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Correlates of Adolescent Engagement and Motivation: Revisiting the Social-Cognitive Model

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CORRELATES OF ADOLESCENT ENGAGEMENT AND MOTIVATION: REVISITING THE SOCIAL-COGNITIVE MODEL

By

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CORRELATES OF ADOLESCENT ENGAGEMENT AND MOTIVATION: REVISITING THE SOCIAL-COGNITIVE MODEL

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Student engagement and motivation have been well-documented as important precursors to academic success for students at the critical transition to high school. This study explores predictors of academic success in terms of both classroom climate and student temperament, two factors that have been extensively studied in young children and college student populations, but less so during the adolescent years. A group of 140 high school freshmen completed a survey regarding their attitudes and perceptions related to their English class. Bivariate and canonical correlation was used in this study to establish correlational relationships between certain classroom climate and temperament predictors and various student outcomes related to engagement and motivation. Results indicated that certain climate predictors (e.g. presence of rigor and sense of relevance of material) and certain temperament predictors (e.g. attention, inhibitory control, and depressive mood) were especially salient in terms of predicting engagement and motivation for this age group.

Dedication

To my sons, Taavi and Caleb, who inspire me every day with their joy, energy, and enthusiasm; and to my mother, Shelley Maattala, who is an endless support for me.

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Chapter 1: Introduction

I was a ninth-grade English teacher during the first years of my career, and I will always have a "place in my heart" for young adolescents at the transition to high school. I also have a place in my heart for their teachers! Although over a decade has passed now since I was a first-year teacher in New York City public schools, I still remember my first students, in my first class; they were street-smart "city kids," at times difficult to reach, and at the same time excited and hopeful about their future and their education. I had a lot of highs, but also a lot of lows. I remember my feelings of being overwhelmed by the intensity and emotional demand of those first years of teaching in a city that was new to me, and with students who did not share my Midwestern upbringing. I remember constantly asking myself the same question: *How can I better connect with my students?*

In the end, although I was able to establish some meaningful relationships (through Facebook and other social media platforms, I kept in contact with many of my former students and do to this day), I still look back and see myriad ways that I could have been a better teacher. Conducting this study has certainly helped me to "reframe" more accurately both the successes and the failures of those early years establishing a classroom of my own.

I have found that I still care about some of the same things as an educator, and that the preceding question is one that we must continually be asking ourselves as each new generation of students comes through our doors year after year. Indeed, my guiding questions as I began this research were these: how can a teacher make her classroom a place that kids want to be? What matters most in motivating students to learn? To some extent, I have been able to get a little closer to answering these questions through this

study. My hope is that this research might also prove illuminating for any teachers of adolescents who might have asked themselves these same questions.

1.1 The Purpose Statement

The diverse life experiences and unique personalities that students bring with them into the classroom makes teaching an exciting and challenging, from class to class and from week to week. Many of us teach high school because we enjoy getting to know our students as individuals, and seeing them daily, we come to know quite a bit about their strengths, weaknesses, and even quirks. But undeniably, certain developmental commonalities tie together the experiences of particular age-groups, and we can count on these commonalities being true of our students by very virtue of their age. Indeed, many teachers feel an affinity for kids of a certain age; I happen to enjoy high school students, whereas the thought of spending the whole day in a third-grade classroom fills me with dread.

Educators and researchers have by now well documented many of these needs for students, by age group, be it early childhood through college age. While many classroom "best practices" can extend to youth at all stages of development, placing value on the needs of children relative to their age and life experience has great benefit. Experts in adolescent development would agree that adolescents are distinct from children and unique in their developmental needs, therefore research finding with younger populations cannot always be generalized to account for the adolescent experience. Indeed, further research with adolescents must continue to address challenges particular to their life stage, and take into thoughtful consideration their perspectives and personal characteristics.

A significant body of research over the past three decades has gone a long way towards uncovering "what matters" for academic success among youth of different age groups. However, variables that make significant contributions to academic success at the elementary and post-secondary level may not be as salient for adolescents, nor have such variables been extensively studied in terms of adolescent populations. For example, while research has established temperament as a predictor of certain classroom outcomes for young children, temperament's impact on the academic success of adolescents remains less clear (Rudasill, Reio, Stipanovic, & Taylor, 2010).

Similarly, while classroom environmental factors, alone, as predictors of adolescent school adjustment (such as classroom belonging (Goodenow, 1993) and school climate (Roeser, Midgely, & Urdan, 1996) were studied in earnest two decades ago, a much greater number of studies in elementary schools have examined the impact of both student individual characteristics and classroom climate as a predictor of children's outcomes, especially at the transition to kindergarten (often referred to as "school readiness") (e.g. Brock, Nishida, Chiong, Grimm, & Rimm-Kaufman, 2008; Furrer & Skinner, 2003; Huffman, Mehlinger, & Kerivan, 2000; Howse, Lange, Farran & Boyles, 2003; Ladd, Buhs, & Seid, 2000; Lowenstein, Friedman-Krauss, Raver, Jones, & Pess, 2015). The limited number of studies examining both the personal and institutional variables that may impact an adolescent sample indicates that further research is warranted for this population (Roeser, Midgley, & Urdan, 1996; Rudasill, Reio, Stipanovic, & Taylor, 2010). This study therefore offers a contribution to educational research that may be missing for students in the developmental niche. Specifically, this study offers clarification on the impact of both risk and protective factors that exert

emotional and motivational influence on ninth graders a time of increased vulnerability for them: the transition to high school.

Transitions, for all people, can be stressful, challenging, and if not met with resilience, increasing their vulnerability to future failure. Students at the transition to middle school, for example, often experience a loss of self-esteem and temporary destabilization of identity, which unfortunately may continue to impact their academic self-efficacy as they move on to higher grades (Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991).

Indeed, for many students, the stress of changes at the transition to high school may affect a student's GPA both temporarily and in a long-term sense. Many a ninth-grade parent has wondered how their child could get such good grades in middle school, and then struggle with high school work. The destabilization of identity experienced by adolescents at this time can result in a loss of motivation and subsequent low achievement from which the student may not recover (Alspaugh, 1998; Isakson & Jarvis, 1999; Schwartz, 1995)

Emotionally, first year high school students may feel a lack of "belonging" in a more populous, impersonal high school environment. Although students may feel that more curricular and extracurricular choices are available to them, they also may get considerably less input and support from adults, who at the same time increase their expectations (Eccles, Midgely, & Adler, 1984; Isakson & Jarvis, 1999). Without academic and emotional support at this transition, students may become increasingly disinterested in school (National Research Council, 2004), ultimately leading to increased absenteeism and feelings of low academic efficacy (Isakson & Jarvis, 1999). Indeed, the

quality of a student's first year of high school is a key factor impacting high-school dropout rates, and for those students who do "stick it out" to graduation, post-secondary achievement (Hossler & Stage, 1992; Neild, Stoner-Eby, & Furstenberg, 2001).

In response to these findings, many high schools that have successfully reduced drop-out rates simply by implementing "transition support programs" for incoming freshman (Mizelle & Irvin, 2000). Such programs bring parents, school staff, and student "ambassadors" together to welcome and support incoming freshman as they navigate through their first year (Hertzog & Morgan, 1999; Mac Iver & Epstein, 1991). At an institutional level, incoming high school students report better feelings of "adjustment" if their school has an "organizational culture" that promotes good study habits and positive social interactions among staff and students (Eman, 2013). Manifested in a range of academic and emotional supports (e.g. a school-wide focus on study skills development, after-school activity recruitment fairs, or lunch-room "mix-up" days where seniors sit with freshman), these policies represent a concrete, effective response to research highlighting the critical nature of this time-period.

However, many ninth-grade students still report concerns about time management and feelings of being overwhelmed with heavier academic workloads than they can handle (Mizelle, 1995). Many of these students may also lack the coping skills or extracurricular support networks that often buffer the effects of stress, resulting in loss of motivation and disengagement from school, despite the best efforts of school staff (Fenzel & Blyth, 1986; Frydenberg & Lewis, 1993). After the first week's "welcome" program has ended, and students have settled into their individual schedules, it is then

often up to individual teachers to ensure that students feel supported and motivated to learn.

This study offers insight into classroom practices, attitudes, and expectations that teachers can employ in order to help students in transition stay engaged. The development of a productive classroom climate depends on teachers considering not only classroom environment factors (e.g. judicious use of incentives, development of challenging, meaningful curriculum), but also the unique, personal characteristics impacting each student's needs (e.g. temperament, motivation level, academic ability). While some teaching strategies will work well for all, teachers must also develop targeted motivational and instructional strategies that address individual differences (Thomas & Chess, 1991; Keogh, 2003).

Temperament, in particular, is an individual difference in students that has been shown to impact both academic self-efficacy and achievement. However, research in the classroom has mainly shown temperament to be either a risk or protective factor for younger children (preschool or elementary years) (Bierman, Coie, Dodge, Greenberg, Lochman, McMahon, et al., 2010; Duncan & Magnuson, 2011; Finn, Pannozzo, & Voelkl, 1995; Rudasill, Gallagher, & White, 2010; Schoen & Nagle, 1994). Studies of adolescent temperament in the classroom are rare, and they have mostly investigated the impact of only one temperament variable (e.g. effortful control) on one outcome (e.g. grade achievement or classroom behavior) (Guerin, Gottfried, Oliver, & Thomas, 1994; Oliver, Guerin, and Gottfried, 2007). Additionally, the literature linking adolescents' individual characteristics to school performance has used summative academic achievement (e.g. graduation rate, grades, or standardized test scores) as the outcome

variable (Conard, 2006; Credé & Kuncel, 2008; Duckworth & Seligman, 2005). This study is unique in that it examines the impact of multiple temperament traits simultaneously on student emotional adjustment to high school, rather than grades. And although grade and test scores are of utmost importance in consideration of student achievement, the literature previously cited has established the value of supporting student engagement with school as an important outcome, especially in ninth grade.

The consideration of temperament, rather than personality, is also notable in this study, as most literature linking adolescents' personal characteristics to school outcomes has used personality (e.g. the Big Five) as a predictor variable. Although the Big Five, normally used with adult populations, has been shown to be equally valid for use with adolescent samples (John, Caspi, Robins, Moffitt, & Stouthammer-Loeber, 1994), a preference for this measure among researchers in adolescent and young adult development has further resulted in a paucity of research on temperament, adolescence, and school outcomes. However, in addition to filling an obvious information gap in the existing research, two other considerations would support further research on the impact of adolescent temperament as a predictor of school adjustment.

Firstly, although the description of certain personality traits seems to mimic certain temperament traits (or clusters of traits), few studies have established clean conceptual linkages between temperament traits and personality factors. Those researchers that have undertaken the comparison highlight the obvious commonalities between the two constructs, but caution against the misinterpretation of them as interchangeable (De Pauw & Mervielde, 2010; Evans & Rothbart, 2007). Thus, findings for existing adolescent

personality studies can offer many thought-provoking insights into adolescent temperament, they cannot offer straightforwardly generalizable results.

Secondly, temperament research in particular, has established the importance of promoting the "goodness of fit" between a child's temperament and her developmental contexts (Keogh, 2003). "Goodness of fit" refers to the match between an individual's temperament and the demands of his environment (Rothbart, 2011); if a child is experiencing "goodness-of-fit," his temperament facilitates positive adaptation to the environment at the same time that the environment responds appropriately to his temperament; however, the opposite is also true: a mismatch between temperament and environment can lead to maladaptation on the part of the child and/or further deterioration of the environment's suitability for him.

Most research on "goodness-of-fit" has centered mainly on the home environments of younger children, especially focusing on the parent-child relationship, and this research has long established a strong, positive correlation between "goodness of fit" and child development. Another context of child development, the school, has also been the focus of numerous child "fit" studies. These studies refer to "stage-environment fit," which measures the school's degree of support for the developmental needs of students in a particular age-group. Findings from these studies further support the importance of a finding a good match for children within appropriate developmentally-supportive educational contexts. Schools, particularly middle schools, who strive for a culture of stage-environment fit have consistently demonstrated gains in student motivation, engagement, and achievement (Eccles, 2004; Eccles, Midgely, & Wigfield, 1993; Eccles

& Roeser, 2009; Gutman & Eccles, 2007; Zimmer-Gembeck, Chipuer, Hanisch, Creed, & McGregor, 2006).

