EXPLORING MOTIVATIONAL PROFILES AMONG HIGH SCHOOL STUDENTS: A SOCIAL-COGNITIVE PERSPECTIVE

BY

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DISSERTATION

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Abstract

Motivational beliefs are central role players in shaping academic self-regulation and achievement, which decline significantly as students matriculate secondary-educational contexts. This study uses an advanced latent-profile mixture model analysis to explore and identify the motivational belief profiles of 273 high school students, profile prevalence, and their respective associations with academic self-regulation and achievement. Three motivational profiles were identified, each representing significant proportions of the sample (57%, 22%, 21%, respectively). Each profile exhibited significant relations across indices of academic self-regulation and achievement. Practical and theoretical implications are discussed.
I would like to dedicate this to my country and all of its children, including my Maya. You deserve the best so please demand it of yourself and others. This is also dedicated to my mother without whom this dissertation and so much more would not have been possible. Lastly, to my late father, whom I love and miss immensely.
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I would like to give thanks and praises to the Most High, Jah! (Ras-ta-fari) for the incalculable blessings. Thank you for sheltering, strengthening, and sustaining me. Your guidance informs my work, and orders my steps. My ancestors have illuminated paths toward freedom and fulfillment in all areas of life for which I can only be grateful and in awe. To my grandmother Vernice, daughter Maya, sister Laurie, cousin/siblings (Keith, Lysa, Kennedy, Tina, Tonya, Brandon, Daniel, Laila, Brandi, and family), and friends Monroe, Timothy, Rob, Jason, Darryl, Tage, Toja, and so may more, I thank you all for your encouragement and unconditional expressions of love, comedy, and friendship which have been essential to my soul. To my mother, who continues to impress me with her spirit and resilience, thank you for believing, for your sacrifices, undying effort, and love, and know that without you none of this would have been possible nor as enjoyable. A special thanks to Dr. Jioni A. Lewis, who has left an indelible impression upon me and the direction of my life. Lastly to Dr. Dorothy Espelage, I owe a great debt as this opportunity to produce knowledge and expand my horizons as a researcher would not have been possible without your example and support (over many years).
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Chapter 1

Introduction

During high school many youth experience dramatic declines in motivation, academic achievement, and in the quantity and quality of the academic self-regulation behaviors that influence performance (Davis, 1994; Garibaldi, 1992; Seidman, Allen, Aber, Mitchell, & Fineman, 1994; Simmons, Black, & Zhou, 1991; Wolters, 2003; Zimmerman, 2000). These declines often deleteriously impact students’ future educational and occupational options, which is critically important to each individual and to our society’s collective ability to meet the demands of the 21st century. Over the last four decades, scholars have increasingly applied social-cognitive motivational theories to understanding these declines. According to social-cognitive theory, motivation is composed of a set of beliefs involving individuals’ conceptions about their ability to perform a task and/or up to a standard, one’s goals and values concerning those standards or tasks involved, and their beliefs about the experiences, practices and behaviors concerning how to achieve. Academic self-efficacy, achievement goal orientation, subjective task-value, and self-regulation theories have figured prominently in motivation research, each representing an area of the multidimensional phenomena that is motivation (Wigfield, Eccles, Schiefele, Roeser, & Davis-Keane, 2006).

The respective beliefs articulated by these theories are proposed to be related to academic outcomes including grades, comprehension monitoring and other self-regulatory practices, and research has substantiated these claims (Bandura, 1997; Dweck & Leggett, 1988; Eccles, 1983; Wigfield & Eccles, 2000; Zimmerman, 2000). In the relatively scant research on secondary-students, studies have shown that these respective beliefs are consistently related to the same academic outcomes (e.g., Conley, 2012; Durik, Vida, & Eccles, 2006; Hulleman, Durik,
Schweigert, & Harackiewicz, 2008; Senko & Harackiewicz, 2005). Also, relations amongst these beliefs have been established by the research (Cho, Weinstein, & Wicker, 2011; Eccles, 1983; Skinner, Wellborn, & Connell, 1990; Wigfield & Cambria, 2010). Taken together this suggests that among adolescents it may be important to explore whether and how the respective motivational beliefs work together to shape academic achievement and the self-regulatory behaviors and practices that lead to it. Other scholars have called for more research on this issue, arguing that academic behavior is multi-determined and that there may be varying patterns or combinations of motivational beliefs that are more or less optimal for promoting achievement than any single variable (Bouffard & Couture, 2003; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010; Liem & Nie, 2008; Pastor, Barron, Miller, & Davis, 2007; Pintrich, 2000c; Roeser, Galloway, Casey-Cannon, Watson, Keller, & Tan, 2008).

Unfortunately only a handful of studies have addressed this question of multiple belief patterns (see Conley, 2012; Harackiewicz, Barron, Carter, Lehto, Elliot, 1997; Wigfield & Eccles, 2002; Pintrich, 2000c; Schwinger, Steinmayr, & Spinath, 2012; Tuominen-Soini, Salmela-Aro, & Niemivirta, 2012), and so we know very little. The little extant research on this issue has tended to focus on populations of college and middle school students, ignoring adolescents during a critical period in which their motivational beliefs are known to become more salient, better calibrated, and when youth will be familiar with the host of skills and capacities needed for academic success (Caprara, Fida, Vecchione, Del Bove, Vecchio, Barbaranelli, & Bandura, 2008).

