). They argued that academic discipline, social activity, and emotional control show incremental power beyond prior academic achievement in predicting first-year college academic performance (Robbins et al., 2006). Also, social control has been identified a strong

predictor of college retention (Robbins et al., 2009). Along similar lines, Kyllonen and his colleagues reviewed past studies and proposed a theoretical model that combines personality, attitude, and quasi-cognitive factors to predict graduate students' attrition and time to degree (Kyllonen et al., 2005). In their research on middle school students, Lounsbury et al. (2003) studied 220 7th graders and 290 10th graders, and they found that aggression and work drive together explained 18% and 21% of the variance in 7th grade and 10th grade GPA respectively. Also, all Big Five personality traits (i.e., agreeableness, conscientiousness, emotional stability, extraversion, and openness) as a set contributed an additional 5% of the variance in the prediction of 7th grade GPA beyond aggression and work drive. Similarly, using the dominance analysis technique, Casillas et al. (under review) found that PSFs demonstrated 19% relative predictive strength in comparison with personal variables, school variables, and past academic achievement when predicting early high school GPA.

Past findings have shown that certain PSFs can predict academic achievement. For example, DiPerna, Volpe, and Elliott (2002, 2005) found that previous achievement had a direct effect on motivation which, in turn, had an indirect effect on later achievement. Dotterer, Hoffman, Crouter, and McHale (2008) found parent-adolescent conflict predicted later achievement, and vice versa. Maughan, Rowe, Loeber, and Stouthamer-Loeber (2003) argued that reading problems can influence depressed mood. In summary, to some extent, academic achievement may directly influence various PSFs.

PSFs, school-level effects, and academic achievement

Some studies of secondary school students have found relationships between school-level factors such as school climate (e.g., academic emphasis, teacher variables, principal leadership), school characteristics (e.g., class size, percentage of minority students), and students' academic achievement (Finn, Pannozzo, & Achilles, 2003; Hoy, Sweetland, & Smith, 2002; Lee & Shute, 2010), whereas other studies show little or no

relationship between school-level factors and achievement outcomes after first controlling for prior academic achievement (Allen, Bassiri, & Noble, 2009; Shapson, Wright, Eason, & Fitzgerald, 1980). In addition to studying relationships between school-level factors and academic achievement, studies show school-level factors may or may not affect students PSFs (ACT, 2009; Finn & Voelkl, 1993; Weishew & Peng, 1993). For example, some studies show that smaller class size and lower percentages of minority students are positively related to high levels of students' engagement (Finn & Voelkl, 1993). However, other studies argue that class size, percentage of minority students and free/reduced lunch recipients, and student-teacher ratio are generally unrelated to PSFs (ACT, 2009, Glovinsky-Fahsholtz, 1992; Weishew & Peng, 1993).

The Matthew effect? Individual Differences in Predicting Academic Achievement

The Matthew effect has been found in various educational treatments and programs when predicting academic achievement (Ceci & Papierno, 2005; Walberg & Tsai, 1983). It refers to a phenomenon that the rich get richer, and the poor get poorer. In many areas of life, the greatest rewards are reaped by the individuals with a higher accumulation of resources (Frank & Cook, 1995). Gottfredson (in press) described that individuals with high general cognitive ability are more likely to attain a higher education level, a job with better prestige, a better income, and generally speaking, have a higher social class and health outcomes than individuals with lower levels of intelligence. Furthermore, high general cognitive ability seems to predict not only better job performance (Gottfredson, 2002; Schmidt & Hunter, 2004) but also higher quality of life (Gottfredson, 1997). For example, in a large-sample longitudinal study, Judge, Klinger, and Simon (2010) found individuals with higher general mental abilities attain higher incomes and occupational prestige after graduation. In addition, they found that these more able individuals demonstrate increased growth in income and occupational prestige

by raising levels of education, training, and job complexity when comparing less able individuals (Judge et al., 2010). Put differently, more-able individuals increase their human capital and benefit more from external resources than less-able individuals.

Although the vast majority of educational research examines means and correlations, the variability of scores often increases over time. Increases in variance have been found in several studies of interventions and school characteristics (e.g., Ceci & Papierno, 2005; Konstantopoulos, 2008; Stanovich, 1986; Walberg & Tsai, 1983). For example, a large-sample longitudinal study using the National Assessment of Educational Progress (NAEP) found that prior educational background, current educative experience and motivation are collinear. Each variable individually and all three together significantly predict academic achievement. However, the advantages of these three factors in predicting achievement are cumulative. For instance, students who have advantages in prior educational background are more likely to have better current educative experience and motivation. In addition, the cumulative advantages of these three factors significantly predict academic achievement. Therefore, the achievement gap often increases over time when comparing students from different educational backgrounds (Walberg & Tsai, 1983).

Similarly, Borkowski and Peck (1986) found that when young gifted and non-gifted children concurrently received the same cognitive strategy training, the achievement gap significantly increased comparing the differences between the beginning and the end of the training program. Thus, when giving the same educational resources (e.g., instruction or learning environment) to all children, more able children often benefit more than less able children, and consequently the achievement gap between these two child groups increases across time (Borkowski & Peck, 1986; Ceci & Papierno, 2005). Although middle school students are not directly represented in these studies, it seems reasonable to hypothesize that high ability or high achieving middle

school students may gain more over time in achievement from particular PSFs, including motivation, social control, and self-regulation, than low ability or low achieving students.

Research Questions and Hypotheses

Preliminary Questions

Do school-level factors such as the percentage of free/reduced lunch recipients and minority students predict students' later academic achievement along with initial academic achievement and PSFs?

Primary Questions

1. Do male and female 8th graders differ on PSF characteristics?

    1a. Hypothesis: Female students outperform male students on motivation.

    1b. Hypothesis: Female students outperform male students on social control.

    1c. Hypothesis: Female students outperform male students on self-regulation.

2. Do students' PSFs moderate sex and initial academic achievement in the prediction of later achievement?

    2a. Hypothesis: Students' motivation significantly interacts with sex and 8th grade achievement to predict 10th grade achievement. Further, the 10th grade academic achievement gap increases between more and less able students because of differences in motivation.

    2b. Hypothesis: Students' social control significantly interacts with sex and 8th grade achievement to predict 10th grade achievement. Further, the 10th grade academic achievement gap increases between more and less able students because of differences in social control.

    2c. Hypothesis: Students' self-regulation significantly interacts with sex and 8th grade achievement to predict 10th grade achievement. Further, the 10th grade

academic achievement gap increases between more and less able students because of differences in self-regulation.

CHAPTER 3

METHODS

Secondary analyses of existing datasets are one of the most promising directions for contemporary educational research (Smith, 2008). The data provided by another reliable source is particularly important for longitudinal studies, given the difficulty of collecting data on a large sample over several years (Glaser, 1963; Smith, 2008). Several studies have examined the effects of both PSFs and academic achievement using existing longitudinal or large-scale assessment datasets with large sample sizes in K-12, such as the National Educational Longitudinal Study of 1988 (Finn & Rock, 1997; Lee & Shute, 2010). The outcomes of these studies are often more generalizable than outcomes of studies with small sample sizes because of the size and representativeness of the samples and because the statistical methods are sufficient to model causal relationships among multiple variables. One disadvantage of using these existing data collected from the government or other parties is that the research questions or PSF constructs are often limited to simple survey items, which may not be specifically developed to assess the full range of students' PSFs. However, this concern is not present in all databases.

The ACT database used in this study was designed for the purpose of measuring students' PSFs as part of the development of the Student Readiness Inventory-Middle School (SRI-MS; ACT, 2009). Data were collected during the spring and fall of 2006. The middle schools invited to participate in the development of the SRI-MS had to meet three criteria: (1) the student body had to be demographically diverse and consist of multiple levels of academic achievement, (2) the school had to use ACT's EXPLORE test, and (3) the district had to be able to provide follow-up data for students as they both entered into and progressed through high school.[1]

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1 Characteristics of the original sample were: A total of 4,660 7th and 8th grade students (Mean age = 13.48, SD = .69; Male = 51.4%; White = 61.9%; 8th grade = 85.8%) from 24 middle schools in eight states throughout the Eastern, Midwestern, and Southern United States.

Sample and Procedures

Of the 4,660 middle school students in the original study, 1,384 8th grade students were included in this study based on three criteria: (1) students took both SRI-MS and assessments of 8th and 10th grade academic achievement (EXPLORE and PLAN, respectively) in the fall of 2006 and the fall of 2008, (2) students' responses were not flagged due to insufficient item response variability or inconsistency in the SRI-MS, and (3) students had no more than 40% missing responses in each scale of the SRI-MS. It is assumed that students with a response rate of less than 60% on each scale were less motivated or had other reasons for their reduced response rate that could impact the value of their contributions (e.g., fatigue, negative emotions, etc.). Therefore, student's scores on any variable with more than 40% incomplete data were excluded. The selected students were from 18 middle schools in six states, including Arkansas, Illinois, Kentucky, Louisiana, Texas, and West Virginia. Approximately half were female (50.7%) and predominantly Caucasian (73.7%), with the remaining ethnic/racial breakdown being: 12.8% Hispanic/Latino, 7.2% African American, 1.8% Multiracial, .9% American Indian/Alaskan Native, .7% Asian American/Pacific Islander, and 2.8% of another race/ethnicity or preferred not to respond (see Table 1). Students' mean age at the time of SRI-MS testing was 13.5 years (SD = .6).

Table 1. Demographic Characteristics as a Percentage of the Sample

Characteristic	8th Grade students (%)
Sex	
Male	49.4
Female	50.6
Race/Ethnicity	
African American/Black (non-Hispanic)	7.2
American Indian, Alaskan Native	.9
Caucasian White (non-Hispanic)	73.7
Asian American, Pacific Islander	.7
Hispanic/Latino	12.8
Multiracial	1.8
Other	1.4
Prefer not to respond	1.5
State	
Arkansas	5.1
Illinois	32.9
Kentucky	0.3
Louisiana	49.9
Texas	0.2
West Virginia	11.6

Note. N = 1,384.

Measures

Psychosocial factors

The SRI-MS, a low-stakes, self-report inventory, was developed to identify academically at-risk middle school students. Unlike most questionnaires used in psychological studies, a distinguishing feature of the SRI-MS is that both evidence on the psychometric properties of the questionnaire and norms were developed using large samples. The questionnaire has ten scales: Academic Discipline, Commitment to School, Family Attitude toward Education, Family Involvement, Managing Feelings, Optimism, Orderly Conduct, Relationships with School Personnel, School Safety Climate, and Thinking before Acting. Scale definitions are shown in Table 2. Nine scales contain 6-point Likert-type items (1 = *Disagree a Lot* and 6 = *Agree a Lot*); one scale (Orderly Conduct) uses a binary response format (1 = *Yes* and 0 = *No*). The questionnaire also asks for information on students' demographic and biographical characteristics.

The SRI-MS was administered to the students in a group setting during class time. Participating students were asked voluntarily to fill out the questionnaire, which took approximately 30 minutes. Selected schools were given school-level summaries of their students' results as an incentive to participate.

After removing students who responded carelessly to items or had more than 40% missing responses in any SRI-MS scale, a second-order confirmatory factor analysis (CFA) of the questionnaire items was implemented using Mplus 5.21 (Muthén & Muthén, 2007) to validate the PSF structure of the questionnaire. An item parceling technique was used to obtain more normally distributed indicators. Parcels were formed by systematically grouping approximately every third item in each score scale (Bandalos, 2002; Bandalos & Finney, 2001; Little, Cunningham, & Shahar, 2002).

Table 2. SRI-MS Scales and Definitions

Scale	Definition
Academic Discipline	Degree to which a student is hardworking and conscientious as evidenced by the amount of effort invested into completing schoolwork.
Commitment to School	Commitment to stay in high school and obtain a diploma.
Optimism	Having a hopeful outlook about the future in spite of difficulties or challenges.
Family Attitude toward Education	Positive family attitude regarding the value of education.
Family Involvement	Family involvement in a student's school life and activities.
Relationships with School Personnel	The extent to which students relate to school personnel as part of their connection to school.
School Safety Climate	School qualities related to student's perception of security at school.
Managing Feelings	Tendency to manage duration and intensity of negative feelings, and to find appropriate ways to express these feelings.
Orderly Conduct	Tendency to behave appropriately in class and avoid disciplinary action.
Thinking before Acting	Tendency to think about the consequences of one's actions before acting.

Note. ACT, Inc. (2009). *Student Readiness Inventory middle school user's guide.* Iowa City, IA: Author.