Given the high value of creating supportive educational and familial contexts for students, further study of the relationship between temperament at the level of the classroom environment would likely yield interesting insights for teachers seeking to establish a responsive, developmentally appropriate classroom. However, the topic has remained somewhat under-explored and thus open for further investigation, especially for teachers of adolescents (Keogh, 2003). Generally, the few existing studies of temperament's impact on adolescents' academic outcomes have shown results similar to those found with younger children. That is, students with higher levels of self-regulatory temperament traits, such as inhibitory control, will do better in most traditional classroom settings, whereas students with traits such as high activity or impulsivity may be at risk for school maladjustment and lack of academic achievement (Liew, 2012; Martin, 1989; Rothbart, 2011). However, there may be other temperament traits, or clusters of traits that represent risk factors for adolescents, not accounted for by studies with younger children. Thus, studying temperament's impact on adolescents, as distinct from children, may yield more nuanced results more applicable to addressing their needs at this particular stage of the developmental trajectory. The purpose of the current study is to investigate the impact of both environmental (teacher behaviors) and psychological (temperament) factors on adolescent adjustment to high school in terms of two factors: academic motivation and classroom engagement.

1.3 Research Questions

The following research questions are addressed in this study:

1) Among various classroom climate factors, which are most closely related to positive classroom outcomes for adolescents?
2) Among various temperament dimensions, which are most closely related to positive classroom outcomes for adolescents?

Chapter 2: Literature Review

2.1 Markers of Success in Secondary School: Student Engagement and Related Outcomes

Research on education in adolescence has shown that student engagement is an important marker of "goodness-of-fit" between the developmental needs of students and the school environment. According to Newmann, Wehlage, & Lanborn (1992), student engagement in academic work is defined as "the student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (p. 12). Much research has demonstrated the importance of student engagement in high school as a positive classroom outcome; it predicts better attendance, continued motivation and achievement as students progress through high school, and even better performance in college (Christenson, Sinclair, Lahr, & Godber, 2001; Klem & Connell, 2004; Shernoff & Hoogstra, 2001). Engagement is also positively related to improvement in adolescents' social relationships and sense of well-being (Murray, 2009; Van Ryzin, 2009). In fact, student engagement is such a robust predictor of achievement that it has been shown to transcend socioeconomic status (Arhar & Kromney, 1993; Finn, 1993). Student engagement may also be a powerful mediator of achievement; Voelkl (1995) found that teacher warmth and student achievement were related only when students were also engaged.

On the other hand, lack of engagement in school is related to negative outcomes for adolescent students including increased absenteeism, lower grades, feelings of boredom or apathy, and higher likelihood of school drop-out (Croninger and Lee, 2001; Goodenow, 2003; Finn, 1989; Larson & Richards, 1991). Of particular concern for

educators of adolescents, disengagement from school has been shown to increase among middle and high school students, with high school students reporting the lowest levels of engagement among K-12 students (Marks, 2000; Martin, 2009; McDermot, Mordell, & Stolzfus, 2001; Skinner, Furrer, Marchand, & Kinderman, 2008). Thus, promoting student engagement for adolescents is of critical importance.

As a construct, student engagement is often conceptualized via multiple types of engagement or multiple definitions (Appleton, Christenson, & Furlong, 2008). Discussions of student engagement also invariably draw in related concepts, such as motivation and self-efficacy, which are essential components of student engagement. Appleton, Christenson, & Furlong (2008), therefore argue for the consideration of student engagement as a "metaconstruct," examined as integrated with other interacting and related constructs. Thus, this study also examines several related outcomes that are complementary and interactional with student engagement: intrinsic motivation, goal orientation, self-efficacy, and meaningfulness of curriculum (or sense of relevance) each of which are discussed below.

A Sense of Relevance

According to Newmann, Wehlage, & Lannborn (1992), promotion of student engagement must involve opportunities for students to do "authentic work" that they perceive as relevant to their goals. Engagement with such authentic, meaningful tasks helps increase students' key need to develop feelings of competence, of the foundations of engagement and motivation (Ryan & Deci, 2000). While people can be motivated by external pressure, people can also be motivated because they value an activity (Ryan & Deci, 2000). For adolescents, a sense of relevance begins with a curriculum that "respects

the way that humans learn" and that is "thematic, experiential, challenging, comprehensive, and inclusive of multiple perspectives" (Benard, 1995, p. 3). As Ryan & Deci (2000) write, "…people will be intrinsically motivated only for activities that have the appeal of novelty, challenge, or aesthetic value" (p. 71). These kinds of activities stimulate the development of competence for people of any age, including adolescents (Ryan & Deci, 2000).

Intrinsic Motivation

According to Ryan & Deci (2000), intrinsic motivation is "the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn" (p. 70). However, Appleton, Christenson, & Furlong (2008) point out that "motivation is…necessary, but not sufficient for engagement" (p. 379). Whereas engagement involves "a person's active involvement in a task or activity," motivation involves the underlying psychological processes that answer the question 'why am I doing this' for a given activity (Appleton, Christenson, & Furlong, 2008, p. 379). All motivational theories demonstrate that motivation is a requirement for positive behavioral outcomes (Deci & Ryan, 1985; Dweck & Elliot, 1983; Keller, 1983; Schiefele, 1991). Thus, researchers in student engagement suggest that it must be understood through a "motivational framework" (Appleton, Christenson, & Furlong, 2008; Furrer, et al., 2006).

Research has by now identified many of the potential antecedents of motivation (for a review see Wiener, 1990), such perceived ability, interest, and implicit beliefs. However, motivation is also enhanced or undermined by social-contextual events, such as positive feedback, supportive relationships, and as discussed above, meaningful

challenges (Ryan & Deci, 2000). Intrinsic motivation can also be enhanced by autonomy-supportive structures such as the allowance of choice and chances for self-directed activities (Deci & Ryan, 1985). Not surprisingly, teachers who are less controlling and allow for autonomy support also encourage greater intrinsic motivation in their students (Deci, Nezlek, & Sheinman, 1981; Flink, Boggiano, & Barrett, 1990). Clearly, student intrinsic motivation is also closely linked with engagement. In fact, in a definition by Marks (2000), student engagement is, in part, motivation to learn.

Like engagement, however, intrinsic motivation tends to decline as students move through the K-12 school years (Harter, 1981). This decline suggests that student perceptions of the classroom environment may change as they grow older and as students experience less motivating conditions. Indeed, Ames & Archer (1988) noted various classroom conditions that inspire motivation in students, including student involvement in decision-making, opportunities for peer interaction, and defining success as improvement or progress rather than grades. However, with secondary schools' increased focus on achievement testing, demanding curricular requirements, large class sizes, and a greater focus on final grades, many teachers may feel hard-pressed to offer time for increased student interaction or progress oriented grading. This can often result in an ability-focused classroom that primarily promotes performance achievement goals (in contrast to mastery goals), and presents a serious challenge to secondary student motivation (Ames & Archer, 1988; Skinner & Belmont, 1993).

Performance Orientation

Because student engagement is represented by behaviors that students must voluntarily and consistently display, engaged students also display a high degree of self-

regulation and intrinsic motivation, or as other researchers have called termed it, "reaction to challenge" (Klem & Connell, 2004). That is, these motivated learners cope with challenge in the classroom by stepping up their efforts and using problem-solving strategies (Klem & Connell, 2004; Skinner, 1995; Skinner, Zimmer-Gembeck, & Connell, 1996). Students who lack such intrinsic motivation may withdraw from challenge by procrastinating or resorting to negative emotions such as blame, anxiety, or hopelessness (Klem & Connell, 2004; Skinner, 1995; Skinner, Zimmer-Gembeck, & Connell, 1996).

While intrinsic motivation has been shown to increase persistence, these students may be relying on extrinsic motivation (Deci & Ryan, 1991; Sheldon, Ryan, Rawsthorne, & Ilardi, 1997). Extrinsic motivation, which results in "behaviors…performed to satisfy and external demand or reward contingency" tends to result in a sense of alienation in people (deCharms, 1968). However, if extrinsic motivation is also accompanied by a sense of valuing the activity, or a greater sense of autonomy, it can also facilitate enhanced performance (see Ryan & Deci, 2000, p. 73, for a discussion of autonomous extrinsic motivation). Thus, both extrinsic and intrinsic motivation may result in enhanced performance, but intrinsic motivation has been shown to be most powerful in promoting achievement and persistence, especially when students are confronted with challenge.

The ways that students react to challenge in the classroom can also reveal a deeper psychological construct: performance orientation. Performance orientation is linked to motivation via its relationship to two types of motivation, intrinsic or extrinsic.

Research indicates that students who set performance achievement goals tend to experience greater psychological distress, especially in the face of challenge, which they may perceive as a threat. The threat is derived from "a concern with being judged able" (Ames & Archer, 1988, p. 260). A student with a performance goal orientation must show "evidence of ability by being successful, by outperforming others, or by achieving success with little effort" (Ames & Archer, 1988, p. 260). Further research indicates that mastery goals, rather than performance goals, tend to correlate more strongly with student persistence and motivation (Maehr & Meyer, 1997; Maehr & Midgely, 1996; Meece, Blumenfeld, & Hoyle, 1988).

Self-Efficacy

Engaged students with high motivational levels are more likely to develop feelings of self-efficacy, another important outcome of the adolescent years (Bandura, 1991). Adolescents also know that they will soon be asked to survive on their own in the adult world, and that development of certain skills and abilities is critical to their survival. This sense of confidence in one's own abilities has been called by various names in psychological literature, including self-efficacy (Bandura, 1991), competence (Deci & Ryan, 1985), self-theories (Dweck, 1990), and implicit theories about the self (Dweck, 2006), but all of these terms share the common idea that our thoughts about ourselves will determine how we behave, which is no less true for adolescent populations. Research in this area has demonstrated that interventions that change direct adolescent self-beliefs in positive ways lead to positive behavioral outcomes, and vice versa. (Yeager & Miu, 2011; Yeager, Trzesniewski, Tirri, Nokelainen, & Dweck, 2011; Williams & Jarvis, 2006).

2.2 Theoretical Models for the Study

Often used to explain a need for school-level reform, experts in adolescent development thus argue for the importance of a stage-environment fit model for schools in which adolescents' developmental needs are being met within their educational contexts (Felner, Ginter, & Primavera, 1982; Eccles et al., 1993). The developmental changes experience by adolescents can be protective or also put them at risk. On the positive side, adolescents become more reflective and independent thinkers, which can lead to increases in self-regulation and a renewed commitment to academic efforts (Goodenow, 1993). On the other hand, as previously mentioned, adolescence can also be a time of increased risk-taking, self-doubt, and decreased engagement at school (Anderman & Maehr, 1994; Eccles et al., 1993). Research over the past couple of decades has established some of the particular needs of adolescents as distinct from children, especially at the transition to high school.

To inform these needs, a second theoretical model used in this study is derived from Benard's research on resiliency. Given the stressors that students may face at the transition to high school, the development of resilience can be a strong protective factor in helping students to be successful in school. According to Henderson & Milstein (1996), resiliency "can be defined as the capacity to spring back, rebound, successfully adapt in the face of adversity, and develop social and academic competence despite exposure to severe stress…" (p. 7). Building on this definition, Benard (1995; 1996) identified three key "protective factors" that foster resilience in youth: 1) the presence of caring relationships in a child's life, 2) establishment of high expectations and the

providing of support necessary to their attainment, and 3) the provision of meaningful opportunities for participation in the classroom and/or school.

However, environmental factors may not be the only variables influencing student motivation and engagement in the classroom. This study also therefore considers the adolescent high school experience from the point-of-view of Bandura's model of triadic reciprocal causation (1978). This model can be used to explain the "basic determinants and mechanisms" underlying students' various levels of motivation and engagement in the classroom (Wood & Bandura, 1989, p. 361). Triadic reciprocal causation posits that students "are neither autonomous agents nor simply mechanical conveyors of animating environmental influences" (Bandura, 1989, p. 1175). Rather, in this model, three interacting elements, including personal factors, environmental factors, and behavioral factors, "influence each other bidirectionally" (Wood & Bandura, 1989, p. 361).