Moreover, it has been difficult to identify individuals’ motivational patterns and their influences on outcomes because the statistical and technological sophistication required to perform such analyses have only recently been developed. Clustering techniques that
predominate in motivation research, such as k-means, hierarchical cluster analyses, and median-split techniques are highly subjective, compelling researchers to rely heavily on theory and their own judgment to make decisions concerning profile form and shape. But with the development of more recent model-based statistical techniques, specifically latent profile analysis (Goodman, 2002; McCutcheon, 2002; Vermunt & Magidson, 2002), and technological advancement in computing, it is now possible and less labor intensive to identify patterns, the proportions of the population that are described by these patterns, and their roles in outcomes, from a model-based perspective.

Latent profile analyses rely on fit statistics such as the Akaike information criteria, Bayesian information criterion, and the sample-size adjusted Bayesian information criteria, the parametric bootstrap likelihood ratio test, and others to assist in decisions about how well models fit the data individually and relative to one another (McCutcheon, 2002; Vermunt & Magidson, 2002). Latent profile analysis also generates posterior probabilities, which can be used to determine whether a model accurately classifies individuals into different latent classes (i.e., profiles or patterns) and to determine the proportions of the sample that belong to the various identified classes (Goodman, 2002; McCutcheon, 2002; Vermunt & Magidson, 2002).

In most studies where the relationship between profile or class membership and some outcome variable has been a subject of inquiry, researchers have generally relied on classify-analyze strategies, in which individuals are assigned to a class via maximum-probability assignment or multiple pseudo-class draws (Abar & Loken, 2010; Pastor et al., 2007; Tuominen-Soini et al., 2012). Though informative, these approaches fail to account for the uncertainty or error in class assignment in the latent class model from which class membership is derived. This may result in attenuated estimates of the relation between the latent class variable and the
outcome variable (Asparouhov & Muthén, 2013). This study relies on methods recently introduced by Lanza, Tan, and Bray (2013) and Asparouhov and Muthén (2013) where posterior class probabilities and their concomitant errors are used in Wald’s tests of association to determine the role of class membership in shaping academic achievement and self-regulation.

Examining each of these concerns has theoretical and practical implications, and in order to address these concerns accordingly this study has three major objectives: (a) to identify individually varying motivational patterns or profiles among high school students, (b) to determine how prevalent these patterns are, and (c) to investigate whether and how the respective patterns are related to academic achievement, and to indices of academic self-regulation that shape performance. This study aims to contribute to the literature by using exploratory latent profile analysis techniques to explore central Illinois adolescent high school students’ naturally occurring motivational patterns from a social-cognitive perspective by including academic efficacy, achievement goal orientation, and subjective task-value beliefs as model variables. These beliefs speak to the essential domains of motivation identified in social cognitive theories of motivation (i.e., do I want to perform, what does it take to perform, and can I do it). By employing these variables in latent profile analysis models, this study fills in gaps in the motivational literature concerning the integration of motivational beliefs within and across motivational frameworks, and the motivational culture of high school students. Furthermore, when used in conjunction with academic self-regulation and achievement, the patterns identified in the analyses of this study can speak to whether there are multiple paths (i.e., patterns) to achievement outcomes, and whether particular patterns are better for particular outcomes. Lastly this study will help speak to the preponderance of the respective profiles in the population in order to more accurately describe the adolescent motivational landscape of the U.S.
Chapter 2

Literature Review

High school can be complicated as youth simultaneously negotiate psychological, biological, affective, peer network, and other changes within environments that are often misaligned and ill-equipped to meet their shifting developmental, social, and academic needs. Much of the extant research suggests that this misalignment contributes to declines in learning, academic achievement (Davis, 1994; Garibaldi, 1992; Simmons et al., 1991), and in the quantity and quality of the self-regulatory strategies that influence learning and achievement, often referred to as academic self-regulation (Seidman et al., 1994; Wolters, 2003; Zimmerman, 2000). This relatively poorer performance can deleteriously impact students’ future educational and occupational options, which is critically important to our society (Fouad & Smith, 1996; Juvonen & Graham, 2004; Seidman, Aber, & Allen, 1996). In efforts to address academic achievement among high school students, many educational psychologists have turned to motivational beliefs and the roles they play in academic achievement and academic self-regulation.

Social cognitive theorists contend that academic achievement and academic self-regulation practices are driven by motivation, which results from the interplay between beliefs and actions concerning: what is necessary to obtain desired results (e.g., academic self-regulation, academic engagement, etc.); beliefs about one’s ability or capacity to attain that result (e.g., self-efficacy, self-competence, etc.); and the desire for and value of that result (e.g., goal orientation, subjective task-values). Subjective task-value, achievement goal orientation, academic self-regulation, and academic self-efficacy are among the most prominent contemporary motivational theories (Bandura, 1997; Dweck & Leggett, 1988; Eccles, 1983; Wigfield & Eccles, 2000).
Early academic research on these theories was promising, and focused on exploring relations between the respective motivational beliefs and various academic outcomes, including grade point average and self-regulatory practices (Bandura, 1997; Dweck & Leggett, 1988; Eccles, 1983; Wigfield & Eccles, 2000; Zimmerman, 2000). Even in the relatively small body of motivational literature on high-school students, studies showed that these respective beliefs were consistently related to the same academic outcomes (Conley, 2012, Durik et al., 2006; Hulleman et al., 2008; Senko & Harackiewicz, 2005). Also, relying heavily on variable-centered approaches (e.g., correlation, regression, etc.) relations amongst these beliefs have been established by the research (Cho et al., 2011; Eccles, 1983; Skinner et al., 1990; Wigfield & Cambria, 2010).