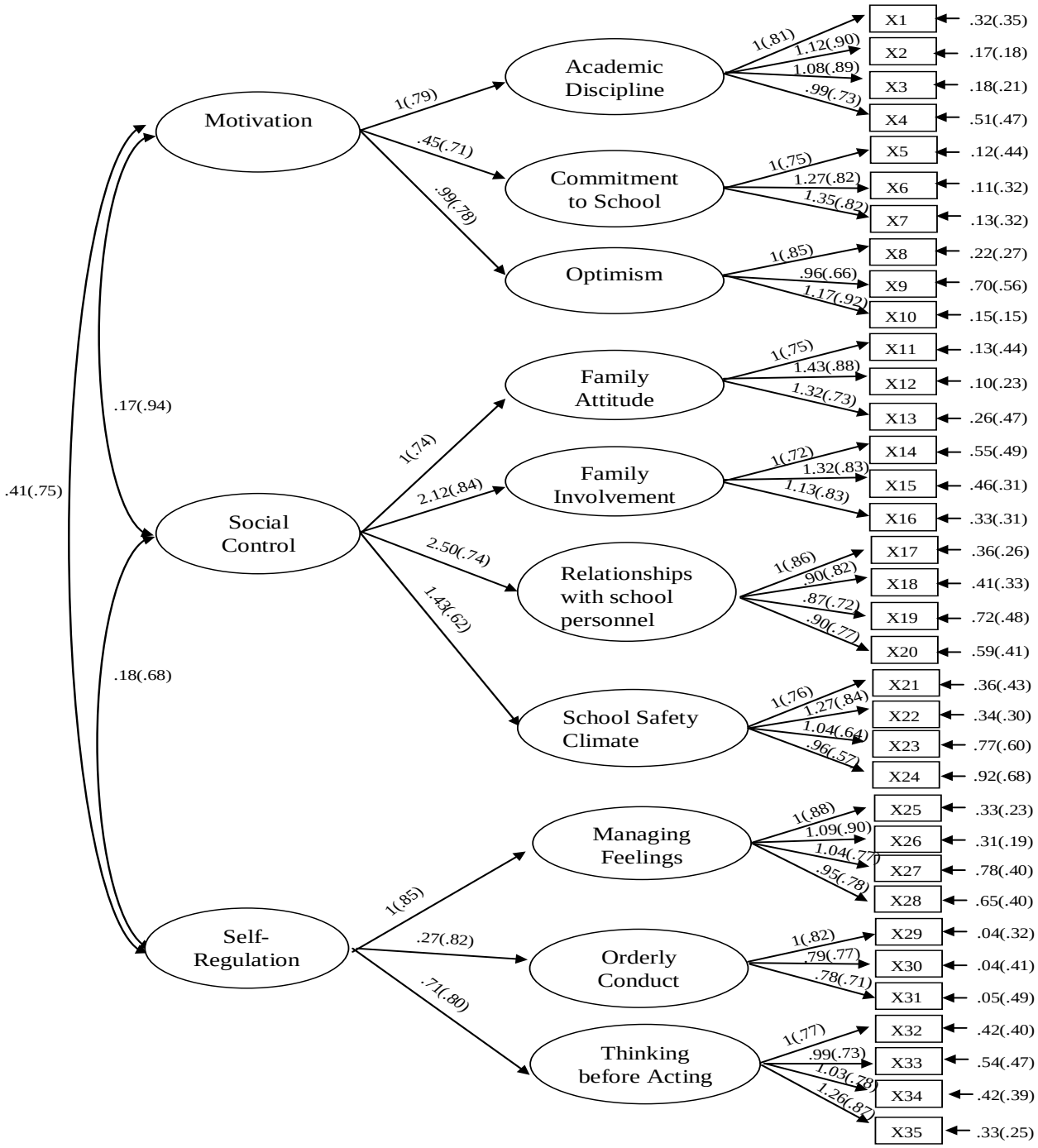
These parcels served as the indicators for each scale, which formed three higher-level, latent PSFs. The latent PSFs in the factor analyses were named Motivation (consisting of Academic Discipline, Commitment to School, and Optimism), Social Control (consisting of Family Attitude toward Education and Family Involvement, Relationships with School Personnel, and School Safety Climate), and Self-regulation (consisting of Managing Feelings, Orderly Conduct, and Thinking before Acting). Factors were estimated using maximum likelihood after first imposing unit loading identification constraint. Several fit indices such as the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean

square residual (SRMR) were examined (Hu & Bentler, 1999). Given 2,694 out of the original dataset of 4,660 students met both above mentioned criteria and were used to validate this structure, this hypothesized multi-level CFA model fit well (χ^2 = 5354.20, *df* = 547, *CFI* = .92, *RMSEA* = .057 [.056 - .059], *SRMR* = .065) (see Figure 1). Synthesizing theoretical and empirical evidence, it is concluded that ten SRI-MS scales could be adequately summarized by these three higher-order latent PSFs.

Therefore, instead of facet-level analyses using the ten original scales from the SRI-MS, the following three PSFs were used in all analyses in this study: motivation, social control, and self-regulation. *Motivation* refers to the degree to which students are conscientious, committed to obtain a high school diploma, and optimistic about their future regardless of difficulties and challenges. *Social Control* refers to the degree to which students perceive their family's engagement in school life and activities, particularly in their attitude toward the value of education and involvement with school activities, as well as students' perceptions of their relationships with school staff and of school safety. *Self-regulation* refers to students' tendency to regulate and express their emotions, behaviors, and thoughts in an appropriate manner.

Academic achievement factors

The students' EXPLORE and PLAN Composite scores were used in the present study. Although using composite scores eliminates the ability to explore relationships for particular subject areas, composite scores provide an overall perspective on academic achievement (e.g., Crone, Lang, Franklin, & Halbrook, 1994). To that end, student's EXPLORE Composite scores were used as an independent variable and PLAN Composite scores were used as a dependent variable. EXPLORE and PLAN are nation-wide testing programs developed for assessing academic achievement at the 8th- and 10th-grade levels, respectively (ACT, 2007a, 2007b; see Table 3). Both test programs include four multiple-choice tests: English, Mathematics, Reading, and Science. Scale scores for



Note. Standardized coefficients are reported in parentheses

Figure 1. The second-order CFA model for PSFs of SRI-MS scales.

the EXPLORE and PLAN tests have been calibrated to the same scale. This means “the EXPLORE test score obtained by an examinee can be interpreted as approximately the PLAN test score the examinee would obtain if that examinee had taken PLAN at the time of the EXPLORE testing” (ACT, 2007a, p. 22). Composite scores for EXPLORE and PLAN, which are the average scale scores across the four subject tests, were used as proxies for students’ general academic achievement. The observed and disattenuated correlations between composite scale scores of these two programs are .84 and .89 respectively (ACT, 2007a, 2007b). The internal consistency reliabilities (KR-20) for EXPLORE and PLAN are both .94 for the national standardization sample.

School-level factors

School-level factors such as the percentage of minority students and free/reduced lunch recipients were used as institutional variables. Other studies using this dataset have found that scores on SRI-MS scales and these two school-level factors are generally unrelated (ACT, 2009; Casillas et al., in press). In this study, the school-level effects in predicting students’ later academic achievement along with PSFs were examined based on these two school factors in the preliminary analyses.

Missing Data Treatments

Using the appropriate missing data treatments could improve the accuracy of estimation and minimize unexpected statistical errors. Given the limitations of traditional treatments (e.g., listwise deletion, mean substitution methods, regression-based single imputation), the Expectation Maximization (EM) algorithm for maximum likelihood (ML) estimation was conducted to create a completed dataset in further analyses (Schlomer, Bauman, & Card, 2010; Yuan, 2000).

Given the assumption of item multivariate normality for imputing data for ML approaches, Mardia's multivariate normality test was applied to items within each scale (Mardia, 1974). Preliminary results showed that the normality assumption was violated in

Table 3. Components and Internal Consistency Reliability of EXPLORE and PLAN

	EXPLORE			PLAN		
	KR-20	Total items	Testing time (min.)	KR-20	Total items	Testing time (min.)
English	.85	40	30	.86	50	30
Mathematics	.82	30	30	.81	40	40
Reading	.83	30	30	.80	25	20
Science	.77	28	30	.83	30	25
Composite	.94			.94		

Note. ACT, Inc. (2007a). *EXPLORE technical manual.* Iowa City, IA: Author.

ACT, Inc. (2007b). *PLAN technical manual.* Iowa City, IA: Author.

this dataset. However, studies have shown that the EM method is robust when the assumption of normality is violated and can still perform well for imputing data (Graham & Schafer, 1999; Schafer, 1997; Yuan, 2000).

When imputing missing data using the EM algorithm, the seed was set as 12345 in SAS PROC MI statements for controlling characteristics of replicating this study. Although different suggestions have been offered for rounding imputed data, unrounded imputed data were used in this study to avoid unnecessary minor statistical errors (Ake, 2005; Graham, 2009; Schafer, 1997). Finally, given the above assumption of 40% or fewer items missing in each SRI-MS scale per student, the full dataset of 1,384 8th grade students was utilized through the EM algorithm for further analyses. Specifically, the missing data were imputed for all items based on each SRI-MS scale, except for students with more than 40% missing in any SRI-MS scales.

Analyses

Analyses for Preliminary Research Questions

Scale scores transformation

Given unequal item numbers and different item formats of SRI-MS scales, all the raw mean scale scores were linearly transformed to new scale scores ranging from 10 to 60 for analyses. For example, Academic Discipline scale scores range from 11 to 66 (11 items); Thinking Before Acting scale scores range from 12 to 72 (12 items); Orderly Conduct scale sores range from 0 to 9 (9 items). Then, once the raw mean scale scores were calculated, the following two equations were used to transform these scores to the new scale scores ranging from 10 - 60 for the 6-point Likert-type and the binary scales, respectively.

Y = MEAN*10 (for 6-point Likert-type scales)

Y = MEAN*50 + 10 (for the binary scale)

After obtaining SRI-MS scale scores on the common score range, the unit weights method was applied to summing these transformed scale scores as aggregate scores for three PSFs: motivation, social control, and self-regulation (Bobko, Roth, & Buster, 2007; Bobko & Schemmer, 1980). Specifically, motivation is the average of Academic Discipline, Commitment to School, and Optimism. Social Control is the average of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average of Managing Feelings, Orderly Conduct, and Thinking before Acting. As Aiken and West (1991) suggested, these aggregate scores then were transformed to z-scores. Consequently, these standardized scores for three PSFs were used in the following serial analyses. Similarly, the students' EXPLORE and PLAN Composite scores were standardized as z-scores for analyses.

Predictivity of school-level factors

A preliminary analysis was performed using the random intercept model to test if school-level factors, including the percentage of free/reduced lunch recipients and minority students, significantly predicted PLAN scores. This model examined PSFs one at a time. The PROC MIXED function in SAS was used to test models.

$$Y_{ij} = \beta_{00} + \beta_{10} X_{1i} + \beta_{20} X_{2i} + \beta_{30} X_{3i} + \beta_{01} X_{4ij} + \beta_{02} X_{5ij} + U_j + e_{ij}$$

β_{00} is the intercept for the average group.

β_{10} is regression coefficient for the achievement variable (standardized EXPLORE scores, X_{1i}).

β_{20} is regression coefficient for a particular PSF variable.

β_{30} is regression coefficient for the interaction term (X_{3i}) between achievement (standardized EXPLORE scores) and the PSF factor.

β_{01} and β_{02} are regression coefficients for school-level variables.

U_j is an unobserved school effect. $U_j \sim N(0, \tau^2)$.

e_{ij} is an unobserved school effect. $e_{ij} \sim N(0, \sigma^2)$.

Analyses for Primary Research Questions

Step 1: Conduct t-test and estimate effect size to examine sex differences

Sex differences between male and female 8th graders were conducted using independent-sample Student's t-tests for each PSF. The effect size (Cohen's d) was also estimated (Cohen, 1988). According to Cohen's benchmarks (Cohen, 1988), effect sizes of .2, .5, and .8 are labeled "small", "medium", and "large" effect, respectively.

Step 2: Prepare data for multiple regression analyses

The relationships of each aggregate PSF and PLAN Composite scores were examined. First, the data were plotted to visually inspect relationships between each PSF and PLAN Composite score and to check for homoscedasticity and outliers. The significance of the R^2 increments in the polynomial regression were also tested. After

considering theoretical and empirical evidence, it was determined that motivation and social control were linearly related with PLAN Composite scores. The curvilinear relationship between self-regulation and PLAN Composite scores was found. Also, the standardized PSF scores, which were three standard deviations below the mean for each PSF, were considered as outliers and removed for further analyses. As a result, 1.45%, .65%, and .07% of all students in motivation, social control, and self-regulation were removed.

Step 3: Conduct multiple regression analyses through constructed models

Linear regression models were run to test the hypotheses that motivation and social control moderate sex and initial academic achievement in the prediction of later achievement (see Model 1). A curvilinear multiple regression model also was run to test the research hypothesis that self-regulation moderates the effects of sex and initial academic achievement on the prediction of later achievement (see Model 2). The incremental validity to the prediction of PLAN Composite scores beyond the variance accounted for by each PSF was also examined through hierarchical multiple regression analyses, which is "probably the most common analytic for quantifying the incremental contributions" (McFall, 2005, p. 320). Specifically, the relationship between EXPLORE and PLAN Composite scores as moderated by sex were first examined. In order to answer the hypotheses 2a, 2b, and 2c, the regression models with three-way interaction terms (i.e., Model 1 and Model 2) were implemented. In a regression equation with interaction terms, the multiplicative terms are the product term of standardized variables (i.e., $Z_{x_1}Z_{x_2}$), rather than the standardized product term of unstandardized variables (i.e., $Z_{x_1x_2}$) (Aiken & West, 1991; Friedrich, 1982). The increment in R-squared was used to measure the amount of variance in the PLAN Composite score that was explained by the constructed model. Also, the increment in R-squared was used to assess the effects of incremental validity of the PSF beyond sex and prior academic achievement, given

Cohen's (1988) benchmarks (small effect R^2 = .03, medium effect R^2 = .10, large effect R^2 = .30).