In this study, student engagement and its related concepts are conceptualized as behavioral factors that are simultaneously influenced by both classroom climate (e.g. environment factors) and student temperament (e.g. personal factors). In the following sections, I will discuss literature relating the impact of first, classroom environment factors, and secondly, personal factors, on student engagement.

2.3 Classroom Environment Factors and Engagement

Research has found that the presence of certain classroom environment factors is important for promoting student motivation and engagement. These factors include: teacher-student relationship quality (and conversely, teacher indifference), promotion of student autonomy, and presence of rigor.

Teacher-Student Relationship Quality

Because adolescents begin to seek social support outside of the family, perceptions of teacher support are of increased importance for maintaining motivation in school and promoting resilience (Benard, 1996). According to Yazzie-Mintz (2006) "engagement is about relationship" (p. 1). Both Midgely, Feldlaufer, and Eccles (1989) and Klem & Connell (2009) found that middle school students' motivation levels were more influenced by a perception of high teacher support than were elementary school students' motivation levels. Klem and Connell (2009) found that middle school students use high levels of teacher support as a "resource," while students with low levels of teacher support, or perceived teacher indifference, were much more likely to be a "liability" for students (p. 269). Students with a supportive teacher not only find schoolwork more interesting and enjoyable, they also have higher expectations for their own success (Goodenow, 1993). Furrer & Skinner (2003) found that, especially for boys, relatedness with a teacher was more closely tied to engagement as students got older, even though relatedness tended to decline as they got older, as well. Not surprisingly, a longitudinal study by Werner & Smith (1989) found that (outside of the family) "resilient" children were most likely to report a favorite teacher as being the most positive source of social support in daily life.

Autonomy

At the same time that adolescents need supportive, nurturing relationships with the adults in their lives, they also must begin to prepare themselves for entry into the wider society. They must acquire increasingly strong self-regulatory skills and must develop a sense of autonomy in order to navigate adult life. In fact, McElhaney, Allen, Stephenson & Hare (2009) argue that, along with attachment, adolescents' need for

autonomy is perhaps the most critical of their developmental needs. In school contexts, autonomy-supportive environments help students maintain academic motivation and subsequent achievement (Deci, 2009; Guay & Vallerand, 1997). Research with adolescents, in particular, underscores this finding, as students who perceive a sense of autonomy in their classes are more likely to engage in school (Allen, Pianta, Gregory, Mikami, & Lun, 1994; Smith, Ito, Gruenewald & Yeh, 2010). Hafen, Allen, Mikami, Gregory, Hamre, and Pianta, (2012) found that among adolescents' perceptions of teacher-support, autonomy, and competence, only autonomy was a robust predictor of their classroom engagement.

According to Benard (1996) teachers and schools can promote autonomy by providing students with meaningful opportunities for participation in the school and the classroom. Autonomy-supporting teachers might encourage critical thinking and dialogue, cooperative learning, plan projects based around student interests, or let students set some of the rules of the classroom (Benard, 1995). Autonomy-supporting teachers who use structured but not authoritarian methods also tend to have students exhibiting greater gains in learning outcomes (Grolnick & Ryan, 1987). Marks (2000) found that students tended to perceive small-group work and individual instruction as being more "student-controlled," and not surprisingly, student-controlled, rather than "teacher-controlled" classroom activities tend to elicit higher student engagement (Grannis, 1978; Stodolsky, 1988). In other words, as Newman (1989) writes, "engagement with learning and internalization of knowledge depend to a large degree on the opportunities students have to 'own' the work" (p. 35).

Notably, both teacher support and a sense of autonomy may help promote a sense of "belonging" for secondary school students. Goodenow (1991) found that as middle school student got older, their sense of belonging in school was increasingly tied to outcome measures of effort. Further research by Goodenow (1992) found that junior high students' sense of belonging was also strongly related to school motivation and persistence. In research by Voelkl (1995) the link between students' sense of belonging and academic achievement was mediated by the presence of opportunities for participation. Finn's (1989) model of school withdrawal also uses a student's increasing lack of engagement as a gradual process of resulting from lack of identification, or sense of belonging at the school, together with lack of opportunities for participation in the life of the school and classroom.

Presence of Rigor

Finally, classrooms that promote a sense of rigor tend to have students reporting higher engagement. According to Newmann, Wehlage, & Lamborn (1992) such classrooms are marked by high quality discourse, the challenging, higher-order questioning, and the promotion and modeling of thoughtfulness by the teacher. Indeed, Newmann, Wehlage, & Lannborn (1992) found that high school students were more engaged in "thoughtful classes" (p. 86). Offering a rigorous curriculum helps students to feel successful through meeting their need for "competence" (Ryan & Deci, 2000). Ryan & Deci (2000) note that the sense of competence, while elicited by external sources, is critical to the maintenance of intrinsic motivation in promoting individual agency and healthy, autonomous functioning. In rigorous classes, students are also more likely to feel less bored and that they are truly learning; according to the *High School Survey of*

Student Engagement, 75 percent of high school students reported feeling bored in class because the "material wasn't interesting" (Yazzie-Mintz, 2006, p. 5).

2.4 Temperament and Engagement

Temperament as a personal factor related to school outcomes has been extensively studied in recent decades (Moritz, Sirota, Kraleman, Prokasky, Madison, & Molfese, 2017; Keogh, 2003). According to Rothbart (2007), temperament "can be defined as individual differences in constitutionally based reactivity and self-regulation" (p. 7). Researchers believe that such biologically-based reactions endure into adolescence and adulthood, even if we learn to mask these reactions for the sake of social adaptation (Kochanska, Murray, & Harlan, 2000; Rothbart, 2007.) Temperament is also "shaped by a combination of genetic and environmental factors" as throughout development, and thus researchers also insist that "temperament is not destiny" (Rothbart, 2007, p. 5).

Temperament is also a multidimensional construct; a person's temperament will include various levels of temperamental dimensions whose combination produces individual variation in observed behaviors. In measurement scales developed by Capaldi and Rothbart (1992) for use with adolescent populations, temperament is conceptualized according to eleven temperament dimensions and two behavioral scales (Capaldi & Rothbart, 1992). These dimensions include: *activation control*, *activity level*, *affiliation*, *attention*, *fear*, *frustration*, *high intensity pleasure*, *inhibitory control*, *perceptual sensitivity*, *pleasure sensitivity*, and *shyness*. The dimensions of the behavior scale include *aggression* and *depressive mood*. Descriptions of the scales and dimensions of this instrument are included in Table 1.

However, the link between temperament and school outcomes has been investigated most frequently among children in the primary and pre-primary grades. In this area, a rich body of research has established the salience of certain temperamental characteristics (such as high levels of effortful control) as beneficial for students in school, and conversely, the presence of other factors (such as low inhibitory control) as potential risk factors (see Moritz, et al., 2017 and Keogh, 2003 for a more complete discussion of research on temperament in the classroom). Nevertheless, much less research has been conducted looking at the temperament dimensions that impact adolescent school outcomes. Research with younger populations, while useful for developing hypotheses for use with adolescent populations, cannot take the place of the need for further research into the impact of adolescent temperament on functioning in the secondary classroom.

Research that has been conducted with samples of secondary school students has often used course grades as an outcome (Duckworth & Seligman, 2005; Duckworth, Tsukayama & May, 2010; Poropat, 2009). Poropat's (1991) findings indicated that as children get progress through school, many individual differences become less associated with course grades, with the notable exception of the personality trait of Conscientiousness (which is conceptually linked, in temperament literature, with effortful control), a finding which is also supported by literature linking self-control to grade achievement among middle-school and high school students (Duckworth & Seligman, 2005; Duckworth, Tsukayama, & May, 2010; Wong & Czikszentmihalyi, 1991) and Conscientiousness to GPA increases in both high school and college student populations

(Conward, 2005; Noftle & Robins, 2007; Willingham, Pollack, & Lewis, 2002; Wolfe & Johnson, 1995).

However, in terms of academic achievement as an outcome, individual differences in adolescents tend to predict grade achievement better than standardized test achievement. In a study by Duckworth, Quinn, & Tsukayama (2012) high school students' self-control was a better predictor of course grades, whereas intelligence was a better predictor of SAT/ACT scores. Other individual factors such as distractibility and persistence, were not found to be unrelated to SAT scores, but highly correlated with grade achievement in both high school and college (Oliver, Guerin, & Gottfried, 2007). Notably, high school GPA has been linked more strongly to both class rank and likelihood of graduation than SAT/ACT scores (Bowen, Chingos, & McPherson, 2009 as cited in Duckworth & Allred, 2012).

Individual differences in students have also been found to be highly predictive of other important educational outcomes such as graduation from high school and school attendance (Janosz, LeBlanc, Boulerice, & Tremblay, 1997; Whisenton & Lorre, 1970). (Look at the research on bottom of page 633 and elaborate). Lounsbury, Steel, Loveland, & Gibson (2004) found that the Big Five factor of Openness to Experience, which has correlations to intrinsic motivation, was the best personality level predictor of school attendance.

Duckworth & Allred (2012) also suggest that students' individual differences, such as higher levels of effortful control, are related to gains in course grades through *quality-adjusted learning hours* (QALHs). They theorize that QALHs are the result of variables that mediate the relationship between temperamental self-control variables such

as attentional shifting and inhibitory control, and the kinds of qualitative school experiences that lead to academic gains. Thus, the pathway through which effortful control is associated with gains in academic performance involves the mediation of factors such as improved self-regulation of interpersonal relationships (i.e. social competence) and positive work-related impulses (i.e. self-regulation of learning) that are the well-established benefits of self-control abilities (Eisenberg, Valiente, & Eggum, 2010; Zimmerman & Kitsantas, 2005).

Further research has confirmed the importance of social competence and work-related self-regulation as a mediator between temperament and academic success (Tsukayama, Duckworth, & Kim, 2011; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). The social and emotional benefits of temperament have also been substantiated by the success of a variety of school interventions and/or curricula targeting social-emotional learning (SEL) (e.g. the Montessori method, Tools of the Mind, the Chicago Readiness Project).

2.5 Literature Gap

In summary, both the classroom environment and student temperament have been established as predictors of important academic outcomes, such as graduation rates and grade attainment, for secondary school students.

However, according to Appleton, Christenson, & Furlong (2008), there is a need for future research in the area of student engagement to "move beyond the indicators of academic and behavioral engagement to understanding the underlying cognitive and psychological needs of all students" (p. 381). This study thus seeks to understand how certain factors in the environment and within themselves may be aiding or interfering with students' critical needs being met in the classroom. The attention to such needs must necessarily

Appleton, Christenson, & Furlong (2008) suggest that the examination of these motivational markers of engagement, and their relationship to other interactional influences in the classroom, may be critical to developing early interventions and identifying students at risk, as the disengagement from school is often a cyclical process in which overt indicators of disengagement, low grades, for example, do not necessarily show up until it is too late to intervene (Christenson & Thurlow, 2004). Similarly, Achambault et al (2009) argues for viewing student engagement as a multidimensional construct encompassing not only behavioral, but also psychological and cognitive engagement. He writes, "a primary advantage of such multidimensionality is that the concept addresses central and related facets of human development (i.e. behaviors, affect, and cognition)."

As previously mentioned, given the critical nature of the ninth-grade year to establishment of a positive secondary school trajectory, this study's focus on cognitive and psychological markers of engagement seeks to offer insights into the psychology of potentially vulnerable students at the transitional period.

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Chapter 3: Methodology

3.1 Purpose Statement

The purpose of the current study is to investigate the impact of both environmental (teacher behaviors) and psychological (temperament) factors for early adolescent student motivation and engagement.

3.2 Research Questions

The following research questions are addressed in this study:

1) Among various classroom climate factors, which are most closely related to positive classroom outcomes for adolescents?
2) Among various temperament dimensions, which are most closely related to positive classroom outcomes for adolescents?

3.3 Institutional Review Board (IRB)

Before beginning the research, I completed the Consortium for IRB Training Initiative in Human Subjects Protections (CITI) to obtain certification in research involving human subjects. Endorsement from the University of Nebraska's Institutional Review Board (IRB) was also received prior to initiating research and data collection.