Taken together this suggests that it may be important to explore whether and how the respective motivational beliefs work together to shape academic achievement and the behaviors and practices that lead to it. Scholars have called for more research on this issue, arguing that academic behavior is multi-determined and that varying patterns or combinations of motivational beliefs may exist that are more or less optimal for promoting achievement than any single variable (Bouffard & Couture, 2003; Conley, 2012; Eccles, 2005; Hulleman et al., 2008; Hulleman et al., 2010; Liem & Nie, 2008; Pastor et al., 2007; Pintrich, 2000c; Roeser et al., 2008; Wigfield, & Eccles, 2000; Wolters, 2003). For example, Wigfield and Cambria (2010) stated that expectancies (e.g., efficacy beliefs) and values collaborate to direct an individual’s achievement-related practices and outcomes, and further that these beliefs share a relationship with personal goals (i.e., content goals). Pintrich (2000c) suggested that different configurations of achievement goal orientation beliefs are not only possible, but likely, and that these
configurations may have implications for the affective, behavioral, and cognitive pathways students take toward achievement.

Though research on patterns of motivational beliefs (i.e., motivational profiles) is burgeoning there are several gaps in the literature. Foremost, in the motivational research of the past several decades there has been a general tendency among researchers to focus on middle school and college students as populations of interest. However, older adolescents are more likely to exhibit greater motivational complexity and diversity given their expanded cognitive, affective and behavioral repertoires, access to resources, and experience (Fox, Hane, & Pine, 2007; Klaczynski & Cotrell, 2004; Piaget, 1964; Vygotsky, 1978). This is a major concern for the field, as adolescence is considered a unique period during which many motivational beliefs undergo dramatic shifts that are unique to late adolescence (e.g., increased differentiation, salience, and better calibration). Additionally, high schools require that students become much more self-directed than elementary and middle school contexts, thereby heightening the roles that motivational beliefs play in achievement outcomes and processes. This all suggests that the motivational beliefs of high school students are likely to differ from those of elementary- and middle-school students, and should increasingly be a population of interest in future research.

Second, only a handful of studies have sought to identify patterns of motivational beliefs and studies have been inconsistent in the beliefs included in analyses, with some studies focusing solely on variables from one framework, and others using combinations from various frameworks (e.g., Conley, 2012; Harackiewicz et al., 1997; Wigfield & Eccles, 2002; Pintrich, 2000c; Schwinger et al., 2012; Tuominen-Soini et al., 2012). Lastly, it has been difficult to identify individuals’ motivational patterns, determine their prevalence, or explore their influences on outcomes because the statistical and technological sophistication required to
perform such analyses have only recently been developed. While the statistical techniques traditionally employed to explore patterns (e.g., k-means and agglomerative clustering, structural equation modeling, regression, etc.) have been informative, these approaches are variable-centered and highly subjective compelling researchers to rely heavily on theory and their own judgment to make decisions, and cannot be relied upon to address person-centered questions. Another statistical concern is that in efforts to address the association between patterns (i.e., profiles) and outcomes, researchers have generally relied on strategies in which individuals are assigned to a class via maximum-probability assignment or multiple pseudo-class draws (Abar & Loken, 2010; Pastor et al., 2007; Tuominen-Soini et al., 2012). These approaches fail to account for the uncertainty or error in class assignment in the latent class model from which profile membership is derived, which can result in attenuated estimates of the relation between the latent class variable and the outcome variable (Asparouhov & Muthén, 2013). But with the more recent development of statistical techniques in which the error or the probability that people were erroneously classified (Asparouhov & Muthén, 2013; Goodman, 2002; Lanza, Tan, & Bray, 2013; McCutcheon, 2002; Vermunt & Magidson, 2002), and technological advancement in computing, it is now possible and less labor intensive to identify patterns and the proportions of the population they describe, and to explore their roles in outcomes from a model-based perspective.

Given that research on patterns of beliefs is in its nascent stages, the consistent conceptual variation in the extant research, the lack of emphasis on secondary-school populations, and the dearth of statistical approaches which could adequately address these issues in the literature, there is a great deal of uncertainty about the kinds of patterns that are prevalent among our student populations, and about what roles these patterns might play in academic
outcomes and processes. As mentioned above, this study aims to contribute to the literature by using advanced model-based analytic techniques to explore understudied adolescent high school students’ motivational belief profiles (i.e., form, shape, and prevalence) from a social-cognitive perspective, using academic self-efficacy, achievement goal orientation, and subjective task-value beliefs as model variables. This study will explore and discuss the implications these profiles have for motivational theory and their practical implications as well. Furthermore, academic self-regulation and achievement indices are used as dependent variables in analyses of their associations with the respective motivational belief patterns.