Model 1

Let Y = PLAN Composite, Z_1 = SEX, Z_2 = EXPLORE Composite, X_i = PSF variables (i=1, motivation; i = 2, social control). PSF variables were tested one at a time.

$$Y = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 X_i + \beta_4 Z_1 Z_2 + \beta_5 Z_1 X_i + \beta_6 Z_2 X_i + \beta_7 Z_1 Z_2 X_i + \varepsilon$$

Model 2

Let Y = PLAN Composite, Z_1 = SEX, Z_2 = EXPLORE Composite, X = self-regulation.

$$Y = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 X + \beta_4 X^2 + \beta_5 Z_1 Z_2 + \beta_6 Z_1 X + \beta_7 Z_1 X^2 + \beta_8 Z_2 X + \beta_9 Z_2 X^2 + \beta_{10} Z_1 Z_2 X + \beta_{11} Z_1 Z_2 X^2 + \varepsilon$$

In Model 1 and Model 2, the three-way interaction terms were examined first to study if males and females performed differently on the PLAN test when prior academic achievement and each PSF varied. If the coefficient of three-way interaction term was significant, a post-hoc probing of moderation effects would be conducted through a slope difference test for understanding how males and females with different prior academic achievement levels perform on later achievement when each PSF increases.

<u>Step 3.1: Conduct post hoc probing techniques to examine significant interaction terms</u>

Post hoc probing techniques were used if significant interaction terms were found. For example, to better understand the three-way interaction for sex, EXPLORE scores, and a PSF, the three-dimensional surface plots were created by sex to display the interaction. In addition, a two-dimensional, three-way interaction plots were created to illustrate simple slopes of PLAN Composite on the PSF at high, average, and low EXPLORE Composite scores for both sexes.

In addition to plotting three-way interactions, both a slope test and a slope difference test were applied. Extending the work of Aiken and West (1991), Dawson and

Richter (2006) proposed an advanced slope difference test to probe three-way interactions in moderated multiple regression. They argued that most current post hoc probing techniques applied to examine two-way interactions have statistical limitations. These limitations include creating an artificial split into subgroups, reducing the power of the analysis, and not allowing for a difference test of slopes across subgroups (Dawson & Richter, 2006). Therefore, in this study, when a significant three-way interaction term was found, Dawson and Richter's method was used to test slope differences. The Bonferroni correction was used to maintain a family-wise alpha level through multiple slope difference tests (Miller, 1981).

Step 3.2: Conduct mediation analysis and estimate mediation effect if no interaction terms were found

The psychosocial mediation model was designed to examine the mediation effects of PSFs if no interaction terms were found. In accordance with MacKinnon (2008) and Fairchild, MacKinnon, Taborga, and Taylor (2009), the mediation models and the formula to estimate mediation effect size (R^2_{med}) are given below.

Let Y = PLAN score, Z = EXPLORE score, Xi = PSF variables (i=1, motivation; i = 2, social control; i = 3, self-regulation). PSF variables were tested one at a time.

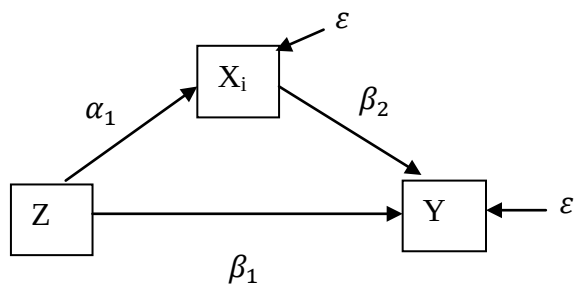


Figure 2. Psychosocial Mediation Model

$X_i = \beta_{0i} + \alpha_1 Z + \varepsilon$

$Y = \beta_0 + \beta_1 Z + \beta_2 X_i + \varepsilon$

The mediation effect = $\hat{\alpha}_1 \hat{\beta}_2$

$R^2_{med} = r^2_{XY} - (R^2_{Y,XZ} - r^2_{ZY})$

CHAPTER 4

RESULTS

Findings of Preliminary Studies

The purpose of the preliminary analyses was to provide basic psychometric evidence on the ten SRI-MS scales, three constructed PSFs (i.e., motivation, social control, and self-regulation), and the relationships of these variables with academic achievement and school-level factors. Specifically, descriptive statistics, internal consistency reliabilities, correlations among scales, PSFs and academic achievement were computed. Also, the effects of school-level factors in predicting later achievement were examined.

Tables 4, 5, and 6 present descriptive statistics for the SRI-MS scales, PSFs, and achievement test scores for males, females and all students, respectively. In general, 8th grade students showed a high tendency to remain Committed to School and a somewhat lower tendency to Think before Acting (range M = 38.91 to 57.27, median M = 47.44). Students' responses were more diverse on the Orderly Conduct scale (SD = 12.99), and less diverse on the Commitment to School scale (SD = 4.59). Table 7 shows moderate-to-high internal reliabilities for the SRI-MS scales (range Cronbach α = .80 to .90, median Cronbach α = .87) and PSFs (range Cronbach α = .92 to .93, median Cronbach α = .92). Table 8 shows correlations between the SRI-MS scales, PSFs, academic achievement, and school-level factors. The largest correlations between the SRI-MS scales and academic achievement were found for Academic Discipline (r = .25, .23) and Orderly Conduct (r = .23, .22), whereas School safety Climate yielded the weakest associations with academic achievement. Caution must be taken in interpreting relationships between study variables due to accumulated measurement errors. Table 9 presents the range and measures of distribution shape, skewness, and kurtosis of standardized PSFs scores and academic achievement for male, female and all students, respectively.

Effects of School-level Factors

The preliminary research question asked about the effects of school level variables in predicting later achievement after controlling for PSFs and initial academic achievement. This question was addressed by constructing a random intercept model that incorporated school-level factors. Results showed that PLAN scores were not associated with school factors ($\tau^2 = .02$, $p > .05$; $\tau^2 = .01$, $p > .05$; $\tau^2 = .01$, $p > .05$ for motivation, social control, and self-regulation models, respectively). Also, results indicated that school-level factors (both the percentage of free/reduced lunch recipients and minority students) had no significant predictive ability for later achievement, after controlling for other study variables (see Table 10). Thus, it is not necessary to implement further multi-level analyses.

Table 4. Descriptive Statistics of the SRI-MS Scales, PSFs, and Academic Achievement (Male Students)

Variables	*M*	*SD*	*Min*	*Max*	*Skewness*	*Kurtosis*
SRI-MS Scales						
Academic Discipline	48.06	8.42	21	60	-.71	-.15
Commitment to School	56.37	5.38	23	60	-2.37	7.01
Optimism	48.52	8.00	10	60	-1.31	2.91
Family Attitude toward Education	56.05	5.05	26	60	-1.95	5.07
Family Involvement	47.53	8.93	10	60	-.92	.98
Relationships with School Personnel	39.09	9.80	10	60	-.49	.11
School Safety Climate	43.33	8.11	16	59	-.58	-.05
Managing Feelings	36.99	10.33	10	60	-.11	-.43
Orderly Conduct	43.33	13.70	10	60	-.58	-.60
Thinking before Acting	38.18	8.53	10	60	-.28	.22
PSFs						
Motivation	50.98	6.01	24	60	-1.10	1.37
Social Control	46.50	6.11	18.50	58.50	-.71	.53
Self-regulation	39.50	9.25	11.33	58.00	-.36	-.48
Academic Achievement						
EXPLORE Composite	15.17	2.93	6	24	.31	.02
EXPLORE English	14.19	3.90	4	25	.43	-.20
EXPLORE Math	15.32	3.31	3	25	-.30	1.38
EXPLORE Reading	14.17	3.54	7	25	.83	.46
EXPLORE Science	16.37	2.92	4	25	-.08	1.34
PLAN Composite	16.81	3.45	5	30	.64	.56
PLAN English	16.10	4.08	4	29	.23	.04
PLAN Math	17.45	4.22	6	32	.77	1.07
PLAN Reading	15.74	4.18	1	30	.26	.18
PLAN Science	17.51	3.59	1	30	.51	2.26

Note. N = 683. *M* = Mean; *SD* = Standard Deviation; *Min* = Minimum scale score; *Max* = Maximum scale score. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting. EXPLORE and PLAN Composite scores are the average of their four test scores: English, Math, Reading, and Science, rounded to the nearest whole number, respectively.

Table 5. Descriptive Statistics of the SRI-MS Scales, PSFs, and Academic Achievement (Female students)

Variables	*M*	*SD*	*Min*	*Max*	*Skewness*	*Kurtosis*
SRI-MS Scales						
Academic Discipline	51.23	7.00	17	60	-1.09	1.56
Commitment to School	58.14	3.47	30	60	-3.33	15.30
Optimism	49.95	8.05	11	60	-1.28	2.02
Family Attitude toward Education	56.82	4.70	28	60	-2.32	7.00
Family Involvement	48.73	9.60	11	60	-1.02	.64
Relationships with School Personnel	41.34	9.27	10	59	-.56	.09
School Safety Climate	44.31	7.91	15	60	-.60	.36
Managing Feelings	42.53	10.86	13	60	-.51	-.49
Orderly Conduct	50.05	11.32	10	60	-1.10	.41
Thinking before Acting	39.63	8.87	12	60	-.47	-.08
PSFs						
Motivation	53.10	5.08	23.67	60.00	-1.48	3.66
Social Control	47.80	6.01	23.75	59.25	-.82	.85
Self-regulation	44.07	8.90	17.33	59.33	-.70	-.21
Academic Achievement						
EXPLORE Composite	15.49	2.67	8	24	.34	-.24
EXPLORE English	14.92	3.67	4	25	.40	-.22
EXPLORE Math	15.43	2.87	5	23	-.15	1.04
EXPLORE Reading	14.65	3.34	6	25	.67	.22
EXPLORE Science	16.48	2.55	7	25	.32	1.32
PLAN Composite	17.40	3.12	9	30	.63	.40
PLAN English	17.50	3.90	6	30	.31	.25
PLAN Math	16.92	3.42	5	31	.77	2.32
PLAN Reading	16.77	4.39	4	30	.31	-.24
PLAN Science	17.83	3.01	11	30	.69	.79

Note. N = 701. *M* = Mean; *SD* = Standard Deviation; *Min* = Minimum scale score; *Max* = Maximum scale score. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting. EXPLORE and PLAN Composite scores are the average of their four test scores: English, Math, Reading, and Science, rounded to the nearest whole number, respectively.

Table 6. Descriptive Statistics of the SRI-MS Scales, PSFs**,** and Academic Achievement (All Students)

Variables	*M*	*SD*	*Min*	*Max*	*Skewness*	*Kurtosis*
SRI-MS Scales						
Academic Discipline	49.66	7.89	17	60	-.91	.52
Commitment to School	57.27	4.59	23	60	-2.83	10.33
Optimism	49.24	8.05	10	60	-1.28	2.41
Family Attitude toward Education	56.44	4.89	26	60	-2.12	5.87
Family Involvement	48.14	9.29	10	60	-.96	.75
Relationships with School Personnel	40.23	9.60	10	60	-.53	.11
School Safety Climate	43.83	8.02	15	60	-.59	.15
Managing Feelings	39.80	10.95	10	60	-.26	-.61
Orderly Conduct	46.73	12.99	10	60	-.84	-.19
Thinking before Acting	38.91	8.73	10	60	-.37	.01
PSFs						
Motivation	52.06	5.65	23.67	60.00	-1.28	2.22
Social Control	47.16	6.09	18.50	59.25	-.76	.65
Self-regulation	41.81	9.35	11.33	59.33	-.51	-.44
Academic Achievement						
EXPLORE Composite	15.33	2.81	6	24	.31	-.07
EXPLORE English	14.56	3.80	4	25	.40	-.21
EXPLORE Math	15.38	3.10	3	25	-.25	1.34
EXPLORE Reading	14.42	3.44	6	25	.74	.32
EXPLORE Science	16.42	2.74	4	25	.07	1.42
PLAN Composite	17.11	3.30	5	30	.60	.48
PLAN English	16.81	4.05	4	30	.24	.15
PLAN Math	17.18	3.84	5	32	.82	1.68
PLAN Reading	16.26	4.32	1	30	.30	-.03
PLAN Science	17.67	3.31	1	30	.56	1.88

Note. N = 1,384. *M* = Mean; *SD* = Standard Deviation; *Min* = Minimum scale score; *Max* = Maximum scale score. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting. EXPLORE and PLAN Composite scores are the average of their four test scores: English, Math, Reading, and Science, rounded to the nearest whole number, respectively.