3.4 Sample Characteristics

Survey responses were submitted by n = 140 high-school freshmen, 50 males (35.7%) and 90 females (64.3%), enrolled in an English course during the 2014 spring semester. The majority of respondents were Caucasian (n = 115; 82.1%), along with seven Asian Americans (5.0%), three Hispanics (2.1%), two Native Americans (1.4%), one African American (0.7%), and 22 people who declared "other" (15.7%).

Students were recruited in three different high schools in 22 classes through a single visit to their ninth-grade English class. Twelve of the classes were accelerated, or "honors" ninth-grade English classes and ten of the classes were "regular" ninth-grade English classes, meaning they were not accelerated. A total of 15 teachers agreed to allow recruitment in their classes. After principal and school district permission was obtained, teachers were contacted directly through e-mail for two schools, and through the principal as a liaison in one school, and an appointment was set up to visit his/her class for recruitment. Teachers signed a permission form indicating their willingness to participate in the study.

Each student was required to obtain parent permission before participating in the survey. Recruitment consisted of a verbal explanation of the study to students during their English class period and before permission forms were handed out to students. Forms were gathered the following school day in their English class, at which time students with signed parent permission forms were given access to the URL link for the survey through Qualtrics. Students completed the online survey on their own time, outside of class. Students had a window of two weeks to complete the survey. Students were told to complete the survey in reference to their perceptions of their English class and current English teacher only.

Incentives were offered for participation. The incentives included a class prize to the class in each high school with the highest survey return rate and a raffle for an iTunes gift card in each high school among all participating students in that high school.

3.5 Measures

First, students were asked to self-report on their temperament by completing 42 items drawn from the Early Adolescent Temperament Questionnaire (EATQ-Ellis & Rothbart, 2001), which is designed to measure temperament in children ages 9-15 (see Appendix A). This questionnaire measures temperament through a five-point scale ranging from 1 ("almost always true untrue of you") to 5 ("almost always true of you"). Temperament is measured according to scores summed across items in 11 temperament scales (activation control, activity level, affiliation, attention, fear, frustration, high intensity pleasure, inhibitory control, perceptual sensitivity, pleasure sensitivity, and shyness), and two behavioral scales (aggression and depressive mood). In order to reduce the length of the original 86-item EATQ, two to three items were chosen to represent each scale, and the aggression scale was not used, due to it being a behavioral scale and not a temperament scale. Depressive mood was used, however, because of its relation to negative affect and neuroticism, which has a basis in personality literature as a potential predictor of adjustment outcomes. Internal consistency of the factors was found to reach the .60 or above criterion for all scales that were included in the original 86-items. (Capaldi & Rothbart, 1992). (See Appendix A.)

Second, student engagement, self-efficacy, performance goal orientation, sense of class relevance, and classroom environment variables (teacher-student relationship quality, teacher indifference, perception of autonomy, and presence of rigor) were measured through 44 items (see Appendix A) drawn from questions written for a self-report survey designed for adolescents, the My Teaching Partner-Secondary (MTP-S), which was developed through the Curry School of Education at the University of

Virginia. The MTP-S contains items drawn from the Patterns of Adaptive Learning Scale (Midgely, Maehr, Hruda, Andermann, Andermann & Freeman, 2000), as well as original items written by researchers in adolescent development at the University of Virginia (Gregory & Ripski, 2008; Ryan & Patrick, 2000). The student questions on classroom environment scale measured three subcategories: "Your Behavior in this Class," "Your Relationship with This Teacher," and "Your Learning Experiences in This Class." Students reported on these items by choosing from one of five responses in a 5-point Likert scale ranging from 1 ("not true at all") to 5 ("very true") (e.g. "We have a lot of lively class discussions"). Students also reported on questions related to their engagement and motivation in the class by choosing from one of five responses in a 5-point Likert scale ranging from 1 ("not true at all") to 5 ("very true") (e.g. "Even if the work is hard, I can learn it").

3.6 Data Analysis

Due to the multivariate nature of the constructs under study, and the exploratory nature of the research questions, the most appropriate statistical method was determined to be canonical correlation analysis (CCA). Although CCA usually requires a large sample size, Tabachnik and Fidell (2013) suggest that ten cases per variable may suffice so long as each measure has a moderately high degree of internal consistency (e.g., α = .80). Therefore, with 140 students having fully completed the initial 86-item measure, it became necessary to reduce the number of variables to 15 or so composite scores with high reliabilities. To achieve this goal, a three-phase design was implemented starting with principle component analyses (PCA) to extract interrelated sets of items. Separate PCAs were conducted for each of the three broadly-defined variable groups: (a)

temperament, (b) *classroom environment/teacher influences*, and (c) *student outcomes*. Next, these results were further refined by using Cronbach's alpha-if-deleted method, which created a smaller number of highly-reliable composite variables. In the final step, these composite variables were analyzed by through factor sets using canonical correlation analysis. All data analyses were performed using SPSS. The results of the data analysis are discussed below.

Chapter 4: Results

4.1 Overview of Results

The first principal component analysis (PCA) was conducted on the 42 temperament items. After the initial orthogonal rotation, a visual inspection of the scree plot suggested the presence of five to eight components. To enhance the interpretability of the results, an oblimin rotation was used, and upon analyzing the pattern matrix, a seven-factor solution was selected to best represent the data. In sum, the seven factors for this group of early adolescents are *inhibitory control* (e.g. ability to suppress inappropriate responses, delay gratification), *depressive mood* (e.g. loss of enjoyment in activities, lowered affect), *attention* (e.g. capacity to focus and shift attention when necessary), *high-intensity pleasure* (e.g. deriving pleasure from novelty or intense experiences), *frustration* (e.g. negative affect when goals are blocked or tasks are interrupted), *perceptual sensitivity* (e.g. detection of subtle or low-intensity changes in the environment), and *shyness* (e.g. withdrawal or avoidance of novel or challenging situations, especially social). Each one of these factors was indicated by multiple items. The reliabilities for each of these factors is in Table # 1.

The second PCA was conducted on the 20 classroom environment items. After the initial orthogonal rotation, a visual inspection of the scree plot suggested the presence of four to five components. To enhance the interpretability of the results, an oblimin rotation was used, and upon analyzing the pattern matrix, a four-factor solution was selected to best represent the data (see Table 2 for reliabilities). In sum, the four factors for this group of early adolescents on the classroom environment items are *teacher-student relationship* (e.g. student feels that she has a warm, supportive relationship with

this teacher), *teacher indifference* (e.g. student feels that this teacher is disrespectful or uncaring towards her), *autonomy* (e.g. student feels that she has considerable control over the direction of the class), and *rigor* (e.g. student detects a challenging and intellectually stimulating environment in the classroom).

A third PCA was conducted on the 16 student outcome (engagement and motivation) items. After the initial orthogonal rotation, a visual inspection of the scree plot suggested the presence of four to six components. To enhance the interpretability of the results, an oblimin rotation was used, and upon analyzing the pattern matrix, a five-factor solution was selected to best represent the data (see Table 3). In sum, the five factors on student engagement and motivation items for this group of early adolescents are *relevance* (e.g. student feels that the coursework is meaningful and relevant to her personal and academic goals), *sense of efficacy* (e.g. student has confidence that she can master the material in the course and overcome challenges), *student engagement* (e.g. student reports displaying engaged behaviors in the classroom such as listening carefully and participating in discussion), *performance avoidance* (e.g. student reports avoiding challenges and reports a lack of initiative in the face of difficulties), and *intrinsic motivation* (e.g. it is personally important to this student to learn the material in this class; student reports a high degree of interest in the material). The reliabilities for these factors are reported in Table 3.

Next, using the factors drawn from the PCA analyses, two canonical correlations were performed using SPSS. The use of canonical correlation analysis (CCA) has several benefits to this study. First of all, as it permits the analysis of the relationships between two sets of variables simultaneously, the risk of Type 1 error is minimized (Sherry &

Henson, 2005). Secondly, according to Sherry & Henson (2005), CCA "may best honor the reality of psychological research," because it "investigates variables that possibly have multiple causes and multiple effects," and is thus more consistent with the contention that human behavior is driven by many intermingled factors, and that singular causes and effects may offer a distorted view of a "complex reality" (p. 38). In this case, CCA is "theoretically consistent" with this study's goal of using Bandura's social-cognitive model to investigate multiple variables and their relationships. Thirdly, principal component analysis revealed the constructs in question in the study to be multi-operationalized in terms of more than one factor existing as a measure of the construct, thus making CCA an appropriate statistical technique for this study.

The first canonical correlation analyzed a set of classroom environment variables and a set of student outcomes (engagement and motivation). The second canonical correlation analyzed a set of temperament variables and a set of student outcomes. Because each function in CCA is orthogonal to every other function, it is possible to provide a separate interpretation for each function (Sherry & Henson, 2005).

Following a model for presenting canonical correlation results provided by Schell & Husman (2008), I begin by offering a brief explanation of canonical correlation analysis (CCA). Next, I report on the structures of the canonical correlations found in this study, first for the classroom environment variables, and then for the temperament variables. In the Discussion section of this paper, I will return to addressing this study's research questions in the light of each canonical variate's structure. (For those readers interested in examining the Pearson correlations between student temperament and

student outcome variables, see Table 4; for correlations between classroom environment variables and student outcome variables, see Table 5).

Much like the way that a factor is created in factor analysis, canonical correlation takes two variable sets and creates two "canonical sets" (or, "variates") based on variables in the set that can be presumed to make up a latent trait of the construct represented by the variables. These two canonical variates are then correlated to produce a certain number of canonical correlations. The number of canonical correlations will be equal to the number of variables in the smallest variable set. As with any correlation, the closer the correlational coefficient is to 1, the more variance in the outcome variables can assumed to be driven by the predictor variables.

Analysis of redundancy variance can also be used to test for meaningfulness of canonical correlations. This analysis examines how much variance each of the canonical variates "extracts from the variables on its own side of the equation" (Tabachnick & Fidell, 2013, p. 584), and is also referred to as "proportion of variance extracted." Analysis of proportion of variance extracted (or, analysis of redundancy variance) for the classroom environment variables showed that the variates for the first two canonical variates (the only two that were statistically significant) when combined, explained 72 % of the variance in the outcome variables, further enhancing the meaningfulness of these two variates.

Once meaningfulness of the canonical variates has been determined, it is necessary to next examine the structure of the variate to see which variables contribute to each side of the correlation. The canonical variate represents two clusters of variables that have been combined for each construct, and then correlated, to make up a latent

dimension of the construct. The variables are thought to have a "combined influence" on the latent dimension. According to Schell & Husman (2008), "identifying what the latent dimension represents is done by interpreting which variables in the set are making meaningful contributions to the variate" (p. 451).

Both canonical coefficients and structure coefficients (or loadings) may be used to indicate the meaningfulness of each variable's contribution. In this study, I used structure coefficients to determine meaningfulness, because, according to Schell & Husman (2008), they are preferable to canonical coefficients in cases where the variables in the set may be intercorrelated (for a more in depth discussion of interpreting canonical variates see Schell & Husman 2001; 2008). Following guidelines by Schell & Husman (2008) and Tabachnick & Fidell (2013), I considered structure coefficients above .30 to indicate meaningful contributions. However, Schell & Husman (2008) also point out that "the identified pattern of variable contribution is meaningful only in the context of theory and literature of the specific constructs and behaviors being examined" (p. 451). Therefore, once "statistical meaningfulness" of each canonical was determined, it was also necessary to analyze these findings in light of previous findings in the literature.

Also of note, canonical correlations can be thought of as having a directionality, that is, being unipolar or bipolar (Schell & Husman, 2008). Polarity is determined by reversing the sign of the canonical or structural coefficient to its opposite sign (either positive or negative). If reversing the sign yields a variate that is still "theoretically interpretable in relation to the literature for the variables within the dimension," then the dimension is considered bipolar, reflecting a latent variable that can have a "high end" and a "low end." (Schell & Husman, 2008, p. 451). If switching the signs leads to

theoretically specious interpretations of the variables, then the dimension is considered unipolar.