Beginning with academic self-regulation, the following section of this paper focuses on the various motivational theories that inform this study, including academic self-efficacy, achievement goal orientation, and subjective task-value theories. Each theory, the respective motivational constructs they proffer, and some of the gaps in the literature are discussed. Another aim of this section is to discuss the evidence concerning the relations between the respective theories’ motivational constructs and academic self-regulation and academic achievement, and the evidence about these constructs’ relations with one another. Lastly, this section of the paper examines the literature concerning the statistical approaches applied to understanding motivational profiles and discusses the advantages of employing latent profile analysis when exploring whether and how these beliefs manifest in combination, as well as when exploring the various associations between motivational profile membership and academic achievement and self-regulation outcomes.

**Conceptualization of Academic Self-Regulation**

Social-cognitive theory contends that motivation plays an important role in shaping learning experiences by directing aspects of students’ academic self-regulation (Pintrich &
DeGroot, 1990; Skinner et al., 1990). Academic self-regulation has been the subject of numerous scholarly inquiries (Bandura, 1997, 2012; Corno & Mandinach, 1983; Fredricks, Blumenfeld, Paris, 2004; Pintrich & DeGroot, 1990; Seaton & Taylor, 2003), which have defined academic self-regulation as a multistage process in which learners direct cognitive, behavioral, and affective effort toward the attainment of some academic goal or goals through interactions with the features of the academic environment (Davis, 1994; Martin, 2005; Schunk, 2005; Zimmerman & Martinez-Pons, 1988).

Cognitive academic self-regulation, as assessed in this study includes organization, rehearsal, and elaboration. Organization is defined as effortful practices such as outlining, clustering, and making connections between related information. Rehearsal involves reciting or naming items from a list to be learned, and is best used on simple tasks in which short-term memory is a sufficient requisite rather than for more long-term or cognitively complex operations (Pintrich, Smith, Garcia, & McKeachie, 1993). Elaboration helps students store information in long-term memory and involves processes such as paraphrasing, summarizing, creating analogies, etc. The metacognitive academic self-regulation indices in this study include critical thinking, and metacognitive self-regulation. Critical thinking refers to the degree to which one applies extant knowledge to new situations or information in order to identify solutions or make decisions. Metacognitive self-regulation involves processes such as planning, goal-setting, monitoring and regulating one’s own psychological and emotional functioning.

Another central component of academic self-regulation includes, resource management. Pintrich et al. (1993) put forth several related concepts including “time and study environment,” which involves planning, scheduling, and managing one’s time and selectively negotiating the contexts in which learning is to take place. Another area of resource management is effort
regulation. Effort regulation is meant to capture a sense of one’s ability and effort to control their effort and attention in the face of disturbances and distractions. Peer learning captures the extent to which students engage their social networks of peers in their learning by sharing and discussing ideas, tasks and more. There is a help-seeking scale that is meant to assess students’ perceptions of their efforts to enlist the support of others (e.g., peers, teachers) when needed. However, this measure has been criticized for its inability to distinguish between forms of help-seeking that are more expedient (e.g., asking for answers, and effort reduction), and forms of help-seeking that are better for learning and improved skill (e.g., adaptive help-seeking). Given this disadvantage this scale was not included in the study.

Bandura (1997) suggests that many different school activities share an emphasis on certain skills that are developed concurrently, particularly when commonalities exist across activities and contexts. This study uses a composite of grades (i.e., self-reported grade point average) across various academic domains (e.g., math, science, English, etc.), and broad conceptualizations of motivational beliefs, and thus it is best to employ a generalized (i.e. cross-domain) conceptualization of academic self-regulation. Pintrich, Smith, Garcia, and McKeachie (1993) developed the Motivated Strategies for Learning Questionnaire (MSLQ). This is one of the most widely used measures of academic self-regulation and it is adopted in this study for its comprehensive assessment of academic self-regulation.

Research continues to buttress the claims of the importance of academic self-regulation for learning, but very little of this research has focused on students in high school who face the demands of larger class sizes, less teacher support, and unfamiliar and more competitive academic standards than in elementary school, all of which markedly impact academic self-regulation (Blatchford, Bassett, & Brown, 2005; Ryan & Patrick, 2001). This study contributes
to the literature by conducting a comprehensive exploration of academic self-regulation among high school students, and its relations to patterns of motivational beliefs that have heretofore not been examined in the literature.