Table 7. Internal Consistency Reliability of the SRI-MS Scales and PSFs

PSFs	Scales	# of items	α-scale	α-factor
Motivation	Academic Discipline	11	.90	.93
	Commitment to School	10	.85	
	Optimism	10	.88	
Social Control	Family Attitude toward Education	10	.84	.92
	Family Involvement	9	.87	
	Relationships with School Personnel	12	.89	
	School Safety Climate	11	.81	
Self-regulation	Managing Feelings	12	.89	.92
	Orderly Conduct[a]	9	.80	
	Thinking before Acting	12	.86	

Note. N = 1,384. All other scales are scored on a six-point, Likert-type scale. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting.

[a] Orderly Conduct is scored on a Y/N scale.

Table 8. Correlations Between SRI-MS Scales, PSFs, Academic Achievement, and School-level Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Academic Discipline	-																
2. Commitment to School	.50	-															
3. Optimism	.51	.51	-														
4. Family Attitude toward Education	.43	.61	.43	-													
5. Family Involvement	.48	.43	.55	.57	-												
6. Relationships with School Personnel	.43	.37	.53	.34	.54	-											
7. School Safety Climate	.30	.26	.41	.25	.31	.53	-										
8. Managing Feelings	.50	.28	.41	.24	.41	.45	.40	-									
9. Orderly Conduct	.53	.22	.28	.21	.28	.34	.34	.64	-								
10. Thinking before Acting	.56	.30	.45	.27	.39	.39	.32	.63	.53	-							
11. PSF-Motivation	.84	.75	.85	.57	.60	.55	.40	.50	.44	.55	-						
12. PSF-Social Control	.53	.52	.64	.63	.81	.84	.70	.51	.40	.46	.69	-					
13. PSF-Self-regulation	.61	.30	.43	.28	.41	.46	.41	.88	.88	.80	.57	.53	-				
14. EXPLORE Composite	.25	.19	.13	.19	.13	.14	.10	.16	.23	.16	.23	.17	.22	-			
15. PLAN Composite	.23	.14	.10	.18	.14	.14	.10	.19	.22	.15	.20	.18	.22	.80	-		
16. Percent Minority in School	-.08	-.01[a]	-.06	.02[a]	-.09	-.06	-.09	-.08	-.08	.05	-.07	-.08	-.05[a]	-.11	-.15	-	
17. Percent F/R Lunch in School	-.05[a]	.02[a]	.00[a]	.01[a]	-.05[a]	.-05[a]	-.02[a]	-.09	-.07	.02[a]	-.02[a]	-.04[a]	-.06	-.16	-.19	.61	-

Note. N = 1,384. All correlations are significant ($p < .05$). Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting. EXPLORE and PLAN Composite scores are the average of their four test scores: English, Math, Reading, and Science, rounded to the nearest whole number, respectively.

[a] $p > .05$

Table 9. Standardized Statistics (z scores) of the PSFs and Academic Achievement

Standardized Variables	*Min*	*Max*	*Skewness*	*Kurtosis*
All students (N = 1,384)				
Motivation	-5.02	1.40	-1.28	2.22
Social Control	-4.70	1.98	-.76	.65
Self-regulation	-3.26	1.87	-.51	-.44
EXPLORE Composite	-3.33	3.09	.31	-.07
EXPLORE Math	-4.00	3.11	-.25	1.34
EXPLORE Reading	-2.44	3.07	.74	.32
PLAN Composite	-3.67	3.90	.6	.48
PLAN Math	-3.17	3.86	.82	1.68
PLAN Reading	-3.53	3.18	.3	-.03
Male students (N = 683)				
Motivation	-4.96	1.40	-.19	1.06
Social Control	-4.70	1.86	-.11	1.00
Self-regulation	-3.26	1.73	-.25	.99
EXPLORE Composite	-3.33	3.09	-.06	1.04
PLAN Composite	-3.67	3.90	-.09	1.05
Female students (N = 701)				
Motivation	-5.02	1.40	.19	.90
Social Control	-3.84	1.98	.11	.99
Self-regulation	-2.62	1.87	.24	.95
EXPLORE Composite	-2.61	3.09	.06	.95
PLAN Composite	-2.46	3.90	.09	.95

Note. Min = Minimum scale score; *Max* = Maximum scale score. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting. EXPLORE and PLAN Composite scores are the average of their four test scores: English, Math, Reading, and Science, rounded to the nearest whole number, respectively.

Table 10. Relationships Between Explore Composite Scores, PSFs, and School-level Factors in Predicting PLAN Composite Scores

Parameter	*B*	*SE*	*t*
Motivation			
Intercept, β_{00}	.07	.14	.47
Explore, B_{10}	.79	.02	47.55***
Motivation, B_{20}	.03	.02	1.52
Explore X Motivation, B_{30}	.06	.01	4.00***
% of Free/reduced lunch, β_{01}	-.14	.32	-.44
% or minority, β_{02}	-.14	.18	-.80
Social Control			
Intercept, β_{00}	.08	.13	.62
Explore, B_{10}	.79	.02	47.71***
Social Control, B_{20}	.04	.02	2.46*
Explore X Social Control, B_{30}	.04	.02	2.85**
% of Free/reduced lunch, β_{01}	-.16	.30	-.51
% or minority, β_{02}	-.14	.17	-.84
Self-regulation			
Intercept, β_{00}	.07	.13	.58
Explore, B_{10}	.78	.02	47.16***
Self-regulation, B_{20}	.05	.02	3.32***
Explore X Self-regulation, B_{30}	.06	.02	3.60***
% of Free/reduced lunch, β_{01}	-.14	.29	-.47
% or minority, β_{02}	-.16	.16	-1.00

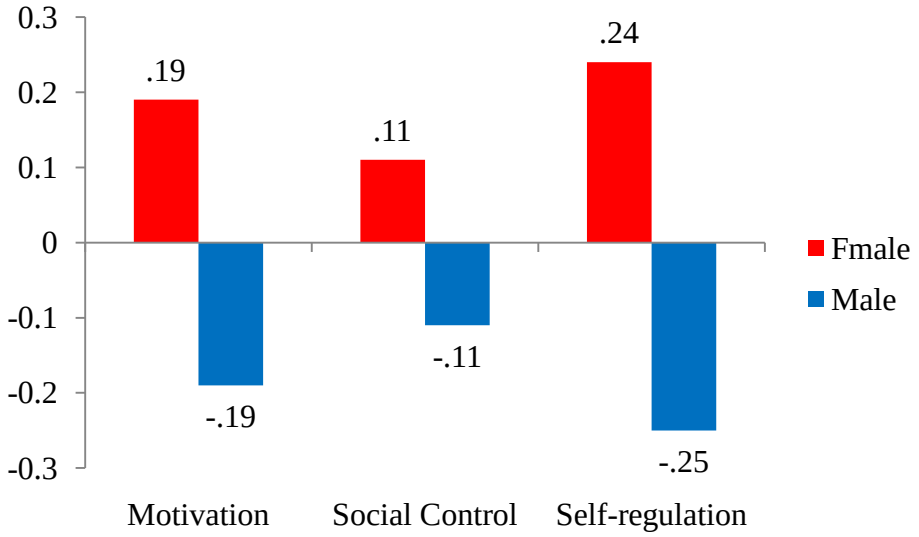
Note. N = 1,384. B = unstandardized regression coefficient; SE = standard error. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting.

* $p < .05$ (two-tailed) ** $p < .01$ (two-tailed) *** $p < .001$ (two-tailed).

Findings of Primary Studies

Sex differences in PSFs

The Primary Question 1 asked if male and female 8th graders differ on PSFs. Hypotheses 1a, 1b, and 1c predicted that females outperform males on motivation, social control, and self-regulation, respectively. In answering the Primary Question 1 and testing the hypotheses, Figure 3 presents means for each PSF. Table 11 presents results of two independent sample t-tests for sex differences on each PSF. In support of the hypotheses, results indicated female students outperformed male students on all three PSFs. Using Cohen's benchmarks (Cohen, 1988), the sex difference effect size was moderate for self-regulation (*d* = .49), and small-to-moderate for both motivation (*d* = .36) and social control (*d* = .21).



Note. All scores are standardized z-scores.

Figure 3. PSF Means by Sexes.

Table 11. PSF Means for Male and Female 8th Graders

PSF	SEX		*t*	*df*	*d*
	Females *n* = 701	Males *n* = 683			
Motivation	.19 (.90)	-.19 (1.06)	7.08***	1332.8	.36
Social Control	.11 (.98)	-.11 (1.00)	3.99***	1382	.21
Self-regulation	.24 (.95)	-.25 (.99)	9.36***	1382	.49

Note. Standard Deviations appear in parentheses below means. *t* = Student t-value; *df* = degree of freedom; *d* = effect size, defined by Cohen (1988). Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting.

*** $p < .001$ (two-tailed).

In answering to the Primary Question 2, multiple regression analyses for each PSF were conducted after removing outliers that were more than three standard deviations below the mean. Table 12 presents the descriptive statistics. The results of analyses examining the relationships between each PSF and PLAN Composite scores are described as follows.

Table 12. Descriptive Statistics of the PSFs After Removing Outliers

PSF	*N*	*M*	*SD*	*Min*	*Max*	*Skewness*	*Kurtosis*
Motivation	1,364	.05	.90	-2.96	1.4	-.85	.28
Social Control	1,375	.02	.96	-2.94	1.98	-.57	-.06
Self-regulation	1,383	0	1.00	-2.94	1.87	-.49	-.48

Note. M = Mean; *SD* = Standard Deviation; *Min* = Minimum scale score; *Max* = Maximum scale score. Motivation is the average aggregate score of Academic Discipline, Commitment to School, and Optimism. Social Control is the average aggregate score of Family Attitude toward Education, Family Involvement, Relationships with School Personnel, and School Safety Climate. Self-regulation is the average aggregate score of Managing Feelings, Orderly Conduct, and Thinking before Acting. A number of participants for each PSF varied due to the missing data.

Motivation and achievement

Table 13 shows results of the analyses examining the relationship between EXPLORE and PLAN Composite scores as moderated by sex for 1,364 8th graders. About 64% of the variation in PLAN Composite scores was accounted for by the combination of sex and EXPLORE Composite scores.

Hypothesis 2a predicted that students' motivation would interact with sex and 8th grade achievement to predict 10th grade achievement. A multiple regression model with a three-way interaction term was implemented to examine the relationship between motivation and PLAN Composite scores as moderated by sex and EXPLORE Composite scores. Table 14 shows that the full model yielded an R-squared of .65. Motivation provided statistically significant increases in variance of PLAN Composite scores beyond sex and EXPLORE Composite scores (ΔR^2 = .005).

Let Z_1=SEX (Male = 0; Female = 1), Z_2= EXPLORE Composite scores, X_1= motivation, the regression equation in Table 14 is:

$$\text{EQ 1: } Y = -.049 + .058Z_1 + .796Z_2 - .004X_1 - .013Z_1Z_2 + .062Z_1X_1 + .008Z_2X_1 + .111Z_1Z_2X_1$$

Table 13. Relationships Between Explore and PLAN Composite Scores as Moderated by SEX (PSF = Motivation)

				95% CI		
Predictor	*B*	*SE*	*t*	*Lower*	*Upper*	R^2
Constant	-.047	.023	-2.04*	-.092	-.002	.639
SEX	.087	.033	2.67**	.022	.152	
EXPcomp	.794	.023	35.11***	.749	.839	
SEX × EXPcomp	.019	.033	.58	-.046	.084	

Note. *N* = 1,364. *B* = unstandardized regression coefficient; *SE* = standard error; CI = confidence interval; *EXPcomp* = EXPLORE Composite scores.

* $p < .05$ (two-tailed) ** $p < .01$ (two-tailed) *** $p < .001$ (two-tailed).

The equation can be rearranged as:

EQ 2: $Y = -.049 + .058Z_1 + .796Z_2 - .013Z_1Z_2 + (-.004 + .062Z_1 + .008Z_2 + .111Z_1Z_2)X_1$

The three-way interaction between sex, EXPLORE Composite score, and motivation was statistically significant (*B* = .111, *p* < .01, 95% CI [.038, .184]). Given this significant interaction effect, Equation 2 can be broken down by sex. Figures 4 and 5 show the three-dimensional surface plot for males and females, respectively, and Figure 6 shows the two-dimensional plot to illustrate how the relationship between motivation and academic achievement (PLAN Composite score) varied by sex and prior academic achievement (EXPLORE Composite score).

The simple slopes and slope difference tests for high- and low-able students in Figure 6 are presented in Table 15. High-able students refer to students whose EXPLORE Composite scores are equal to or greater than a percentile rank of 95 (PR ≥ 95); while low-able students refer to students whose EXPLORE Composite scores are equal to or less than a percentile rank of 5 (PR ≤ 5). Table 16 presents a two-way table that contains

the number of students in each cell with cutoffs on EXPLORE Composite scores and motivation in order to provide a better sense as to the meaningfulness of the findings.

Results showed that the slopes for both high-able and low-able female students were significant. Specifically, when high-able female students' motivation increased, so did 10th grade academic achievement ($t(1363) = 4.47$, $p < .001$). However, low-able female students performed significantly worse on later achievement as their motivation increased ($t(1363) = -2.49$, $p < .05$). There were no differences for high-able or low-able male students when their motivation increased. After comparing the slope differences between high-able female and high-able male groups, results showed that the slope of high-able female students significantly differed from high-able male students ($t(1356) = 3.30$, Bonferroni's $p < .013$). Also, the slope of high- and low-able females were significantly different ($t(1356) = 4.18$, Bonferroni's $p < .013$). That is, as motivation increased, the difference of later achievement increased and the Matthew effect was confirmed for female students.