4.2 Canonical Correlation Results: Classroom Environment Variables.

Results of the first canonical correlation analysis (CCA) for classroom environment variables are shown in Figure # 1. Because four classroom environment variables were present (the smallest variable set), four possible canonical correlations were created. Of these, two were statistically significant, however, CCA also requires that researchers check for "meaningfulness" of the correlations, regardless of significance. Examination of explained variance in the correlation (R_c^2) suggested that only the first two correlations were meaningful because: 1) each of the first two correlations exceeded .30 (which is a standard cutoff with which to assess contribution of the relative strength of a canonical correlation), and 2) examination of R_c^2 indicated that these two sets of classroom environment variables accounted for 49% and 12%, respectively, of the variance in motivation variables. According to Schell & Husman (2008), these results are sufficient to indicate that student engagement and motivation can be meaningfully predicted from the classroom environment variables.

For the first canonical correlation, the classroom environment variable set (Set 1) included teacher-student relationship quality, teacher indifference, autonomy, and rigor (Sherry & Henson, 2005). The student outcome variable set (Set 2) included relevance, sense of efficacy, student engagement, performance-avoidance goal orientation, and intrinsic motivation. Increasingly large structure coefficients indicated better teacher-student relationship quality, greater sense of autonomy in the classroom, more rigorous teacher expectations, an increased sense of relevance of the class material, a strong sense

of efficacy, high student engagement, and high student motivation. On the other hand, increasingly large structure coefficients also indicated a higher sense of teacher indifference and a greater tendency toward performance-avoidant goal orientation.

The first canonical correlation was .70 (49 percent shared variance); the second was .34 (11.5 percent shared variance). The remaining two canonical correlations determined to be too weak to warrant interpretation, as they only accounted for 5.5 and less than 1 percent of the shared variance, respectively. With all four canonical correlations included, $F(20, 412.211) = 6.152$, $p < .001$, and with the first canonical correlation removed, $F(12, 331.010) = 2.079$, $p < .01$. Subsequent *F* tests were not statistically significant. The first two pairs of canonical variates, therefore, accounted for the significant relationships between the set of predictor variables (classroom climate and temperament) and student outcomes (motivation and engagement) in each canonical pair.

Figure 1 displays data on the first two pairs of canonical variates. Total proportion of variance and total redundancy indicate that the first pair of canonical variates indicated a strong relationship between the predictor set and the criterion set, but the second pair indicated a less strong relationship, and thus the interpretation of the second pair is somewhat more questionable.

With a cutoff correlation of .30, the variables in the classroom environment set that were negatively correlated with the first canonical variate were *teacher-student relationship quality*, *sense of autonomy*, and *presence of rigor*, with *teacher indifference* positively correlated with the first canonical variate. Looking at the structure coefficients of each variable in the synthetic predictor, we can see that the relevant predictor variables were thus *teacher indifference* (.85), *presence of rigor* (-.75), and *sense of autonomy* (-

.71), with *teacher student relationship quality* (-.51) making secondary contributions. Teacher indifference was inversely related to the other classroom climate variables.

Among the student outcome variables, *relevance of material*, *sense of efficacy*, *student engagement*, and *intrinsic motivation* correlated with the first canonical variate, with relevance of material (-.88) and student engagement (-.83) contributing the most shared variance, with *sense of efficacy* (-.64) and *intrinsic motivation* (-.52) making more modest contributions. According to Sherry & Henson (2005), the first canonical variate explains, "as much of the variability in the observed variable sets as possible" (p. 42).

Therefore, the first pair of canonical variates indicates that the less a student feels that they have a positive teacher-student relationship (-.51), a sense of autonomy in the classroom (-.71), and a sense of the presence of rigor (-.75), along with the more they feel the teacher is disrespectful or indifferent towards them (.85), then *the more likely* they are to feel the class is not relevant (-.88), to be less engaged (-.64), have a lower sense of efficacy (-.83), and diminished intrinsic motivation (-.52).

Interpretation of this canonical correlation based on its "polarity" also yields some insights. The high end of first canonical variate conformed to expected formulations of an authoritative teacher's classroom (i.e. one with both high warmth and high control). This pattern represented a classroom with high support for student autonomy and high teacher expectations of rigor, along with more positive student-teacher relationships, and lower teacher indifference. This pattern was associated with students reporting higher engagement, sense of relevance, self-efficacy, and intrinsic motivation, as was to be expected from this type of "gold standard" class environment (Keogh, 1982; Lerner, 1982; Santrock, 2014).

The second canonical variate in the classroom climate set was composed of *sense of teacher indifference*, *sense of autonomy*, and *the presence of rigor*, and the corresponding canonical variate from the student outcomes set was composed of *student engagement* and *intrinsic motivation*. According to Sherry & Henson (2005), the second function in CCA is created after the first function (discussed above) has already accounted for as much variability in the variable sets as possible (p. 42). Thus, the second function is explaining a proportion of variance from what was left over after the first function was run. Thus, although this function was determined to be significant at the $p < .01$ level, it is important to keep in mind that it still represents a little over 10% of the leftover variance. Nevertheless, the combination of these variates may reveal noteworthy relationships between the variables in terms of degree and directionality.

At the low end of this dimension, the structure loadings revealed classroom environments with less student autonomy, less rigor, poorer student-teacher relationship quality, and a higher level of teacher indifference. This pattern of lower quality classroom environment variables was associated with a pattern of more negative outcomes in terms of intrinsic motivation, student engagement, sense of class relevance, and low self-efficacy. This pattern of classroom environment and motivation variables together at the low end of the dimension appears to depict a less-supportive classroom environment, or one in which a teacher has neglected to provide both cognitive and emotional scaffolding appropriate for adolescents (Pianta & McCombs, 2013; Santrock, 2014). The first canonical variate, therefore, appears to be bipolar, as both ends of the dimension appear to describe classrooms that conform to descriptions of nurturing classroom with a

structured teacher, and a more non-nurturing classroom with a permissive or dismissive teacher (Santrock, 2014).

In the second canonical dimension for classroom environment variables (see Figure 1), the classroom environment offered higher support for autonomy and rigor, but also higher teacher indifference. The primary contributors to the second synthetic predictor variable were presence of rigor (.54) and teacher indifference (.51), with secondary contributions being made by sense of autonomy (.31). On the criterion side, intrinsic motivation (.55) was the strongest contributor, with student engagement (-.31) as a secondary contributor, which was the only variable in this model to be negatively related to the classroom climate predictors. However, it could be argued that the only relevant criterion on this side is intrinsic motivation, as predicted by the most relevant of predictors: presence of rigor and teacher indifference.

Therefore, perhaps this is another type of classroom that also helps maintain intrinsic motivation for students, although it seemed somewhat to lessen student engagement. As evidenced in the second canonical variate, teachers who were showed more indifference, but nevertheless maintained high expectations through a rigorous environment, and a high degree of student autonomy, were also likely to have students reporting higher intrinsic motivation. Thus, while intrinsic motivation was a consistently positive outcome of both types of these classrooms for students, only the classroom environment in the first canonical was concurrently associated with higher self-efficacy, sense of relevance, and maintenance of high student engagement. Interestingly, this was also the classroom in which lower teacher indifference and more positive student-teacher relationships made up the canonical on the predictor side.

Conversely, in classrooms with a pattern of higher teacher indifference, lower student-teacher relationship quality, and a lack of autonomy and rigor, students reported lower student intrinsic motivation, engagement, sense of relevance, and self-efficacy. Classrooms with lower indifference (higher caring), but lack of rigor or autonomy, also contributed to lower student intrinsic motivation (Hafen, Allen, Mikami, Gregory, Hamre, & Pianta, 2012). However, engagement was slightly higher in these latter classrooms. This type of teacher may reflect a more "permissive" style of classroom management (Santrock, 2014).

Notably, the presence rigor and autonomy emerged as persistent predictors of positive outcomes for students. Autonomy and rigor contributed to both significant dimensions in conjunction with student intrinsic motivation and engagement. Again, in the lower end of the second dimension, teacher caring may have been protective for maintaining higher student engagement scores despite the lack of intrinsic motivation that went along with lower rigor and autonomy.

This pattern of variables was positively correlated with gains in intrinsic motivation, but losses in terms of student engagement. The high end of this dimension thus appears to describe a classroom benefitting the student who may be so highly self-motivated that she is somewhat indifferent to classroom quality influences. This classroom might be somewhat cold, but still rigorous, allowing for a lot of autonomy and a somewhat indifferent attitude on the part of the teacher towards the students personally, but not towards to curriculum. The high end of this dimension therefore still seems to fit with some aspects of an authoritative classroom, but may also reflect a degree of

"authoritarianism" on the part of the teacher (Charles & Senter, 2012; Santrock, 2014). Accordingly, students in this type of classroom may be moderately less engaged.

At the low end of the second canonical dimension for classroom environment, the structural loadings point towards classrooms where the teacher is less indifferent, but also provides less student autonomy and less rigor. This mixed cluster of variables was associated with slightly higher student engagement, but lower intrinsic motivation. This type of classroom may be interpreted as a "permissive" classroom, where the teacher may be high in warmth, but low in rigor, or necessary behavioral support structures (Santrock, 2014).

A comparison of the two dimensions for the classroom environment variables also yielded some unexpected results. Specifically, as a predictor, student-teacher relationship quality was part of the first canonical variate, but not the second, and both sense of relevance and self-efficacy were also outcomes of the first canonical variate, but not the second. Also, somewhat surprisingly, teacher indifference and intrinsic motivation were positively correlated in the second canonical variate.

4.3 Canonical Correlation Results: Temperament Variables

Results of the canonical correlation analysis for temperament variables are shown in Figure # 2. Of the five possible canonical correlations, two were statistically significant. Meaningfulness of these two correlations was again assessed through analysis of R_c^2 and redundancy analysis. Each of the first two correlations exceeded .30, with the set of temperament variables accounting for 46% and 19% of the variance in motivation variables. Analysis of redundancy variance found that the variates for the first two canonical variates (the only two that were statistically significant), when combined,

explained 88 % of the extracted variance in the outcome variables. These results indicate that meaningful predictions of student engagement and motivation can be made based on these two temperament variates.

The canonical correlation analysis found two distinct dimensions that contained four "types" of students based on temperament clusters. Two of these four student types were related to positive outcomes for adolescents, and two were related to more negative outcomes. Figure 2 displays data on the second two pairs of canonical variates, for temperament. Total proportion of variance and total redundancy indicate that the first pair of canonical variates was more strongly predictive of outcomes than the second, which was minimally related.

The first canonical correlation was .675 (45.5 percent shared variance); the second was .444 (19.7 percent shared variance). The remaining five canonical correlations were determined to be too weak to warrant interpretation, as they only accounted for 8.5, 6, and 1 percent of the shared variance, respectively, and none were statistically significant at the $p < .01$ level. With all four canonical correlations included, $F(35, 473.571) = 3.585$, $p < .001$, and with the first canonical correlation removed, $F(24, 395.42) = 3.20$, $p < .01$. Subsequent F tests were not statistically significant. The first two pairs of canonical variates, therefore, accounted for the significant relationships between the two sets of variables.

With a cutoff correlation of .30, the variables in the first temperament set that were negatively correlated within the first canonical variate were *inhibitory control* and *attention*, with *depression, shyness, and frustration* positively correlated with the first canonical variate. Looking at the structure coefficients of each variable in the synthetic

predictor, we can see that the relevant predictor variables were thus *inhibitory control* (-.82) and *attention* (-.83), and *depressive mood* (.68), with *shyness* (.41) and *frustration* (.38) making secondary contributions.

Among the student outcome variables, *relevance of material*, *sense of efficacy*, *student engagement*, and *intrinsic* motivation correlated with the first canonical variate, with *student engagement* (-.87) and *sense of efficacy* (-.78), and *intrinsic motivation* (-.68) contributing the most shared variance, with *sense of relevance of material* (-.56) making a more modest contribution.

Therefore, the first pair of canonical variates for temperament thus indicates that the lower a student's level of inhibitory control (-.82), and level of attention (-.83), and the higher her level of depressive mood (.68), shyness (.41), and frustration (.38), then *the more likely* she is to have lower engagement (-.87), lower self-efficacy (-.78), lower intrinsic motivation (-.68), and feelings that the class material is not relevant (-.56).