**Conceptualizations of Academic Achievement Goal Orientation**

The earliest iteration of achievement goal orientation theory (also referred to as normative goal, or classical goal theory, see Cho et al., 2011; Pintrich & Zusho, 2002) held that two primary achievement goals existed, mastery and performance goal orientations (Dweck & Leggett, 1988; Nicholls, 1984). Mastery orientation was conceptualized as a focus on developing academic competence over time, improving learning, and understanding tasks according to personal standards or by meeting task based criteria (Ames, 1992; Nicholls, Cheung, Lauer, & Patashnick, 1989; Pintrich, 2000a). Early work on performance goals suggested that those who endorse them are primarily concerned with a normative focus on demonstrating academic ability, appearing smart, obtaining favorable social judgments, and avoiding the appearance of incompetence. While normative goal orientation theory proposed a relatively clear set of relations between goals and outcomes, researchers noted that this two dimensional model might prove to be an oversimplification and called for further research (Elliot, McGregor, & Gable, 1999; Elliot & Mapes, 2005). Reviews of the literature, conducted by Hulleman, Schrager, Bodmann, and Harackiewicz (2010) and by Senko, Hulleman, and Harackiewicz (2011) provided broad overviews of goal orientation research and both contended that the connections between goals and outcomes were more complicated than initially suggested by normative goal orientation theory.
Revised goal orientation. Revised goal theory was offered as a reconceptualization of normative goal theory, in part to address the inconsistencies obtained in earlier goal orientation research. This iteration bifurcated the goal constructs into approach and avoidance forms producing performance-approach, performance-avoidance, mastery-approach, and mastery-avoidance orientations (Elliot et al., 1999; Elliot & Harackiewicz, 1996; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Pintrich, 2000a). Performance-approach refers to the goal of demonstrating ability, performing better than others, and attaining favorable judgments based on normative standards of competence. Performance-avoidance goals reflect a desire to avoid failure, and judgments of inability and incompetence relative to others (Elliot et al., 1999; Elliot & Church, 1997). Mastery-approach goals are defined as entailing a focus on attaining a task-based or intrapersonal competence (e.g., striving to learn, personal growth, and improved performance), usually pursued based on personal interest and curiosity (Campbell, Barry, Joe, & Finney, 2008; Cury, DaFonseca, Zahn, & Elliot, 2008; Hulleman et al., 2010; Muis, Winne, & Edwards, 2009). Mastery-avoidance goals, the newest dimension of the goal orientation framework, focus on avoiding misunderstanding, losing skill or proficiency, or avoiding task-based incompetence, and is undergirded by a sense of fear and anxiety (Cury et al., 2008; Elliot et al., 1999; Elliot & McGregor, 2001; Pintrich, 2000c). Mastery-avoidance has been underutilized, in part because it is a relatively newer construct, and in part because of concerns about its conceptualization (Madjar, Kaplan, & Weinstock, 2011; Pintrich, 2003). Researchers also contended that mastery-avoidance goals were inappropriate for young children who were not likely to have developed enough skill and experience to fret over losing them, and others criticized it for being indistinguishable from perfectionism orientation, and performance-avoidance goals (Bodmann, Hulleman, & Schrager, 2007; Pintrich, 2003). Despite these early
concerns, scholars continued to explore the mastery-avoidance construct in US and international samples and have found it to be a valid and reliable construct, distinct from the other goal orientation beliefs via path and factor analyses (Conroy, Elliot, & Hofer, 2003; Finney, Pieper, & Barron, 2004; Elliot & McGregor, 2001; Kaplan, 2007; Pastor et al., 2007).

Revised goal orientation’s relations with achievement indices and academic self-regulation. Extant studies on this goal indicate that due to its emphasis on worry and anxiety it is either unrelated to, or negatively associated with grades (Baranik, Stanley, Bynum, & Lance, 2010; Bodmann et al., 2007; Cury et al., 2008; Elliot et al., 1999; Elliot & McGregor, 2001; Hulleman et al., 2010) and exam and overall class performance (Baranik et al., 2010; Elliot & Murayama, 2008; Putwain, Sander, & Larkin, 2013; Yeo, Loft, Xiao, & Kiewitz, 2009). Findings across studies tend to indicate that overall, mastery-avoidance goals have a deleterious impact on academic self-regulation. More specifically, positive associations have been reported between maladaptive cognitive learning strategies and mastery-avoidance (Baranik et al., 2010; Madjar et al., 2011). Help-seeking and other adaptive forms of academic self-regulation have been negatively associated with mastery-avoidance as well (Elliot & McGregor, 2001; Kaplan, 2007). Given its centrality to achievement goal theory, the enhanced possibility of examining this phenomenon among secondary students, and the growing evidence of the construct’s validity it is included in this study. The Achievement Goal Questionnaire (Elliot & McGregor, 2001) has been the most widely used tool for assessing mastery-avoidance goal orientations. Though more recent iterations of this measure have been created and have generated some evidence of reliability and generalizability (Elliot & Muruyama, 2008), this work is still in its nascent stages and thus this study uses the earlier iteration (Elliot & McGregor, 2001), in its assessment of mastery-avoidance among high school students.
Under revised goal orientation theory, mastery-approach has enjoyed considerably more attention than mastery-avoidance, and the findings have mirrored those of the normative goal theory. As noted above, the literature generally indicates that this goal has a positive effect on effort, persistence, involvement, deep learning strategies, high self-monitoring, control of cognition, persistence, self-evaluation of comprehension etc. (Kaplan, Lichtinger, Gorodetsky, 2009; Pajares, Britner, & Valiante, 2000), but findings about its relations with academic achievement have vacillated between being positive and unrelated (Anderman & Young, 1994a; Elliot & Harackiewicz, 1996; Middleton & Midgley, 1997). One credible explanation for these varied findings emerged from early work on normative goals which held that mastery goals were driven by personal interest which does not always require one to earn high academic scores or even to attend to all of the material presented to them. Moreover, reaching a personal academic milestone on a particular achievement indicator does not necessarily mean that youth will earn a high honor on that indicator.