Table 14. Relationships Between Motivation and PLAN Composite Scores as Moderated by SEX and Explore Composite Scores

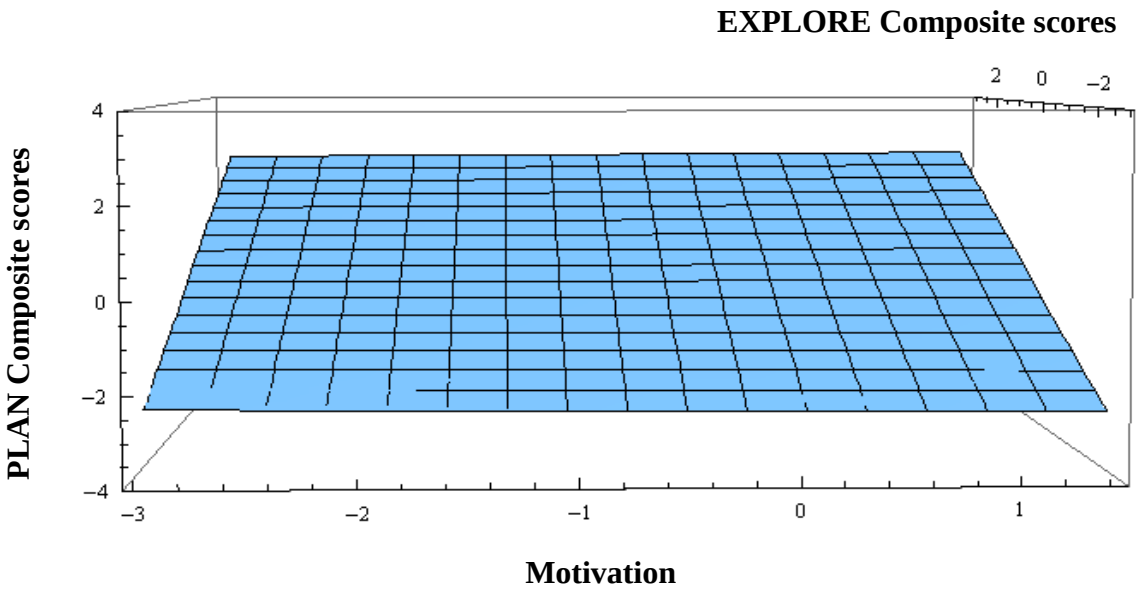
				95% CI		
Predictor	*B*	*SE*	*t*	*Lower*	*Upper*	$R^2(\Delta R^2)$
Constant	-.049	.024	-2.08*	-.096	-.002	.645 (.005***)
SEX	.058	.034	1.73	-.009	.125	
EXPcomp	.796	.023	34.44***	.751	.841	
MOT	-.004	.025	-.17	-.053	.045	
SEX × EXPcomp	-.013	.034	-.39	-.080	.054	
SEX × MOT	.062	.038	1.63	-.013	.137	
EXPcomp × MOT	.008	.024	.32	-.039	.055	
SEX × EXPcomp × MOT	.111	.037	2.98**	.038	.184	

Note. N = 1,364. B = unstandardized regression coefficient; SE = standard error; CI = confidence interval; *EXPcomp* = EXPLORE Composite scores; *MOT* = Motivation; ΔR^2 shows the incremental contribution of motivation beyond sex and EXPLORE Composite scores. Specifically, Step 1 includes SEX, EXPcomp, and SEX × EXPcomp. Step 2 includes SEX, EXPcomp, MOT, SEX × EXPcomp, SEX × MOT, EXPcomp × MOT, and SEX × EXPcomp × MOT. ΔR^2 is the difference between R^2 in Step 1 and Step 2.

* $p < .05$ (two-tailed) ** $p < .01$ (two-tailed) *** $p < .001$ (two-tailed).

Male: Z_1=0

EQ 3: $Y = -.049 + .796Z_2 + (-.004 + .008Z_2)X_1$

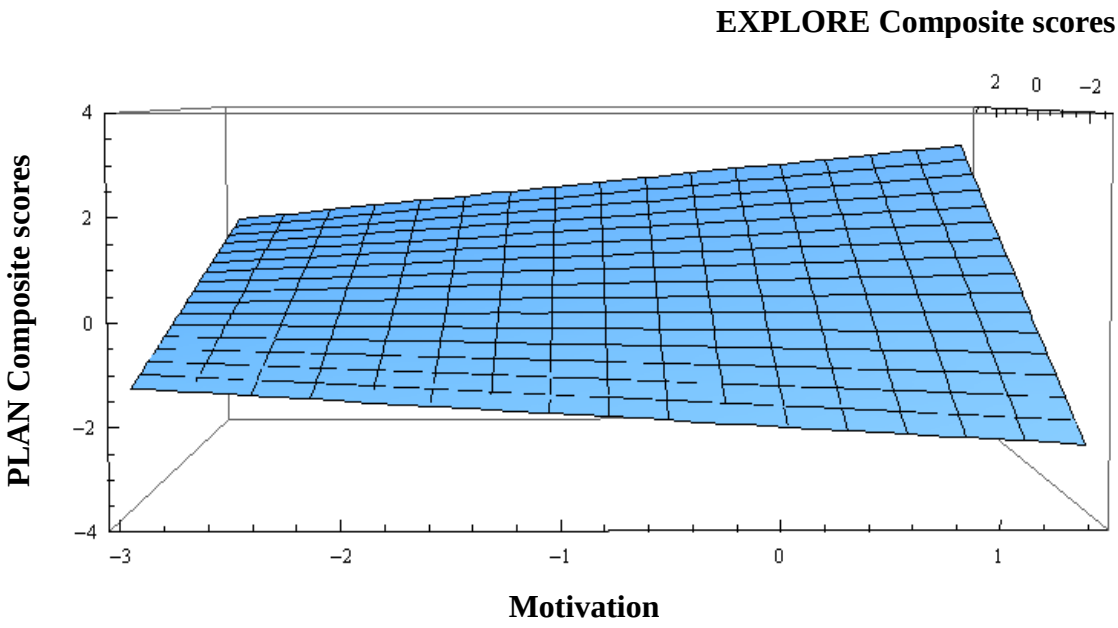


Note. All scores are standardized z-scores.

Figure 4. A three-dimensional surface generated from the regression equation of PLAN Composite scores on EXPLORE Composite scores and motivation for male students.

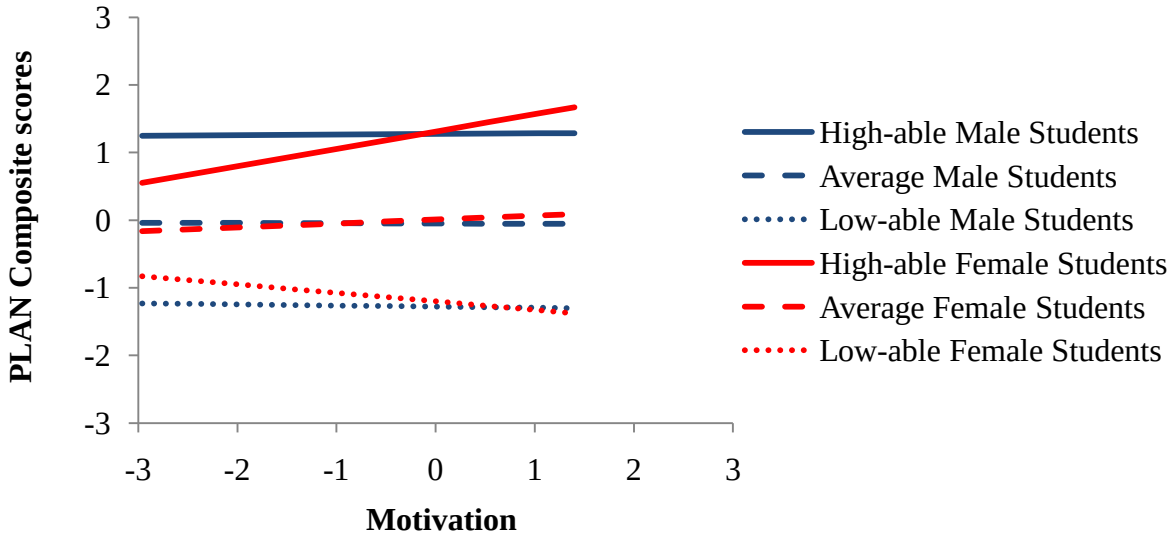
Female: Z_1=1

EQ 4: $Y = .009 + .783Z_2 + (.058 + .119Z_2)X_1$



Note. All scores are standardized z-scores.

Figure 5. A three-dimensional surface generated from the regression equation of PLAN Composite scores on EXPLORE Composite scores and motivation for female students.



Note. Low-able, average, high-able students refer to students whose EXPLORE Composite scores are PR ≤ 5, 5 < PR < 95, and PR ≥ 95, respectively. All scores are standardized z-scores.

Figure 6. Relationships between motivation and PLAN Composite scores at low, average, and high EXPLORE Composite scores and both sexes.

Table 15. Tests of Simple Slopes of PLAN on Motivation

Group	*B*	*SE*	*t*	*p*
1 (Male, High-able students)	.01	.05	.19	.847
2 (Male, Low-able students)	-.02	.04	-.37	.710
3 (Female, High-able students)	.26	.06	4.47	.000
4 (Female, Low-able students)	-.13	.05	-2.49	.013
Slope differences				*Bonferroni's p*
1 and 3	-.25	-.08	3.30	.000
2 and 4	.11	-.07	-1.65	.025
1 and 2	.03	.08	.32	.188
3 and 4	.38	.09	4.18	.000

Note. N = 1,364. *B* = unstandardized regression coefficient; *SE* = standard error. Low-able, average, high-able students refer to students whose EXPLORE Composite scores are PR ≤ 5, 5 < PR < 95, and PR ≥ 95, respectively. Slope difference tests were conducted based on Dawson and Richter's (2006) work. The Bonferroni correction was applied to maintain a family-wise alpha level of .05 through four slope differences tests. That is, a slope difference test is statistically significant when the *p* value is less than .013.

Table 16. The Distribution of Scores on Prior Academic Achievement and Motivation

Prior Academic Achievement	Motivation		
	Low	Average	High
Low	21 (14/7)	59 (38/21)	3 (2/1)
Average	155 (97/58)	871 (403/468)	130 (47/83)
High	11 (8/3)	91 (50/41)	23 (10/13)

Note. N = 1,364. Low-able, average, high-able students on prior academic achievement refer to students whose EXPLORE Composite scores are PR ≤ 5, 5 < PR < 95, and PR ≥ 95, respectively. Low-able, average, high-able students on motivation refer to students whose motivation scores are equal or less than one standard deviation of the mean, within one standard deviation of the mean, and equal or greater than one standard deviation of the mean. The number of males and females appear in parentheses (i.e., number of males/ number of females).

Social Control and achievement

Table 17 shows results of the analyses examining the relationship between EXPLORE and PLAN Composite scores as moderated by sex for 1,375 8th graders. Again, about 64% of the variation in PLAN Composite scores was accounted for by the combination of sex and EXPLORE Composite scores.

Table 17. Relationships Between Explore and PLAN Composite Scores as Moderated by SEX (PSF = Social Control)

				95% CI		
Predictor	*B*	*SE*	*t*	*Lower*	*Upper*	R^2
Constant	-.048	.023	-2.09*	-.093	-.003	.641
SEX	.094	.032	2.92**	.031	.157	
EXPcomp	.777	.022	25.30***	.734	.820	
SEX × EXPcomp	.038	.032	1.18	-.025	.101	

Note. N = 1,375. B = unstandardized regression coefficient; SE = standard error; CI = confidence interval; EXPcomp = EXPLORE Composite scores.

* $p < .05$ (two-tailed) ** $p < .01$ (two-tailed) *** $p < .001$ (two-tailed).

Hypothesis 2b predicted that students' social control would interact with sex and 8th grade achievement to predict 10th grade achievement. A multiple regression model with a three-way interaction term was implemented to examine the relationship between social control and PLAN Composite scores as moderated by sex and EXPLORE Composite scores. Table 18 shows that the full model yielded an R-squared of .65. Social control provided statistically significant increases in variance of PLAN Composite scores beyond sex and EXPLORE Composite scores (ΔR^2 = .006).

Let Z_1=SEX (Male = 0; Female = 1), Z_2= EXPLORE Composite scores, X_2 = social control, the regression equation in Table 18 is:

$$\text{EQ 5: } Y = -.051 + .075Z_1 + .779Z_2 + .005X_2 + .01Z_1Z_2 + .064Z_1X_2 + .018Z_2X_2 + .074Z_1Z_2X_2$$

The equation can be rearranged as:

$$\text{EQ 6: } Y = -.051 + .075Z_1 + .779Z_2 + .01Z_1Z_2 + (.005 + .064Z_1 + .018Z_2 + .074Z_1Z_2)X_2$$

The three-way interaction between sex, EXPLORE Composite score, and social control was statistically significant (*B* = .074, *p* < .05, 95% CI [.007, .141]). Given this significant interaction effect, Equation 6 can be broken down by sex. Figures 7 and 8 show the three-dimensional surface plot for males and females, respectively, and Figure 9 shows the two-dimensional plot to illustrate how the relationship between social control and academic achievement (PLAN Composite score) varied by sex and prior academic achievement (EXPLORE Composite score).