The high end of the first canonical dimension for temperament (see Figure 2) portrayed a cluster of traits that were related to positive outcomes: higher inhibitory control, higher attention, and lower negative mood, shyness, and frustration. The positive student outcomes related to this pattern were higher sense of relevance and student engagement, along with increased self-efficacy and intrinsic motivation. Thus, this pattern of predictor and criterion variables together appears to describe the prototypical "good" student, who is often appreciated by teachers, well-adjusted to school, less easily distracted, and relatively emotionally stable (Keogh, 1989; Kornblau, 1982; Lerner, Lerner, Windle, Hooker, Lenerz, & East, 1986; Martin, Nagle, & Paget, 1983).

At the low end of this dimension, the opposite of this profile emerged: a student with a pattern of lower inhibitory control and attention, and higher negative mood, shyness, and frustration. This pattern may describe a less well-regulated student, with a more "difficult" temperament, or one who is more distractible and struggles more with adjustment to school. Not surprisingly, this cluster of temperament traits was associated with students reporting decreased sense of relevance, self-efficacy, engagement, and intrinsic motivation in the classroom (Keogh, Pullis, & Cadwell, 1982; Krakow, Maguire, & Kopp, 1986; Lerner, 1983; 1984; Thomas & Chess, 1977).

On the high end of the second canonical dimension of temperament variables (see Figure 2), a pattern of traits emerged that included higher perceptual sensitivity, but lower negative affect, frustration, and high-intensity pleasure. The students described by this cluster of traits would seem to be low-reactive and very attuned to his environment. This cluster of traits was associated with students reporting a greater sense of relevance and higher intrinsic motivation. To some extent, this pattern also may capture the profile of an "easy" child, one who does not react strongly to changes in the environment, but rather takes things "as they come," and is generally less "reactive" (Bender, 1985; Thomas & Chess, 1977).

The structure coefficients at the low end of this dimension, conversely, described students who were lower in perceptual sensitivity, and higher in negative affect, frustration and high intensity pleasure. This cluster of traits was associated with lower sense of relevance and lower intrinsic motivation in the classroom. These students may be a more reactive or distractible, or may be represented by a person who is more of a

"thrill-seeker, and easily bored by activities that seem dull or uninteresting (Bender, 1985; Lerner 1983; 1984)

The second canonical variate in the temperament set was composed of *depressive mood*, *high-intensity pleasure*, *frustration*, and *perceptual sensitivity* and the corresponding canonical variate from the student outcomes set was composed of *sense of relevance of material* and *intrinsic motivation*. As with the first canonical correlation, although this function was determined to be significant at the $p < .01$ level, it is important to keep in mind that it still represents approximately 20% of the leftover variance.

The contributors to the second synthetic predictor variable were presence all modest to weak predictors including perceptual sensitivity (.63), high intensity pleasure (.52), frustration (.37), and depressive mood (-.36). On the criterion side, sense of relevance of material (.65) was the strongest contributor, with intrinsic motivation (.30) as a secondary contributor. Interpretation reveals that the higher a student is in perceptual sensitivity, high intensity pleasure, and frustration, and the lower in depressive mood, that the more likely she is to feel the material in the class is relevant to her life and to have higher intrinsic motivation.

In observing only the "high ends" of these canonical pairs, we can see that the well-regulated student portrayed in the first canonical variate conforms to classic formulations of the "good student." This pattern represents a student with high inhibitory control and attention, and lower shyness, negative affect, and frustration. This pattern was associated with students reporting higher sense of relevance, self-efficacy, engagement, and intrinsic motivation. On the high end of the second canonical variate, a student with higher perceptual sensitivity, but lower negative affect, frustration, and high intensity

pleasure was also more likely to find the classroom material to be personally relevant and to report higher intrinsic motivation.

Two of the four types of students, however, reflected more negative outcomes for adolescents. In the low end of the first canonical dimension, a pattern of low inhibitory control and attention, and higher negative mood, shyness, and frustration seemed to reflect the "disregulated" student, or one with a more "difficult" temperament, and was associated with students reporting a lower sense of relevance, self-efficacy, engagement, and intrinsic motivation. Another type of student, one who was lower in perceptual sensitivity, but higher in negative affect, frustration, and high intensity pleasure, also reported lower scores in two areas: sense of relevance and intrinsic motivation.

Regardless of canonical dimension, negative affect and frustration emerged as persistently meaningful factors for predicting adolescent outcomes, as they were negatively correlated with positive outcomes such as sense of relevance and intrinsic motivation. Inhibitory control, attention, and shyness, were part of the first canonical, and seemed to be related to self-efficacy and student engagement (as these three temperament traits and two outcomes dropped out of the second canonical). However, the second canonical provided the appearance of high-intensity pleasure and perceptual sensitivity, in in negative correlation with each other. Each of these temperament traits seemed to contribute differentially to sense of relevance and intrinsic motivation for adolescents. Students higher in perceptual sensitivity, but lower in high-intensity pleasure reported higher sense of relevance and intrinsic motivation, and vice versa, when these traits were also combined with high or low levels of both negative affect and frustration, respectively.

A few notable differences also emerged in comparing the first dimension of temperament variables with the second. The first canonical variate for temperament was distinguished from the second by the absence of inhibitory control, attention, and shyness, as predictors. The outcome variables of self-efficacy and student engagement, at the same time, dropped out of the second canonical variate. The second canonical variate still predicted sense of relevance and intrinsic motivation, but inhibitory control, attention, and shyness were replaced with perceptual sensitivity as a predictor.

Chapter 5: Discussion

The goal of this study was to further clarify the impact of certain variables on the most important motivational and behavioral outcomes for adolescents in a classroom setting. This study was conducted as an investigation of the classroom environment and temperament factors that, based on theory, may contribute to positive outcomes for adolescents in these settings. The results show that various patterns of factors do indeed contribute to these positive outcomes to varying degrees, but also that the absence of these factors may be associated with negative outcomes.

Overall, analysis of the bivariate relationships among variables revealed that the classroom environment factors of teacher-student relationship, sense of autonomy, and presence of rigor, were all positively correlated with student engagement, sense of efficacy, intrinsic motivation, and feelings of class relevance. The strongest relationship was between the presence of rigor and these constructs, followed by sense of autonomy, and finally, teacher-student relationship. (Bivariate correlations among the four classroom environment factors and the five engagement and motivation variables are presented in Table 4.) Teacher indifference was negatively correlated with sense of efficacy, student engagement, intrinsic motivation, and sense of class relevance. Performance-avoidance goal orientation was not well correlated with any of the classroom environment factors.

Analysis of the data using canonical variates also revealed interesting associations among these constructs. The canonical correlation analysis found two distinct dimensions that contained four types of classrooms, each revealing patterns of factors that may be important for adolescent outcomes. Two of these four classrooms reflected factors that

predicted positive outcomes for adolescents, and two reflected factors that predicted negative outcomes. The structure coefficients at the high end of the first canonical dimension for classroom environment variables (see Figure 1) were comprised of a cluster of traits that seem to reflect a typical "high-quality classroom" with an authoritative teacher: higher classroom support for autonomy, rigor, good student-teacher relationship quality, and lower teacher indifference. The combination of these classroom environment variables was associated with higher student engagement, greater sense of relevance, higher sense of student self-efficacy and higher intrinsic motivation. This correlation is meaningfully consistent with literature on positive classroom environments for adolescents, a well-managed classroom with an authoritative teacher who provides a high degree of both warmth and structure (Baumrind, 1971; 2012; Charles & Senter, 2012; Doyle, 1986; Nie & Lau, 2009; Santrock, 2014).

Among the seven temperament dimensions extracted by factor analysis, both attention and inhibitory control had high positive correlation with four factors: student engagement, sense of class relevance, sense of efficacy, and intrinsic motivation. The only other dimension associated with the temperament measure to show significant correlation with all four of these factors was depressive mood, and the correlation was negative, with the strongest negative correlation being in relation to student engagement. Shyness had a modest negative correlation with sense of efficacy, and frustration had a modest negative correlation with student engagement. As with the classroom environment variables, none of the temperament variables were revealed to have a significant correlation with performance-avoidance goal orientations.

Thus, within the dimensions observed in this study, we can see the emergence of certain more salient factors, both in terms of classroom environment and temperament, that are especially important for positive adolescent development and success in school, which will be discussed below.

The Importance of Intrinsic Motivation and Student Engagement

Not surprisingly, intrinsic motivation emerged as persistent, meaningful outcome within every significant canonical variate, and it was usually positively correlated with student engagement (which emerged in three of the four significant canonicals) (Reeve, 2014). In terms of classroom environment, having a caring teacher (low teacher indifference and higher student teacher-relationship quality) was strongly related to students having a sense that the material was relevant, maintaining self-efficacy, being engaged, and staying intrinsically motivated. However, the benefits of having a caring teacher may also be dependent on the degree to which the teacher also allowed for student autonomy to a high degree and maintained rigorous curricular expectations. Additionally, for some students, intrinsic motivation did not decrease, even in the presence of teacher indifference.

Indeed, intrinsic motivation may be most closely tied to the classroom environment factors of rigor and autonomy, as these students maintained high intrinsic motivation when these variables were present, even if the teacher seemed less caring on a personal level. Student engagement, however, may be more closely linked with teacher warmth, as classes with higher teacher indifference showed lower in student engagement, even if motivation remained constant. Conversely, when teachers were less indifferent, but also provided for less autonomy and rigor, the students' intrinsic motivation

decreased, and student engagement increased (Reeve, Jang, Carrell, Jeon, & Barth, 2004). Thus, it was possible for some students to be highly motivated, but show less student engagement, indicating that these two constructs are not necessarily always positively correlated for adolescents.

In terms of temperament's impact on intrinsic motivation, students with temperament profiles that were more "well-controlled" (either high degree of perceptual sensitivity or else high degree of both inhibitory control and attention) and somewhat emotionally-stable (low negative affect and frustration) also tended to report higher intrinsic motivation. Higher shyness was also negatively correlated with intrinsic motivation, which is in keeping with literature on shyness as a possible risk factor for children in school (Coplan & Rudasill, 2016).

A Sense of Relevance

Students' perceptions that the class material was relevant to their lives was a persistent outcome for adolescents. Present in three of the four significant canonical pairs, sense of relevance was also always positively correlated with intrinsic motivation. Sense of relevance (and self-efficacy, as well) may be somewhat linked to student-teacher relationship quality, as both appeared to make meaningful contributions to the first canonical variate among classroom environment factors, but not to the second canonical variate, in which student-teacher relationship quality had dropped out as a meaningful contributor.

In terms of temperament factors' impact on sense of relevance, this outcome was negatively correlated with negative affect and frustration for both canonical pairs, and with shyness in the first, and high-intensity pleasure in the second. These findings

indicate that students who struggle with emotional regulation in terms of externalizing (frustration) or internalizing (shyness) may also have a harder time finding personal relevance in their schoolwork. This makes sense because they may be preoccupied with other matters of a more personal, internal nature (Coplan & Rudasill, 2016).

Temperamental Risk and Protective Factors for Adolescents

As was expected, inhibitory control and attention both emerged as strongly predictors of positive outcomes for adolescents in terms of student engagement and motivation. This finding was in keeping with previous studies of temperament that report both traits to be critical protective factors for children in school. Perceptual sensitivity also emerged as a possible protective factor, as it seemed to help students to maintain intrinsic motivation a sense of relevance of the class material.

Negative affect was a risk factor for both significant canonical variates, as was frustration, both of which were positively correlated to predict lower sense of relevance and intrinsic motivation. Higher shyness in addition to these latter two traits also predicted lower engagement and self-efficacy, which was also a finding in keeping with literature on shy children in school. High intensity pleasure, when present with negative affect and frustration, may also lead to a decreased sense of relevance and lower intrinsic motivation for adolescent students.

Autonomy and Rigor as Critical Environmental Supports

Teachers who created a classroom environment that was rigorous and supportive of autonomy also could see increased intrinsic motivation among their students (Hafen et al., 2012; Reeve, et al., 2014). If this teacher was also perceived to be low in indifference and maintained quality relationships with students, students also reported higher self-

efficacy, engagement, and sense of relevance. However, even teachers who showed a high degree of indifference towards their students could help students maintain higher levels of intrinsic motivation if they still maintained supports for autonomy and a rigorous curricular environment. However, more indifferent teachers may also see moderate decreases in student engagement.