Elliot and Dweck (2005) proposed that performance-avoidance goals create disadvantages for students because they entail a salient desire to avoid undesirable outcomes and a salient focus on social comparison, which often culminates in increased anxiety, effort withdrawal, challenge avoidance, and self-handicapping, particularly in cases where students lack confidence. Performance-avoidance goals have been linked to increased use of inappropriate study strategies (Bouffard & Couture, 2003; Elliot et al., 1999), interference with task-focus (Senko et al., 2011), effort withdrawal and avoidance coping, and lower academic engagement (Lau, & Nie, 2008), and they are consistently associated with poorer academic achievement outcomes (Bouffard, Vezeau, & Bordeleau, 1998; Elliot & Harackiewicz, 1996; Middleton & Midgley, 1997; Yeo, Sorbelo, Koy, & Smillie, 2008). Elliot, McGregor, and Gable (1999)
averred that in the approach dimension of performance goals, competitive desires to be better than others drive behavior, and that this positive valence would likely produce adaptive responses in order to realize the goal, which has generally been supported in subsequent research (Barron & Harackiewicz, 2001; Bouffard & Couture, 2003; Cho et al., 2011; Conley, 2012; Elliot & Dweck, 2005; Muis et al., 2009). For example, Senko and colleagues (2011) found positive relations between successful problem-solving and performance-approach goals, and Bouffard, Vezeau, and Bordeleau (1998) found that this goal positively related to higher overall academic performance. Given the generally consistent trend of positive associations between this goal and achievement outcomes, it seems reasonable to expect consistent positive relations with students’ academic self-regulation. However, in a number of studies it has been negatively linked with academic self-regulation indicators, such as reductions in adaptive help-seeking (Anderman, Griesinger, & Westerfield, 1998; Harackiewicz et al., 1997; Middleton & Midgley, 1997; Ryan & Pintrich, 1998). Incorporating the approach-avoid distinction into achievement goal orientation theory has proven beneficial in answering some important questions about inconsistencies identified in the early normative goal orientation literature, but a number of questions remain while new ones have been generated.

Multiple goals perspective. Some empirical evidence indicates that pursuing one type of goal does not preclude the pursuit of others (Harackiewicz et al., 1997; Middleton & Midgley, 1997; Pintrich, 2000c). Pintrich (2000c) also stated that because of the evidence of these goals’ respective influence on various achievement outcomes, optimal motivation might require goal combinations. Other scholars have echoed this point, arguing that it is important to examine whether and how these goals work together in order to identify combinations that may be more or less optimal for promoting achievement, and may help to explain some of the inconsistencies.
that have been found (Hulleman et al., 2010; Pastor et al., 2007). This approach has come to be known as the multiple goals perspective (Barron & Harackiewicz, 2001; Cho et al., 2011; Harackiewicz & Linnenbrink, 2005; Nicholls et al., 1989; Pintrich, 2000c; Zusho & Barnett, 2011).

Research on the multiple goals perspective has gained some traction and several studies have established that these beliefs do manifest in various combinations, though the findings have been inconsistent in that they have not all identified the same combinations. Some studies have found that mastery-approach and performance-approach goals are correlated particularly for college-aged students (Elliot & Church, 1997; Elliot & Harackiewicz, 1996), where others have found low or insignificant relations. Mastery goals have also exhibited negative and null relations with performance-avoidance goals (Dweck & Leggett, 1988; Harackiewicz et al., 1997). Using a median-split approach in one of the earliest studies of the multiple goals phenomena, Pintrich (2000c) found that students’ could be characterized by several different patterns, including a sole mastery-approach focus, combinations of mastery and performance-approach goals, or a strict performance-avoidance orientation. Other studies have corroborated these results with similar findings (Luo, Paris, Hogan, & Luo, 2011; Pastor et al., 2007; Tuominen-Soini et al., 2012), however the inquiries into the multiple goals perspective have generally applied variable-centered statistical techniques, such as correlation, regression, path analyses, etc. This has produced a number of interesting findings that suggest that these social-cognitive constructs relate to, and shape various outcomes. Variable-centered approaches permit conclusions about variables rather than about how these variables manifest, relate and function together within individuals, a task which is better performed by person-centered analyses (Goodman, 2002, Vermunt & Magidson, 2002).
This study seeks to make contributions to this literature in several ways. First it employs the *Achievement Goal Questionnaire* to assess mastery-avoidance, as few studies have included this construct in their assessment of goals, in order to shed light on its utility and prevalence in various model-identified groups of students. This study will also use the *Patterns of Adaptive Learning Strategies* questionnaire (Midgley, Maehr, Hruda, Anderman, Anderman et al., 2000) to measure the generalized mastery-approach, and both the avoidance and approach dimensions of performance goals. Achievement goal orientation research has also insufficiently explored the full set of beliefs among high school students, which has inhibited the understanding of how these beliefs function during this period. This study will contribute to this area by examining goals and goal patterns, among an understudied population, in conjunction with the critical subjective task-value and ability beliefs that are central to social-cognitive theory’s conceptualization of motivation. Please note that the relations these goals share with academic self-efficacy and subjective task-value variables in this study are included in the discussion below.