The simple slopes and slope difference tests for high- and low-able students are presented in Table 19. Using the same PR cutoffs on prior academic achievement described earlier, Table 20 presents a two-way table that contains the number of students in each cell with cutoffs on EXPLORE Composite scores and social control in order to provide a better sense as to the meaningfulness of the findings.

Results showed that the slopes for both high-able and low-able female students were significant. Specifically, when high-able female students' social control increased, so did 10th grade academic achievement (*t*(1374) = 4.50, *p* < .001). However, low-able female students significantly performed worse on later achievement as their social control increased (*t*(1374) = -1.65, *p* < .05). There were no differences for high-able or low-able male students when their social control increased. After comparing the slope differences between high-able female and high-able male groups, results showed that the slope of high-able female students significantly differed from high-able male students (*t*(1367) =

2.74, Bonferroni's $p < .013$). Also, the slopes of high- and low-able female students were significantly different ($t(1367) = 3.65$, Bonferroni's $p < .013$). That is, as social control increased, the difference of later achievement increased and the Matthew effect also was confirmed for female students.

Table 18. Relationships Between Social Control and PLAN Composite Scores as Moderated by SEX and Explore Composite Scores

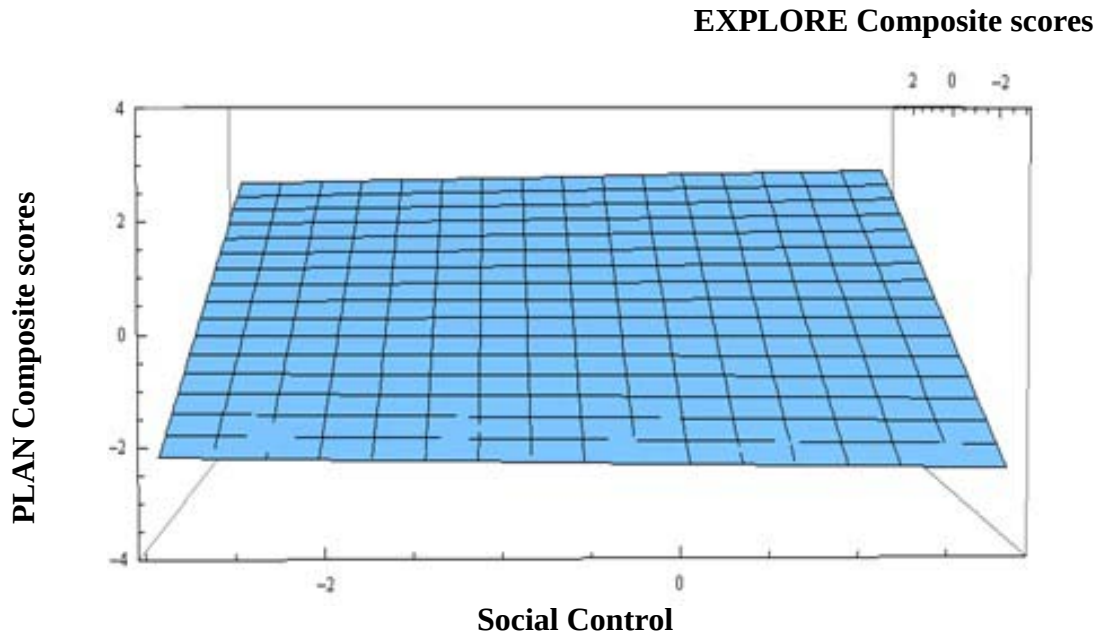
				95% CI		
Predictor	*B*	*SE*	*t*	*Lower*	*Upper*	$R^2(\Delta R^2)$
Constant	-.051	.023	-2.19*	-.096	-.006	.647 (.006***)
SEX	.075	.033	2.29*	.010	.140	
EXPcomp	.779	.022	34.79***	.736	.822	
SOC	.005	.024	.19	-.042	.052	
SEX × EXPcomp	.010	.033	.30	-.055	.075	
SEX × SOC	.064	.034	1.86	-.003	.131	
EXPcomp × SOC	.018	.022	.82	-.025	.061	
SEX × EXPcomp × SOC	.074	.034	2.19*	.007	.141	

Note. $N = 1{,}375$. *B* = unstandardized regression coefficient; *SE* = standard error; CI = confidence interval; EXPcomp = EXPLORE Composite scores; SOC = Social Control; ΔR^2 shows the incremental contribution of social control beyond sex and EXPLORE Composite scores. Specifically, Step 1 includes SEX, EXPcomp, and SEX × EXPcomp. Step 2 includes SEX, EXPcomp, SOC, SEX × EXPcomp, SEX × SOC, EXPcomp × SOC, and SEX × EXPcomp × SOC. ΔR^2 is the difference between R^2 in Step 1 and Step 2.

* $p < .05$ (two-tailed) *** $p < .001$ (two-tailed).

Male: $Z_1 = 0$

EQ 7: $Y = -.051 + .779Z_2 + (.005 + .018Z_2)X_2$

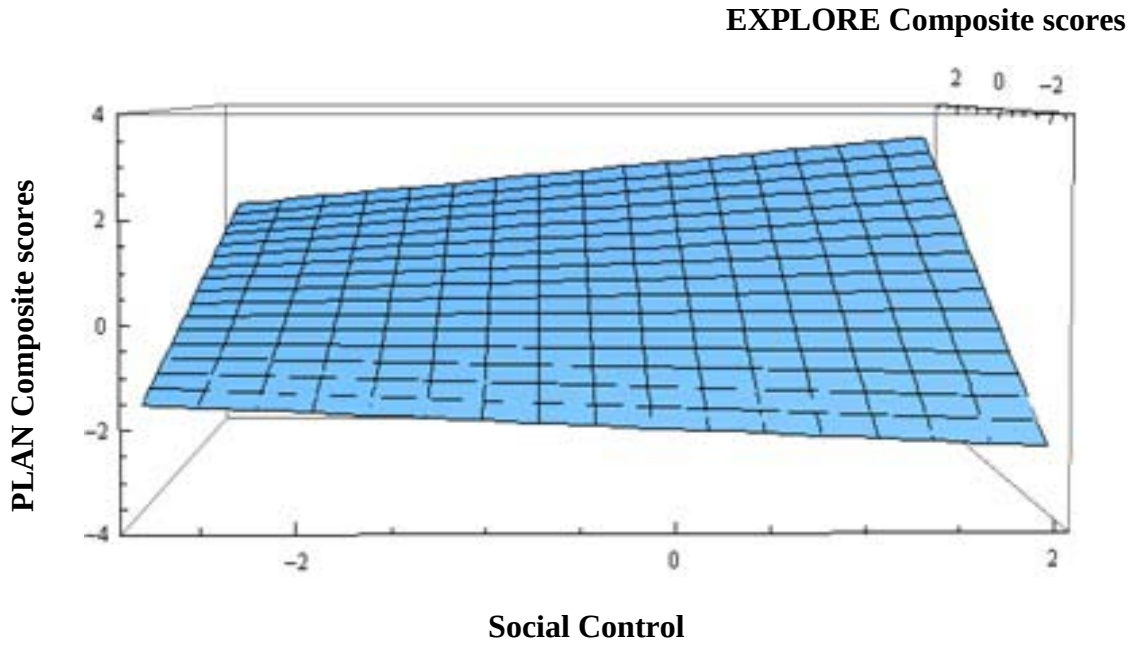


Note. All scores are standardized z-scores.

Figure 7. A three-dimensional surface generated from the regression equation of PLAN Composite scores on EXPLORE Composite scores and social control for male students.

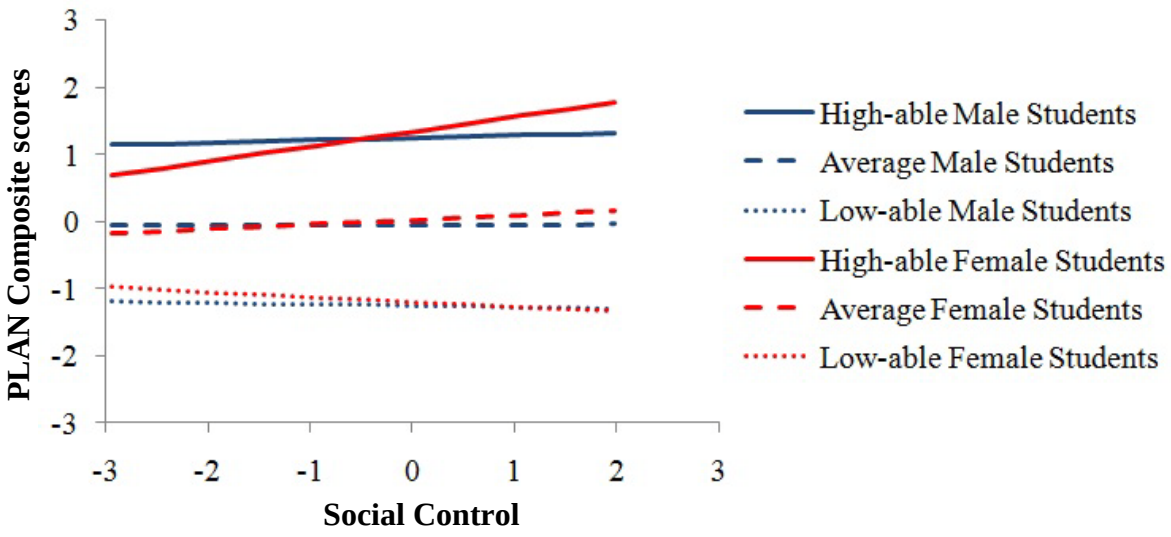
Female: $Z_1 = 1$

EQ 8: $Y = .024 + .789Z_2 + (.069 + .092Z_2)X_2$



Note. All scores are standardized z-scores.

Figure 8. A three-dimensional surface generated from the regression equation of PLAN Composite scores on EXPLORE Composite scores and social control for female students.



Note. Low-able, average, high-able students refer to students whose EXPLORE Composite scores are PR ≤ 5, 5 < PR < 95, and PR ≥ 95, respectively. All scores are standardized z-scores.

Figure 9. Relationships between social control and PLAN Composite scores at low, average, and high EXPLORE Composite scores and both sexes.

Table 19. Tests of Simple Slopes of PLAN on Social Control

Group	*B*	*SE*	*t*	*p*
1 (Male, High-able students)	.035	.047	.74	.458
2 (Male, Low-able students)	-.024	.039	-.61	.544
3 (Female, High-able students)	.222	.049	4.50	.000
4 (Female, Low-able students)	-.075	.046	-1.65	.010
Slope differences				*Bonferroni's p*
1 and 3	-.187	-.068	2.74	.002
2 and 4	.051	-.060	-.85	.099
1 and 2	.059	.072	.82	.103
3 and 4	.297	.082	3.65	.000

Note. N = 1,375. *B* = unstandardized regression coefficient; *SE* = standard error. Low-able, average, high-able students refer to students whose EXPLORE Composite scores are PR ≤ 5, 5 < PR < 95, and PR ≥ 95, respectively. Slope difference tests were conducted based on Dawson and Richter's (2006) work. The Bonferroni correction was applied to maintain a family-wise alpha level of .05 through four slope differences tests. That is, a slope difference test is statistically significant when the *p* value is less than .013.

Table 20. The Distribution of Scores on Prior Academic Achievement and Social Control

Prior Academic Achievement	Social Control		
	Low	Average	High
Low	27 (20/7)	57 (37/20)	4 (2/2)
Average	173 (97/76)	813 (394/419)	177 (62/115)
High	17 (10/7)	79 (45/34)	28 (12/16)

Note. N = 1,375. Low-able, average, high-able students on prior academic achievement refer to students whose EXPLORE Composite scores are PR ≤ 5, 5 < PR < 95, and PR ≥ 95, respectively. Low-able, average, high-able students on social control refer to students whose social control scores are equal or less than one standard deviation of the mean, within one standard deviation of the mean, and equal or greater than one standard deviation of the mean. The number of males and females appear in parentheses (i.e., number of males/ number of females).

Self-regulation and achievement

Table 21 shows results of the analyses examining the relationship between EXPLORE and PLAN Composite scores as moderated by sex for 1,383 8th graders. Again, about 64% of the variation in PLAN Composite scores was accounted for by the combination of sex and EXPLORE Composite scores.

Table 21. Relationships Between EXPLORE and PLAN Composite Scores as Moderated by SEX (PSF = Self-regulation)

				95% CI		
Predictor	*B*	*SE*	*t*	*Lower*	*Upper*	R^2
Constant	-.047	.023	-2.05*	-.092	-.002	.641
SEX	.090	.032	2.78**	.027	.153	
EXPcomp	.787	.002	35.64***	.783	.791	
SEX × EXPcomp	.024	.032	.75	-.039	.087	

Note. N = 1,383. *B* = unstandardized regression coefficient; *SE* = standard error; CI = confidence interval; EXPcomp = EXPLORE Composite scores.