5.2 Limitations

After the completion of this research project, some limitations were notable for their impact on findings. One obvious limitation would be the small sample size obtained, and the limited number of classes, which reduces the generalizability of the findings. Additionally, among the six high schools where students were recruited, the three high schools who gave permission to conduct the research were the city's public high schools with a larger population of high SES students. Another potential barrier to generalizability could also be the lack of differentiation between "honors" or "accelerated" ninth grade English and the "regular" sections. In fact, when final survey results were tabulated, a higher percentage of students in the sample were from "honors" classes. Finally, the data obtained was through student self-report, not supplemented by parent or teacher-report, which may affect findings.

In addition, the use of canonical correlation as a method of analysis also carries with it certain theoretical limitations (Tabachnik & Fidell, 2013). Interpretability is a major limit of canonical correlation, because the algorithm seeks to "maximize the linear relationship between two sets of variables," it is better at showing accurate relationships when there is a linear relationship present, rather than a non-linear relationship (Tabachnick & Fidell, 2013, p. 574). Therefore, it may not account for relationships that

may be *possible* correlations, due to their lack of linearity (the possible relationship between income and IQ, for example). Finally, the results of a canonical correlation analysis do not imply a causal relationship between an IV and a DV. Tabachnik & Fidell (2013) insist that "this is truly a correlational technique" (p. 575).

5.3 Summary

In conclusion, in this research project, interesting insights emerged related to the particular developmental needs of ninth-grade students at the transition to high school. Temperament clusters that might represent risk factors or protective factors for adolescents were identified, as were classroom practices and teacher attitudes that can promote a positive school experience for these children. Although there were several limitations to this study, the findings were able to shed light on how we might further support students in having successful early secondary school experiences. Further research is recommended, especially as it applies to subpopulations of adolescent students, gifted or special needs, students, for example. Additional research might also examine the interaction effects of certain temperament clusters and environmental factors for this population of students.

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Table 1

Item Statistics & Reliability Analysis of Seven Composite Measures of Student Temperament

Composite/Item	*M*	*SD*	*ITC*
Inhibitory Control (α = .74)	-	-	-
I put off working on projects until right before they're due. (R)	3.04	1.31	*0.64*
I do something fun for a while before starting my homework, even when I'm not supposed to. (R)	2.46	1.26	*0.52*
I pay close attention when someone tells me how to do something.	3.63	1.00	*0.50*
I can stick with my plans and goals.	3.75	0.88	*0.49*
Depressive Mood (α = .77)	-	-	-
I can stick with my plans and goals. (R)	2.23	0.86	*0.37*
I feel pretty happy most of the day. (R)	2.05	0.89	*0.59*
I get sad more than other people realize.	3.23	1.33	*0.56*
I feel sad even when I should be enjoying myself, like at Christmas or on a trip.	2.31	1.14	*0.60*
I am quite a warm and friendly person. (R)	1.89	0.80	*0.35*
I get sad when a lot of things are going wrong.	3.79	1.05	*0.54*
I get irritated when I have to stop doing something that I am enjoying.	3.89	0.95	*0.40*
I get very upset if I want to do something and my parents won't let me.	3.5	1.03	*0.35*
Shyness (α = .90)	-	-	-
I am shy.	2.81	1.31	*0.87*
I am not shy. (R)	2.82	1.31	*0.86*
I feel shy about meeting new people.	2.99	1.22	*0.68*
High-Intensity Pleasure (α = .59)	-	-	-
Skiing fast down a steep slope sounds scary. (R)	3.22	1.42	*0.42*
I would not be afraid to try a risky sport, like deep-sea diving.	3.40	1.29	*0.42*
Attention (α = .80)	-	-	-
I am good at keeping track of several different things that are happening around me.	3.82	0.99	*0.49*
I have a hard time finishing things on time. (R)	3.99	1.20	*0.56*
It is easy for me to concentrate on homework problems.	4.01	0.89	*0.59*
I finish my homework before the due date.	3.48	1.28	*0.63*
When someone tells me to stop doing something, it is easy for me to stop.	3.89	0.99	*0.43*

I pay close attention when someone tells me how to do something.	3.66	0.95	*0.50*
I put off working on projects until right before they're due. (R)	3.04	1.30	*0.55*
Frustration (α = .62)	-	-	-
I get upset if I'm not able to do a task really well.	3.78	1.08	*0.38*
When someone tells me to stop doing something, it is easy for me to stop. (R)	2.11	0.99	*0.33*
I get irritated when I have to stop doing something that I am enjoying.	3.87	0.98	*0.40*
I get very upset if I want to do something and my parents won't let me.	3.47	1.05	*0.49*
Perceptual Sensitivity (α = .68)	-	-	-
I like to look at the pattern of clouds in the sky.	3.29	1.26	*0.53*
I enjoy listening to the birds sing.	3.25	1.24	*0.53*
I like the crunching sound of autumn leaves.	3.82	1.24	*0.45*

Note. (R) indicates an item's response data were reverse scored prior to reliability analyses via Cronbach's alpha (α) and corrected item-total correlations (*ITC*).

Table 2

Item Statistics & Reliability Analysis on Four Composite Measures of Classroom Influence

Composite/Item	*Mean*	*SD*	*ITC*
Relationship (α = .69)	-	-	-
This teacher knows something about me from outside of class (activities I enjoy, the music I like, etc.).	3.17	1.54	0.55
When I see this teacher in the hallway outside of class, she or he says "hi."	3.55	1.39	*0.49*
When I've figured out a problem, teacher gives me more challenging ones.	2.49	1.22	0.47
Indifference (α = .86)	-	-	-
This teacher interrupts me when I have something to say.	1.30	0.77	0.71
This teacher doesn't listen to my opinion.	1.22	0.71	*0.76*
This teacher never listens to my side.	1.17	0.69	*0.65*
This teacher doesn't seem to enjoy having me in class.	1.37	0.92	*0.59*
This teacher likes me. (R)	1.88	0.89	*0.71*
This teacher really cares about me. (R)	2.06	1.05	*0.60*
Autonomy (α = .81)	-	-	-
In working out a problem, teacher says keep thinking until I really understand.	3.37	1.16	*0.63*
This teacher doesn't let me do just easy work, but makes me think.	3.64	1.12	*0.63*
Teacher asks me to explain how I get my answers.	3.12	1.22	*0.53*
When I've figured out a problem, teacher gives me more challenging ones.	2.49	1.22	*0.48*
This teacher accepts nothing less than my full effort.	3.94	1.07	*0.44*

Note. (R) indicates an item's response data were reverse scored prior to reliability analyses via Cronbach's alpha (α) and corrected item-total correlations (*ITC*).

Table 3

Item Statistics & Reliability Analysis on Five Composite Measures of Student Outcomes

Composite/Item	*Mean*	*SD*	*ITC*
Relevance (α = .82)	-	-	-
It's easy to see why what we're learning really matters.	3.49	1.22	*0.64*
What I learn will probably help me in the future.	2.83	1.25	*0.62*
The course content is very interesting to me personally.	3.54	1.29	*0.74*
Efficacy (α = .72)	-	-	-
Even if the work is hard, I can learn it.	4.32	0.83	*0.52*
I can do almost all the work in a class if I don't give up.	4.46	0.85	*0.55*
I'm certain that I can master the skills taught in class this year.	4.16	0.90	*0.54*
Engagement (α = .75)	-	-	-
When I'm in this class, I listen very carefully.	3.79	0.91	*0.64*
I pay attention in this class.	4.19	0.88	*0.70*
When I'm in this class, I participate in class discussions.	3.55	1.19	*0.47*
I try hard to do well in this class.	4.43	0.93	*0.43*
Performance Avoidance (α = .73)	-	-	-
I don't want my teacher to think that I know less than other students.	3.46	1.44	*0.63*
I try not to look like I am having trouble doing the work.	3.03	1.37	*0.57*
It is important to me that I don't look stupid in class.	3.86	1.12	*0.46*
Intrinsic Motivation (α = .79)	-	-	-
One of my goals in class is to learn as much as I can.	3.71	1.13	*0.70*
It's important to me that I improve my skills this year.	4.09	0.96	*0.67*
It's important to me that I thoroughly understand my class work.	4.19	0.87	*0.57*

Note. (R) indicates an item's response data were reverse scored prior to reliability analyses via Cronbach's alpha (α) and corrected item-total correlations (*ITC*).

Table 4
Correlation Matrix for Student Temperament & Student Outcomes Variable Sets

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Inhibitory	–											
2. Depressed	-.43**	–										
3. Shy	-.07	.24**	–									
4. Attention	.75**	-.37**	-.10	–								
5. High-Intensity	-.12	-.07	-.06	-.04	–							
6. Frustration	-.36**	.58**	.05	-.48**	-.04	–						
7. Sensory	.11	-.08	.04	.09	.00	-.14	–					
8. Relevance	.32**	-.30**	-.07	.31**	-.17	-.20*	.29**	–				
9. Efficacy	.38**	-.27	-.24**	.47**	.06	-.11	.06	.53**	–			
10. Engagement	.50**	-.45	-.20*	.48**	-.01	-.29**	.10	.55**	.52**	–		
11. Avoidance	-.01	.19*	.14	.02	-.02	.17	-.05	.10	.22*	.00	–	
12. Intrinsic	.48**	-.28**	-.10	.38**	-.10	-.14	.16	.57**	.41**	.53**	.10	–

Note.
*Relation is significant at $p < .05$ level.
**Relation is significant at $p < .01$ level.

Table 5
Correlation Matrix for Variable Sets of Classroom Influences & Student Outcomes

Variable	1	2	3	4	5	6	7	8	9
1. Relationship	–								
2. Indifference	-.39**	–							
3. Autonomy	.52**	-.36**	–						
4. Rigor	.58**	-.39**	.58**	–					
5. Relevance	.29**	-.47**	.49**	.50**	–				
6. Efficacy	.35**	-.34**	.34**	.43**	.54**	–			
7. Engagement	.34**	-.56**	.36**	.41**	.57**	.51**	–		
8. Avoidance	.06	.09	-.05	-.05	.09	.18	.00	–	
9. Intrinsic	.22*	-.22*	.29**	.40**	.56**	.40**	.55**	.11	–

Note.
*Relation is significant at $p < .05$ level.
**Relation is significant at $p < .01$ level.