**Conceptualization of Academic Self-Efficacy**

Expectancy-value theory (Eccles, 1983; Wigfield & Eccles, 2000) conceptualizes self-efficacy as an expectancy belief that reflects individual’s notions about their ability to complete a task. Academic self-efficacy refers to students’ judgments about their abilities to complete their schoolwork successfully and focuses on their perceptions and feelings regarding their capabilities to perform to a standard across a variety of academic settings, domains, and tasks (Alspaugh, 1998; Bandura, 1986; Chen, 2003; Schunk, 1991, 2003). The proposition is that this factor works by influencing aspects of cognition, affect, behavior, and achievement (Bandura,
People with higher levels of academic self-efficacy believe that they are more capable of accomplishing their academic goals than those with lower levels, and thus are more likely to display the behaviors, and beliefs which will heighten the probability of attaining those goals (Bandura, 1993; Pajares & Graham, 1999; Wettersten, Guilmino, Herrick, Hunter, Jagow et al., 2005). Bandura (1997) suggested that in schools, individuals are likely to develop a generalized sense of ability when activities share similar subskills, when skills are developed concurrently, or when commonalities exist across diverse activities. As high school is one such context, this study employs the generalized conceptualization of academic self-efficacy offered by the *Patterns of Adaptive Learning Strategies* questionnaire (Midgley et al., 2000).

**Academic self-efficacy relations with academic achievement and academic self-regulation.** Investigations of the relations between academic self-efficacy and various measures of academic achievement have consistently found that efficacy is significantly related to indices of academic performance (Chen, 2003, Gutman & Midgley, 2000; Pajares & Graham, 1999; Pintrich & DeGroot, 1990; Roeser, Midgley, & Urdan, 1996; Saunders, Davis, Williams, & Williams, 2004). For example, Roeser, Midgley, and Urdan (1996) found that academic self-efficacy is positively related to annual grade point average. Gutman (2006) and Chen (2003), found math self-efficacy was related to math G.P.A. and standardized math test scores, respectively.

**Academic self-efficacy relations with academic self-regulation.** According to efficacy theory (Bandura, 1986), the higher one’s efficacy the more likely they are to display adaptive academic self-regulation patterns, and much of the research has found that indeed academic self-efficacy and various aspects of academic self-regulation are positively and significantly related.
For example, in a study using one time point, Miserandino (1996) found that students who held high beliefs in their ability were more likely to report higher participation, and persistence. However, when examining the literature on efficacy beliefs, as with goal orientation research, not much attention has been given to the high school years, and even less focuses on the role it plays in motivational profiles (Conley, 2012).

**Academic self-efficacy’s relations with achievement goals.** The majority of research that has explored the relations between achievement goals and academic self-efficacy has relied on correlation and various forms of regression analysis (Bong, 2001; Bouffard & Couture, 2003; Cho et al., 2011). Many of these studies proposed and found positive relations between academic self-efficacy and the approach forms of goals based on the perceived role that confidence plays in adopting and pursuing these goals. Moreover the avoidance goals were thought to be negatively related to academic self-efficacy, as the desire to avoid was driven by anxiety and fear both of which are antithetical to confidence. The results were inconsistent with some studies finding negative associations between academic self-efficacy and avoidance goals (Bong, 2001), some finding no relationship (Nicholls, 1984), and others finding marginally positive relations (Cho et al., 2011; Nicholls et al., 1989). The relationship of self-efficacy and mastery-avoidance goals has been a little examined area of inquiry (Hulleman et al., 2010; Wigfield et al., 2006) and thus it is difficult to postulate how these two constructs would relate. It is important to note here that efficacy and goal orientation beliefs may work together for some people and not for others to influence outcomes, but variable-centered approaches cannot answer this question and thus more person-centered research is needed to speak to these issues. Altogether, investigating these relations can be useful in enhancing favorable academic outcomes, and in improving the processes by which these outcomes are attained. I hope to contribute to this body of research by
examining whether and how academic self-efficacy manifests in combination with the various achievement goal orientation constructs and task-value beliefs.

**Conceptualization of Task-Values**

Task-values are indicative of the value component of expectancy-value theory. It is comprised of four separate types of values: utility, intrinsic, and attainment values, and cost perceptions (Eccles, 1983; Pekrun, 2006; Wigfield & Eccles, 2002). Intrinsic value represents the intrinsic reasons, such as enjoyment and fulfillment that an individual has for engaging in an activity. Utility-value refers to how useful an activity, task, or outcome is for reaching some goal(s). Attainment-value is represented by the importance one places on doing well on a task in terms of their self-schema or identity. Lastly, cost refers to sacrifices (e.g., time, energy, etc.) that individuals make in order to engage in an activity in a task. There have been a few attempts to assess cost (Bong, 2001; Conley, 2012; Cox 2004), but there are few measures of cost that have been sufficiently validated, and there has been some inconsistency in the measures used, thus this study will omit this construct from further consideration.

Values are most often assessed within the domains of academic subjects (e.g., math, English, history, science, etc.) but there is support for a generalized form of subjective task-values when conceptualized as reflecting cross-domain academic beliefs (Graham, Taylor, & Hudley, 1998). For example, a number of scholarly works have described the importance of task-values for decisions to participate and persistence across a variety of subjects (Cole, Bergin, Whittaker, 2008; Durik et al., 2006; Simpkins et al., 2006), suggesting that this construct can be applied across subjects. This study utilizes a modified version of the *Competence Beliefs and*
Subjective Task Values Questionnaire (Eccles, Wigfield, Harold, & Blumenfeld, 1993) to measure generalized forms of task-value beliefs.