* $p < .05$ (two-tailed) ** $p < .01$ (two-tailed) *** $p < .001$ (two-tailed).

Hypothesis 2c predicted that students' self-regulation would interact with sex and 8th grade achievement to predict 10th grade achievement. A multiple regression model with a three-way interaction term was implemented to examine the relationship between self-regulation and PLAN Composite scores as moderated by sex and EXPLORE Composite scores. Table 22 shows that the full model yielded an R-squared of .65. Self-regulation provided statistically significant increases in variance of PLAN Composite scores beyond sex and EXPLORE Composite scores ($\Delta R^2 = .007$).

The three-way interactions between sex, EXPLORE Composite score, and self-regulation in Table 20 were not statistically significant. Self-regulation (linear term) showed a significant effect in predicting PLAN Composite score (B = .059, p < .05, 95% CI [.000, .118]). That is, the expected change in PLAN Composite score is .059 per unit increase in social control, when sex and EXPLORE Composite score is held constant.

Given the psychosocial mediation model in Chapter 3, results indicated that the mediation effect of self-regulation was significant ($\alpha_1 = .210, p < .0001;\ \beta_2 = .056, p < .001;\ \alpha_1\beta_2 = .012$). The estimated size of the mediation effect is .046 ($r^2_{XY} = .049;\ R^2_{Y,XZ} = .642;\ r^2_{ZY} = .639$).

Table 22. Relationships Between Self-regulation and PLAN Composite Scores as Moderated by SEX and Explore Composite Scores

				95% CI		
Predictor	*B*	*SE*	*t*	*Lower*	*Upper*	$R^2(\Delta R^2)$
Constant	-.058	.029	-2.00*	-.115	-.001	.648 (.007***)
SEX	.083	.043	1.92	-.001	.167	
EXPcomp	.788	.028	28.50***	.733	.843	
SR (linear)	.059	.030	1.96*	.000	.118	
SR (quadratic)	.021	.021	1.01	-.020	.062	
SEX × EXPcomp	.028	.044	.63	-.058	.114	
SEX × SR (linear)	.003	.039	.08	-.074	.080	
SEX × SR (quadratic)	-.030	.031	-1.00	-.091	.031	
EXPcomp × SR (linear)	.012	.029	.40	-.045	.069	
EXPcomp × SR (quadratic)	-.010	.019	-.49	-.047	.027	
SEX × EXPcomp × SR (linear)	.075	.039	1.90	-.002	.152	
SEX × EXPcomp × SR (quadratic)	-.031	.031	-1.01	-.092	.030	

Note. N = 1,383. *B* = unstandardized regression coefficient; *SE* = standard error; CI = confidence interval; EXPcomp = EXPLORE Composite scores; SR (linear) = Self-regulation (linear term); SR (quadratic) = Self-regulation (quadratic term). Specifically, Step 1 includes SEX, EXPcomp, and SEX × EXPcomp. Step 2 includes SEX, EXPcomp, SR (linear), SR (quadratic), SEX × EXPcomp, SEX × SR (linear), SEX × SR (quadratic), EXPcomp × SR (linear), EXPcomp × SR (quadratic), SEX × EXPcomp × SR (linear), and SEX × EXPcomp × SR (quadratic). ΔR^2 is the difference between R^2 in Step 1 and Step 2.

* $p < .05$ (two-tailed) *** $p < .001$ (two-tailed).

CHAPTER 5

DISCUSSION

This study examined the roles of psychosocial factors (PSFs) (i.e., motivation, social control, and self-regulation) in predicting achievement gains for 8th grade students two years later. In addition, the interaction of sex and 8th grade achievement with these factors in predicting achievement in 10th grade was also studied.

The results showed that 8th grade females demonstrated significantly higher levels of motivation, social control, and self-regulation than males. All of these PSFs showed slight, but significant incremental contributions (less than 1%) beyond sex and prior achievement (see Tables 14, 18, and 22). Small effects of three-way interaction terms among PSF, sex and prior achievement were found for motivation and social control.

Specifically, among the female students, the Matthew effect was evidenced for motivation and social control, which means PSF effects were positive for females with higher prior achievement and negative for females with lower prior achievement. Among the male students, neither motivation nor social control were significant predictors of later achievement for students with either higher or lower prior achievement. There were no interactions with self-regulation for either sex or prior achievement. For both males and females, self-regulation partially mediated the effects of initial achievement when predicting later academic achievement. The magnitude of the partial mediation effect on self-regulation is medium. The relationships between each PSF and achievement, and related measurement issues are discussed in this chapter.

Motivation and Achievement

Eighth grade females demonstrated greater motivation than males. In addition, the high-able females appeared to benefit more academically from being highly motivated than their high-able male peers in that high-able female students' 10th grade scores increased as motivation increased. For male students, motivation was not found to be a

significant predictor of later achievement. These results may relate to sex differences in students' attributions of academic success in terms of their self-theories that have been found by other researchers (see Dweck, 2000, for a literature review). Past studies show that high-able females are more likely to attribute their academic success to personal effort, whereas high-able male students are more likely to attribute their academic success to natural ability (Assouline et al., 2006; Siegle, Rubenstein, Pollard, & Romey, 2010).

However, differences that emerged between the high- and low-able female students were quite surprising. When comparing high- and low-able female students, the 10th grade academic achievement gap increased as motivation increased. Specifically, given the EXPLORE and PLAN tests which have been calibrated to the same scale, the high-able female students performed better as motivation increased while, in contrast, low-able female students performed worse as motivation increased. To that end, among female students, the Matthew effect was evidenced in a psychometric manner. One possible explanation for low-able females is goal orientation, which is an important source of motivation (Bandura, 1977). Low-able females with performance goals may avoid negative judgments of their competence (Dweck, 1986). Further once they experience academic difficulty, they are likely to show helpless patterns, and, in turn, perform worse at a later time regardless of motivation (Dweck, 2000). However, although the significant interaction effect was obtained, the incremental contribution of motivation beyond sex and prior achievement was only account for .5% of the variance in later achievement. Therefore, the interpretation of the Matthew effect on motivation should be extremely cautious in explanation of academic success.

Past studies showed that motivational variables only showed slightly related to academic achievement, although small but statistically significant contribution has been obtained (Cattell & Butcher, 1968; Hustinx et al., 2009; Kline, 1979, 1993; Shiner, 2000; Steinmayr & Spinath, 2009). For example, given two large middle school samples in a

five-year longitudinal study, the significant magnitude of the motivation effects was between .02 and .06 (Hustinx et al., 2009). In another study of high school students, the significant incremental contribution of motivation variables was only account for .4% variance of academic achievement beyond prior achievement and general intelligence (Steinmayr & Spinath, 2009). Consistent with aforementioned studies, the current findings showed small, but significant incremental contribution (fractions of less 1% of the variance). Therefore, the interpretation of motivation effects should be very conservative in explanation of academic achievement. Furthermore, later academic achievement may be better interpreted in the light of prior academic success (Kline, 1993), although the incremental contribution of motivation can be obtained.

Gagné and St Pére (2001) argued that motivation was not significant in predicting school achievement among the females they studied from an all-girl high school. Past studies have addressed possible explanations for their findings such as a restricted range of intrinsic motivation in the female sample, psychometric problems of the instrument, the use of a domain-unspecific measure of intrinsic motivation, or short-time study period (Hustinx et al., 2009; Steinmayr & Spinath, 2009). The findings of the Matthew effect among female students in this study may provide other possible explanations for the conflicting results that motivation showed a certain degree of predictivity in academic achievement for females. Clearly, when examining all female students without considering achievement differences, the effects of motivation might be averaged to 0.

The jingle fallacy might be another way to explain various degree of motivation effects. Jingle fallacy on measuring motivation means that motivation is measured by the same name, but different constructs in various studies (see Pedhazur & Schmelkin, 1991). For example, Gagné and St Pére (2001) measured intrinsic and extrinsic motivation in terms of Deci and Ryan’s self-determination theory (Deci & Ryan, 1985), while motivation measured in this study refers to a combination of academic discipline, commitment to school, and optimism. Therefore, it is worthwhile to understand how the

construct of motivation is defined and measured when examining the effects of motivational variables in different studies.

Social Control and Achievement

Family plays an important role in students' learning (Fan & Chen, 2001; Hill & Tyson, 2009). In school, learning is a social process that often takes place in collaboration with peers and teachers (Zins, et al., 2004). Also, safer school environment improves students' learning (Creemers, 1994; Gronna & Chin-Chance, 1999). Students' perception from both family and school, components of social control, are related to their learning.

In addition to demonstrating greater motivation, the 8th grade females also demonstrated greater social control than the males. Earlier research on sex differences in social control, including family engagement and teacher-student relationships, are mixed when predicting scholastic achievement (Eamon, 2005; Hughes, Cavell, & Willson, 2001; Keith et al., 1998; Muller, 1998). For example, studies indicated that the relationship between parent involvement and academic achievement is similar across sexes. However, in certain racial/ethnic groups (e.g., Latino students), female students are more responsive to parent involvement in education than male students, and perform better in school (Eamon, 2005). Also, Hughes et al. (2001) argued that female students have better teacher-student relationships than male students.

The results in this study supported the hypothesis that students' social control interacts with sex and current achievement to predict later achievement, although the effect is small, but significant. The 10th grade academic achievement gap increased as levels of social control increased between high and low-able female students. Specifically, high-able female students performed better as social control increased; however, as with motivation, the low-able female students performed worse as social control increased. To that end, among female students, the Matthew effect was evidenced psychometrically once again. For male students, social control did not predict later

achievement. However, similar to motivation, although the significant interaction effect was obtained, the incremental contribution of social control beyond sex and prior achievement was small, accounting for only .6% of the variance in later achievement. Therefore, the interpretation of the Matthew effect on social control should be used with extreme caution as an explanation of academic success.

In a meta-analysis study, Hill and Tyson (2009) found the average weighted correlation between general parental involvement and achievement in middle school across the 32 independent samples was small but significant (r = .18). Similarly, the relationship between social control and later academic achievement in this study also resulted in a correlation of .18, although social control in this study included constructs of general parental involvement (i.e., family attitude toward education, and family involvement), relationship with school personnel, and school safety.

In post-hoc analyses, the current results showed that high-able female students with high social control had higher later achievement than high-able male students who also had high social control. Kerr and Nicpon (2003) reported that many gifted male students feel alienated and disengaged during childhood. This might explain why more high-able male students were not more influenced by social control. In addition, as with motivation, later academic achievement may be better interpreted in the light of prior academic achievement. A rigorous knowledge base is needed to improve later academic performance, while low-able female students performed worse as social control increased.

Self-regulation and Achievement

The findings in this study did not support the hypothesis that students' self-regulation interacts with sex and 8th grade achievement to predict 10th grade achievement. Using Baron and Kenny's (1986) steps to establish mediation, partial mediation was established when initial achievement significantly predicted self-regulation, and when self-regulation significantly predicted later achievement. The fact that self-regulation

predicts later achievement was found in earlier studies (e.g., Maughan et al., 2003). Across sexes and levels of initial achievement, self-regulation showed a medium effect size of partial mediation when predicting later academic achievement, which is consistent with earlier findings (Fredricks et al., 2004; Gumora & Arsenio, 2002; Wentzel, 1993).

In contrast to earlier findings in a college sample (e.g., Robbins et al., 2006), this study did not find the curvilinear relationship between self-regulation and students' later achievement, after first controlling for initial achievement and sex. Instead, as in previous research with a middle school sample (Duckworth & Seligman, 2005; Gumora & Arsenio, 2002; Wentzel, 1993), this study found a linear relationship between self-regulation and academic achievement.

Counter-intuitive findings: Motivation and Social Control

Most interestingly, this study showed that low-able female students' achievement gains from 8th to 10th grade decreased as either motivation or social control increased. Put differently, when low-able females reported a relatively high degree of either motivation or social control, they performed worse on the 10th grade achievement test. These counter-intuitive findings can be explained in terms of measurement and educational policy perspectives.

The students' PSFs were assessed through self-ratings, which have known measurement issues, such as relative references, social desirability, fakability, and coachability (Kyllonen, 2005; Paulhus, 1984). In addition, Paulhus (1984) argued that an individual might engage in self-deception or impression management when responding to self-report items. Individuals engaging in self-deception actually believe their positive self-reports. Individuals engaging in impression management respond to items in ways that would to present themselves positively to others (Fisher & Katz, 2000; Paulhus, 1984). In this study, low-able female students may rate themselves highly on PSFs (i.e., motivation and social control) due to either self-deception or impression management.

An alternative explanation is that individuals respond to items by comparing their PSFs to the peers with similarly low ability (Kyllonen, 2005). In this context, low-able students might perceive “high” PSFs when comparing themselves to their like-ability peers. This is why psychosocial assessments are considered as low-stakes testing and are not suitable as the sole criterion for prediction and selection purposes. Using fake-resistant psychosocial assessments (e.g., situational judgment tests) and others’ ratings (e.g., collecting objective behavioral data from institutional records, teachers, or counselors) might be an alternative avenue to minimize these possible measurement problems (Casillas et al., under review; Kyllonen, 2005).