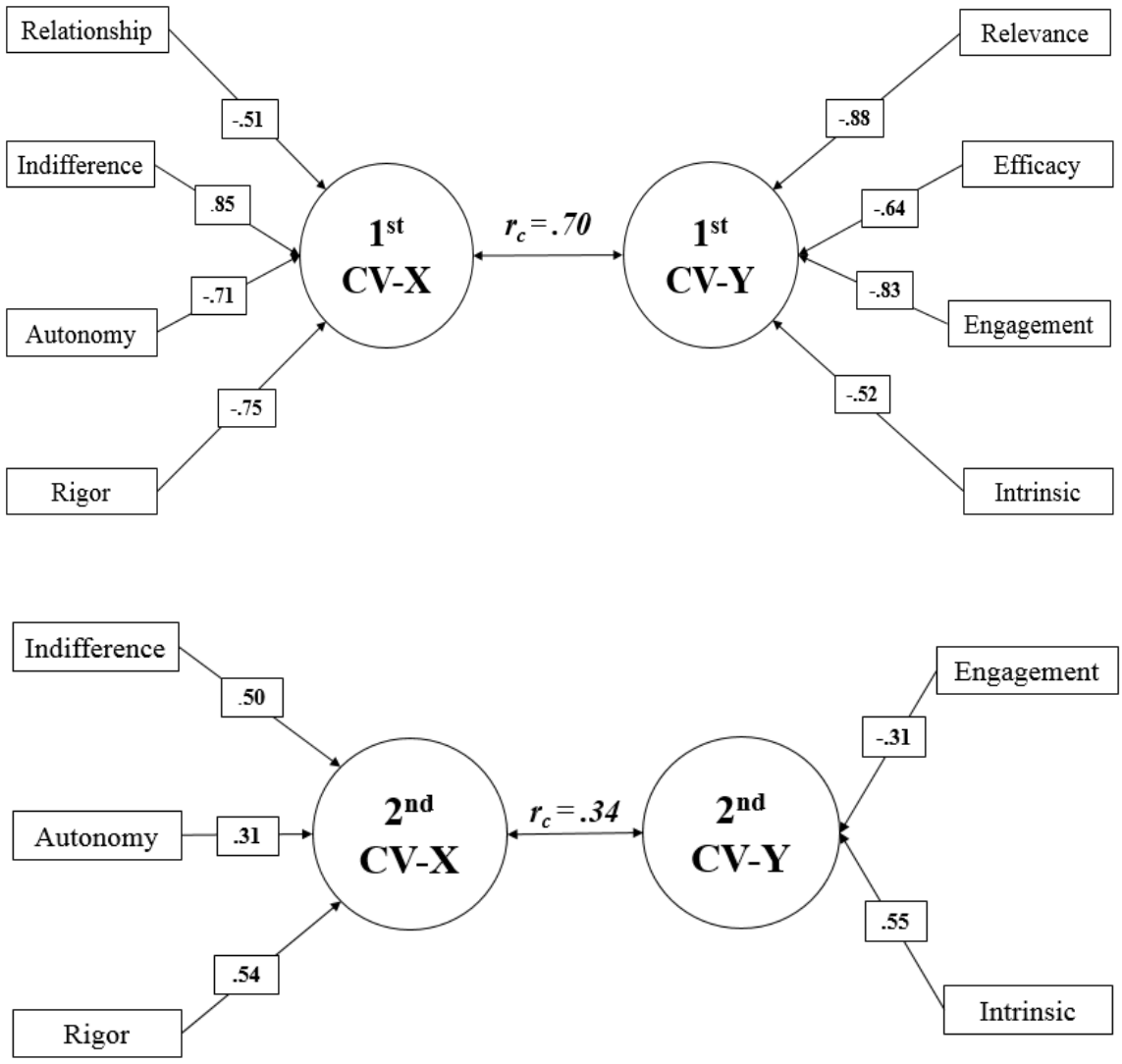

Figure 1. Visual representation for the two canonical variate pairs observed to be significant for the variable sets of *Classroom Environment Factors* (X) and *Student Outcomes* (Y). Only those loadings above 0.3 are shown.

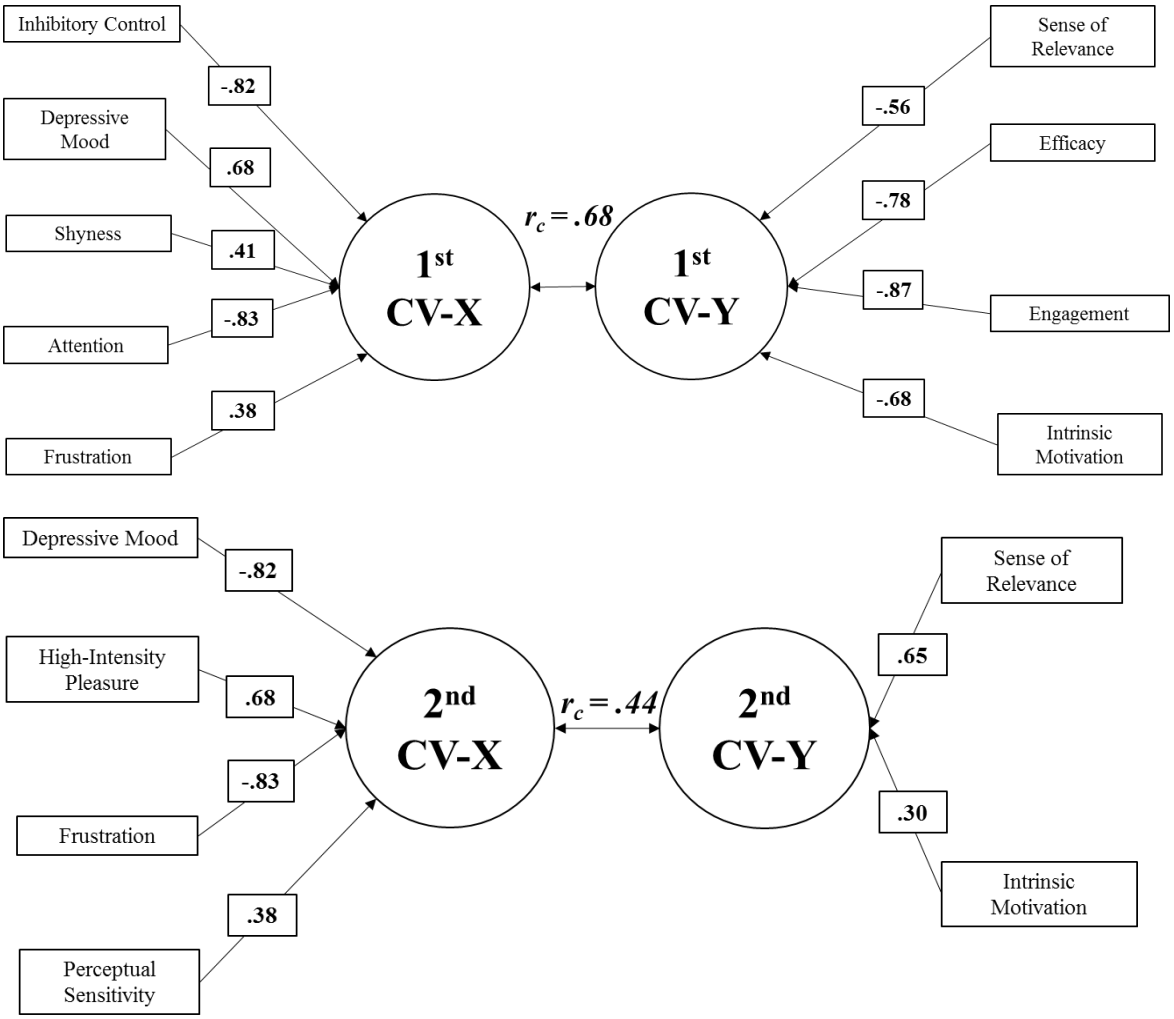

Figure 2. Visual representation for the two canonical variate pairs observed to be significant for the variable sets of *Student Temperament* (X) and *Student Outcomes* (Y). Only those loadings above 0.3 are shown.

Appendix A
Initial 86-Item Survey

The same 5-point Likert response format was used for the entire survey, for which higher numbers indicated greater agreement with the item.		
1	***R9_1***	It is easy for me to concentrate on homework problems.
2	***R9_2***	I feel pretty happy most of the day.
3	***R9_3***	I think it would be exciting to move to a new city.
4	***R9_4***	I like to feel a warm breeze blowing on my face.
5	***R9_5***	I notice even little changes taking place around me, like lights getting brighter in a room.
6	***R9_6***	I have a hard time finishing things on time.
7	***R9_7***	It's hard for me not to open presents before I'm supposed to.
8	***R10_1***	When someone tells me to stop doing something, it is easy for me to stop.
9	***R10_2***	I feel shy about meeting new people.
10	***R10_3***	I enjoy listening to the birds sing.
11	***R10_4***	I want to be able to share my private thoughts with someone else.
12	***R10_5***	I do something fun for a while before starting my homework, even when I'm not supposed to.
13	***R10_6***	I am very aware of noises.
14	***R10_7***	I like to look at the pattern of clouds in the sky.
15	***R11_1***	I can tell if a person is angry by their expression.
16	***R11_2***	It bothers me when I try to make a phone call and the line is busy.
17	***R11_3***	Skiing fast down a steep slope sounds scary to me.
18	***R11_4***	I get sad more than other people realize.
19	***R11_5***	I will do almost anything to help someone I care about.
20	***R11_6***	I get frightened riding with a person who likes to speed.
21	***R11_7***	I find it hard to shift gears when I go from one class to another at school.
22	***R12_1***	I get very upset if I want to do something and my parents won't let me.
23	***R12_2***	I get sad when a lot of things are going wrong.
24	***R12_3***	I finish my homework before the due date.
25	***R12_4***	I worry about getting in trouble.
26	***R12_5***	I am good at keeping track of several different things that are happening around me.
27	***R12_6***	I would not be afraid to try a risky sport, like deep-sea diving.
28	***R12_7***	It's easy for me to keep a secret.
29	***R13_1***	It is important for me to have close relationships with other people.
30	***R13_2***	I am shy.
31	***R13_3***	I get irritated when I have to stop doing something that I am enjoying.
32	***R13_4***	I put off working on projects until right before they're due.
33	***R13_5***	I enjoy going places where there are big crowds and lots of excitement.
34	***R13_6***	I am not shy.
35	***R13_7***	I am quite a warm and friendly person.
36	***R14_1***	I feel sad even when I should be enjoying myself, like at Christmas or on a trip.
37	***R14_2***	I feel scared when I enter a darkened room at home.
38	***R14_3***	I pay close attention when someone tells me how to do something.
39	***R14_4***	It frustrates me if people interrupt me when I'm talking.
40	***R14_5***	I can stick with my plans and goals.
41	***R14_6***	I get upset if I'm not able to do a task really well.
42	***R14_7***	I like the crunching sound of autumn leaves.

43	***B16_1***	I sometimes annoy my teacher during class.
44	***B16_2***	I sometimes get in trouble with my teacher during class.
45	***B16_3***	I sometimes don't follow my teacher's directions during class.
46	***B16_4***	I sometimes disturb the lesson that is going on in class.
47	***B16_5***	I try hard to do well in this class.
48	***B16_6***	When I'm in this class, I participate in class discussions.
49	***B16_7***	I pay attention in this class.
50	***B17_1***	When I'm in this class, I listen very carefully.
51	***B17_2***	In this class, I do just enough to get by.
52	***B17_3***	When I'm in this class, I think about other things.
53	***B17_4***	It's important to me that I improve my skills this year.
54	***B17_5***	One of my goals in class is to learn as much as I can.
55	***B17_6***	It's important to me that I thoroughly understand my class work.
56	***B17_7***	I'm certain that I can master the skills taught in class this year.
57	***B18_1***	I can do almost all the work in a class if I don't give up.
58	***B18_2***	Even if the work is hard, I can learn it.
59	***B18_3***	I sometimes copy answers from other students during tests.
60	***B18_4***	It is important to me that I don't look stupid in class.
61	***B18_5***	I don't want my teacher to think that I know less than other students.
62	***B18_6***	I try not to look like I am having trouble doing the work.
63	***B18_7***	I try to keep other students from thinking that I'm smart.
64	***T20_1***	This teacher interrupts me when I have something to say.
65	***T20_2***	This teacher doesn't listen to my opinion.
66	***T20_3***	This teacher never listens to my side.
67	***T20_4***	This teacher likes me.
68	***T20_5***	This teacher really cares about me.
69	***T20_6***	This teacher doesn't seem to enjoy having me in class.
70	***L21_1***	It's easy to see why what we're learning really matters.
71	***L21_2***	What I learn will probably help me in the future.
72	***L21_3***	The course content is very interesting to me personally.
73	***L21_4***	The teacher makes connections between what we're learning and interesting things in real life.
74	***L21_5***	Students often get to make decisions about how the class is run.
75	***L21_6***	Students often get choices about how to do projects or assignments.
76	***L21_7***	We have a lot of lively discussions.
77	***L22_1***	Students often feel like they get to help lead the class.
78	***L22_2***	The teacher changes what's planned to make it more interesting for students.
79	***L22_3***	The teacher does pretty much all of the talking in class.
80	***L22_4***	When I see this teacher in the hallway outside of class, she or he says "hi."
81	***L22_5***	Teacher knows something about me from outside of class (activities I enjoy, music I like, etc.).
82	***L22_6***	When I've figured out how to do a problem, this teacher gives me more challenging problems.
83	***L22_7***	This teacher asks me to explain how I get my answers.
84	***L23_4***	When working out a problem, this teacher tells me to keep thinking until I really understand.
85	***L23_5***	This teacher doesn't let me do just easy work, but makes me think.
86	***L23_6***	This teacher accepts nothing less than my full effort.