Educational policies provide another perspective for understanding these counter-intuitive findings. These findings suggest that students’ 8th grade academic achievement has a large impact on their readiness for high school, given a strong relationship between 8th and 10th grade achievement (r = .80). Further, students’ PSFs only demonstrate positive influences on high school academic performance if they have built a rigorous knowledge base in middle school. In other words, low-able students (e.g., bottom 5% students in this study) in 8th grade have a less likelihood to achieve better in 10th grade regardless of motivation and social control they perceived. Therefore, policy makers should recognize that PSF effects come into play in increasing students’ academic achievement in 10th grade only after they have gained sufficient achievement in 8th grade.

Incremental Validity versus Clinical Utility

Sechrest (1963) claimed that the incremental validity should be presented when the test is intended for applied, predictive use. However, Hunsley and Meyer (2003) argued that “interpretation of how meaningful it is to have an incremental validity value of a particular size can be rather contentious” (p.450). Therefore, in addition to considering the incremental validity of PSFs, their clinical utility should be taken into account. From the perspective of clinical utility, interpretations of psychosocial

assessments may include description and prediction of an individual's performance, which, in turn, provides key information for further educational interventions/treatments (Meehl, 1959; Wiggins, 1988). Consistent with earlier findings (Casillas et al., in press; Steinmayr & Spinath, 2009), in the present study, in terms of incremental validity, all PSFs provided statistically significant, but slight increases in variance (ΔR^2 = .5% to .7%) of later achievement beyond sex and initial achievement. However, in terms of clinical utility, PSFs can play important roles in providing a better understanding of at-risk students (Balfanz et al., 2007; Kline, 1993; Rumberger & Lim, 2008). Also, Durlak et al. (2011) argued that students' performance on PSFs can serve as references for educators to design further educational interventions, although it is worth noting that statistically significance testing results based on a large group do not translate into predictions for individuals (Weiner, 2003).

Classroom teachers and educational policy-makers should be able to provide the evidence of clinical utility in terms of students' psychosocial profiles alone with their academic achievement performance. Furthermore, teachers may find better educational doses to remedy the weaknesses of psychosocial characteristics to prevent an at-risk individual from being a failing student or an underachiever. Educational policy-makers may find how psychosocial factors help individual students learn in school and become life-long, autonomous learners in society.

Accountability Systems for Academic Success

Various test-based educational accountability systems have been used to measure student's academic performance since the "No Child Left Behind Act of 2001" was implemented (Linn, 2006). Further, specific accountability models, such as status, improvement, growth, and value-added models, have been applied to aggregate achievement or to measure school effectiveness (Allen et al., 2009). The common feature of these accountability systems is to measure academic proficiency through academic achievement tests. Currently, only a few states have developed state-wide psychosocial

learning standards and assessment (Dusenbury, Zadrazil, Mart, & Weissberg, 2011; Lantieri, 2008), although these skills have been shown to improve academic success and help reduce dropout rates (Balfanz et al., 2007; Rumberger & Lim, 2008; Sparks, 2011).

This study reshapes the traditional test-based accountability systems to predict students' academic performance through incorporating psychosocial and academic achievement assessment based on a growth accountability model that was defined in the earlier work (Allen et al., 2009). Further, it provides a basis for studies of how comprehensive accountability systems prepare students for academic success or identifying at-risk students to prevent dropouts as early as middle school. Similar efforts to develop new accountability systems involving psychosocial learning have been initiated in different places, such as the development of common-core standards for social-emotional learning, integration of achievement, behavior, and career planning in K-12 programs, and early-warning signs that included students' course performance and behaviors (Dusenbury et al., 2011; Sparks, 2011).

Implications

For classroom teachers

It has long been recognized that a one-size-fits-all educational model does not work for many students (Corno et al., 2002; Cronbach & Snow, 1977). The students in this study exhibited a wide range of achievement and PSF scores suggesting that differentiated instruction in the classroom is needed to meet their individual needs. In particular, students benefit when their psychosocial needs are addressed through differentiated curricula in the classroom (Huebner, 2010; Lawrence-Brown, 2004; VanTassel-Baska & Wood, 2010). Differentiated instruction is not individualized instruction, which provides different instruction to each student (Tomlinson, 2001), often preventing students from interacting with other classmates (Lohman & Hagen, 2002). Instead, differentiated instruction emphasizes the selection of educational activities that provides multiple avenues for learning in the domain based on students' prior

achievement, rate of learning, and learning interests in mixed-ability classrooms (Huebner, 2010; Lohman, 2009; Tomlinson, 2001). Students have various opportunities to learn, and teachers need to work with the whole class, small groups, and individuals alternatively to meet students' diverse learning needs (Tomlinson, 2001). Therefore, although PSFs had less impact for males in this study, especially on motivation and social control, it is possible that the effect could be greater for both sexes if teachers were able provide differentiated academic and psychosocial curricula. Differentiated instruction may be particularly important for strengthening early educational interventions for academically disadvantaged students before their academic performance declines further, or worse, they become dropouts (Fuchs, Fuchs, & Stecker, 2010).

For educational policy-makers

In his State of the Union address, President Obama remarked, "And so the question is whether all of us – as citizens, and as parents – are willing to do what's necessary to give every child a chance to succeed" (White House, 2011). At the same time, research showed that many 8th grade American students are left behind in national and international standardized testing programs, and further, are off-target for college readiness (ACT, 2008; Fleischman, Hopstock, Pelczar, & Shelley, 2010; Schmeiser, 2011). In addition to providing rigorous courses in middle school, some states have started to incorporate psychosocial learning into courses, and to teach and measure nonacademic skills needed for academic success (Lantieri, 2008; Sparks, 2011). When referring to educational accountability, policymakers should recognize the outcomes of both cognitive and psychosocial skills, which prepare students for 21st century readiness (Bellanca & Brandt, 2010). As Joseph S. Renzulli said,

> High scores never put a new drug on the market, or designed a new bridge, or created a new television series. It's always been the kinds of confluence of ideas and again, I would always emphasize task commitment, that cause these things to emerge. (Mitchell, 2010, p.164)

Strengths and Limitations

This study has a number of strengths and limitations. In terms of strengths, a large cohort of students was studied for this two-year longitudinal study. Further, the full range of students' PSFs were assessed by a self-report psychosocial assessment with theoretical and psychometric support, and their 8th grade and 10th grade academic achievement were assessed by EXPLORE and PLAN which are nation-wide standardized testing programs. Given a large sample size, a valid comprehensive psychosocial assessment, and standardized achievement testing programs, the findings are likely to generalize. In addition, this study showed how male and female 8th graders perform differently in the prediction of later academic achievement when prior achievement and each PSF, including motivation, social control, and self-regulation vary. The current findings can inform teachers about the differentiated psychosocial interventions that may better foster students' learning. Last, beyond studies of personality traits, both psychological and social variables, as well as prior academic achievement, were investigated to provide a more comprehensive learning assessment.

Five limitations of the study are noted. First, the sample was not demographically representative. Although a large sample size was analyzed in this study, over 80% of the 8th grade students were recruited from Illinois (32.9%) and Louisiana (49.9%), and over 70% were Caucasians. Limited variation in geography and racial/ethnical backgrounds might limit the power of generalization.

Second, this study examined three broad psychosocial domains - motivation, social control, and self-regulation - which reveal the relationships between PSFs and achievement. However, the implications of current findings are limited in clinical settings due to the lack of specific information that is provided in the subscales. Especially when designing Individualized Education Programs (IEP) for at-risk or gifted students, specific scale profiles (e.g., Academic Discipline) under each broad psychosocial domain are more useful and needed to design targeted interventions.

Third, this study is limited by the relatively short time frame between academic assessments (about 2 years), as well as the fact that the PSFs were measured at about the same time as the first academic assessment (EXPLORE). With a longer assessment interval, and with PSFs measured at a point in time between the two assessments, stronger relationships between PSFs and achievement might be expected.

Fourth, the criterion used in this study is a standardized achievement test score, PLAN Composite, which differs from that used in previous psychosocial studies of college students, such as GPA (e.g., Robbins et al., 2004; Robbins et al., 2006). PSFs showed relatively larger incremental contribution beyond the prior academic achievement, including high school GPA and standardized testing programs when predicting students' college GPA. For example, Robbins et al. (2006) found all PSFs showed 3.5% and 3.4 % of incremental variance in first-semester college GPA and first-year cumulative GPA beyond the institutional and demographic factors, and academic achievement. Also, in previous psychosocial studies of middle school students, PSFs are more correlated with GPA than standardized academic achievement (ACT, 2009; Lounsbury, Sundstrom et al., 2003; Lounsbury, Welsh et al., 2005). It seems that the magnitude of relationship between PSFs and GPA may not generalize to the standardized achievement test scores. One possible reason is that GPA can be considered as a domain-general factor which includes academic and non-academic performance, whereas a standardized achievement test score is only used to assess students' academic performance. PSFs used in this study are domain-general factors. For example, students with higher motivation may have strong motivation on non-academic activities, rather than academic learning. Thus, the relationship between PSFs and GPA are stronger than the relationship between PSFs and standardized achievement test scores.

In addition to overall achievement test scores or GPA, instructional sensitive measures might better reflect the influence of PSFs. Instructional sensitive measures are tests which should be able to differentiate students who received instruction from those

who did not receive instruction (Kosecoff & Klein, 1974; Polikoff, 2010). Unlike measuring general academic achievement, instructional sensitive measures in a subject could provide more specific information on exactly what students learned in particular classes. For example, highly motivated students who receive math instruction should perform differently from less motivated students who receive the same content when instructionally sensitive test is administrated to both groups of students.

Last, the typical regression models with interaction terms in this study were based on the standardized measures of PSFs. However, the interaction terms in the models were the product term of standardized variables (i.e., $Z_{x_1}Z_{x_2}$), rather than the standardized product term of unstandardized variables (i.e., $Z_{x_1x_2}$). To advance the accuracy of assessment, Wen, Marsh, and Hau (2010) proposed structural equation models of latent interactions, which provides appropriate latent interaction terms to deal with this measurement issue.

Future Research

Given the limitations of self-reported psychosocial instruments, teacher-reported data based on students' actual behavior should be also collected when predicting achievement. In addition to examining psychosocial factors, most studies have shown that students' school behavior can be helpful in the prediction of academic risk and success, as well as for planning instructional support (Balfanz et al., 2007; Brady, Tucker, Harris, & Tribble, 1992; Swift & Spivack, 1969; Yen et al., 2004). Also, it is expected that along with self-report psychosocial measures, teacher-reported behavioral scales (e.g., Behavioral Monitoring Scale, ACT, 2010) could serve as another useful instrument in terms of similar psychosocial constructs and provide more accurate information for helping students succeed. For example, although both psychosocial factors and behavior can provide significant predictive power in explaining students' later academic achievement, Alexander, Entwisle, and Kabbini (2001) argued that dropout behavior for students with low socioeconomic status (SES) is more related to engagement behaviors

when compared to psychosocial factors. Similarly, Lubbers, Van Der Werf, Kuyper, and Hendriks (2010) found that the effects of personality in predicting academic achievement are fully or partially mediated by homework behavior. Although some studies have investigated the relationships among achievement, psychosocial factors, and behaviors (Alexander et al., 2001; Finn & Rock, 1997; Lubbers et al., 2010), it is not yet fully understood how effectively and efficiently to use both self-report psychosocial measures and teacher-reported behavioral scales when predicting later academic achievement for students of different sexes and levels of prior achievement. Specifically, it is unclear that how to compare and interpret the results from both self-report and teacher-reported psychosocial assessments for certain student populations. These questions need to be investigated, which may provide a better understanding of accuracy and utility of a combination of self-report and teacher-reported PSF assessments in secondary school settings.

Examining narrow psychosocial characteristics is also suggested. Contrary to expectations, this study found that motivation and social control did not significantly predict later achievement among 8th grade males. While past studies showed that broad psychosocial domains are closer to observable and malleable behavior, and are better predictors of educational and work success (e.g., Paunonen & Ashton, 2001; Peterson, Casillas, & Robbins, 2006), Lounsbury et al. (2003) showed that narrow psychosocial traits can also provide significant incremental validity in predicting academic performance. In addition, examining narrow psychosocial characteristics could provide a better and more detailed understanding of sex differences in motivation and social control. For example, within motivation, Zimmerman (2008) argued that students with higher levels of sustained effort are more likely to complete academic tasks and achieve their goals. Consequently, it is hypothesized that academic discipline may play a more prominent role in predicting later academic achievement, whereas other two psychosocial characteristics, commitment to school and optimism could have smaller contributions. In

addition, within social control, it is reasonable to separate family engagement from social control, since past meta-analytic studies have shown that parental involvement significantly predicts later academic success (Fan & Chen, 2001; Hill & Tyson, 2009). Therefore, unraveling the differential effects of narrow psychosocial characteristics in the prediction of academic achievement would be worthwhile in future research.

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