**Subjective task-values’ relations with academic achievement and academic self-regulation.** Zimmerman (2000) discussed the role task-values have in academic self-regulation, stating that if students do not value the tasks in which they are engaged, they are less likely to make study plans, set learning goals, or adopt strategies that will ensure success. Wigfield and Eccles (1992) contend that intrinsic-value for an activity will impact students’ choices to participate in an activity they enjoy, a claim that has been substantiated repeatedly across various domains (Durik et al., 2006; Pintrich & DeGroot, 1990; Simpkins, Davis-Kean, & Eccles, 2006). Pintrich and Degroot (1990) found evidence that task importance—a combination of utility values and attainment values—was positively related to the use of cognitive strategies. With respect to subjective task value and achievement, Cole, Bergin, and Whittaker (2008) found a significant positive relationship between task importance and achievement test scores. A meta-analysis of task-values conducted by Hulleman and colleagues (2010) found that utility-values predicted performance, and better than attainment or intrinsic values.

**Subjective task-values’ relations with academic self-efficacy.** Subjective task-values studies have more consistently explored the connections between values and self-efficacy, perhaps due to the fact that expectancy beliefs are an essential part of the expectancy-value framework from which subjective task-values emerge (Bong, 2001; Cox & Whaley, 2004; Durik et al., 2006; Eccles, 1983). Efficacy beliefs tend to share a positive relationship with subjective task-values, particularly intrinsic- and utility-values (Bong, 2001; Eccles et al., 1993). In several studies of middle school students using multiple regression and cluster analysis, Bong (2001) and Conley (2012) observed these positive relations. Eccles and colleagues (1997) proposed that
among younger students this is due to the greater emphasis placed on enhancing students’ sense of competence through self-referenced improvement, lower emphasis on competition in classrooms and engaging in the work for the sake of enjoyment. They proposed that as students get older, efficacy and values enjoy a reciprocal relationship, whereby successful learning and performance improves efficacy and one’s general sense of self-worth, which enhances the value of engaging in the tasks and the desire to perform successfully.

Subjective task-values’ relations with achievement goals. Early consensus in the literature on the relationships between achievement goal orientations and subjective task-values was that approach goals would be positively related to subjective task-values, based in part on the notion that pursuing a desired goal implies a value for particular outcomes. However subsequent findings indicated that mastery-approach is most closely and positively linked with intrinsic-values where performance-approach goals are more closely linked to attainment and utility values (Conley, 2012; Hulleman et al., 2008; Liem & Nie, 2008). Hulleman, Durik, Schweigert, and Harackiewicz (2008) proposed that these associations were likely due to the conceptual overlap between goal orientations and values within the social-cognitive framework, that is they share an emphasis on desire. Senko and Harackiewicz (2005) commented on the close positive associations found between mastery-approach and intrinsic-value arguing that this is due to a mutual focus on engaging in tasks for the sake of self-improvement and personal enjoyment. However, because of the consistent reliance on variable centered analytic approaches, it is not clear how prevalent these relations are in the population, and while these are theoretically sound explanations more work is needed to substantiate these claims among older students.
In summary, achievement goals, academic self-efficacy and subjective task values have a lengthy record of influencing academic performance and various forms of academic self-regulation, and many of these beliefs share mutual associations and relationships. Shared influence among motivational beliefs, and associations between these beliefs and academic achievement and academic self-regulation, intimate that together these beliefs may form patterns that may be observed. However there are several concerns that necessitate further inquiry. First, for each of these beliefs there is a marked dearth of research on high school students. This is problematic because they tend to exhibit unique motivational trends across each of the respective motivational beliefs of interest in this study, in comparison to middle school and college students. Additionally the findings suggest that these beliefs are complexly related, and intimate that there may be multiple individually varying motivational patterns. As a result, calls have been made for more research that integrates these constructs to provide a more comprehensive picture of how these beliefs work together (or fail to work together) to produce outcomes (Bouffard & Couture, 2003; Conley, 2012; Liem & Nie, 2008; Pintrich, 2000a; Pintrich & DeGroot, 1990; Roeser, Eccles, & Sameroff, 1998; Wigfield & Eccles, 2002).

Motivational Beliefs Patterns

Researchers are increasingly heeding this call and have shown that ensuring academic success in high school is a complicated matter (Abar & Loken, 2010; Barron & Harackiewicz, 2001; Bouffard & Couture, 2003; Conley, 2012; Harackiewicz et al., 2002; Harackiewicz & Linnenbrink, 2005; Liem & Nie, 2008; Pintrich, 2000c; Pintrich & DeGroot, 1990; Roeser et al., 1998; Wigfield & Cambria, 2010; Wigfield & Eccles, 2002). Conley (2012) included ability, value beliefs (including cost), and goal orientations in a cluster analysis of middle-school
adolescents’ motivational profiles and explored their relations to psychological distress and performance. She identified seven clusters that were more or less adaptive for students’ emotional well-being and academic performance, noting that there were multiple paths to various levels of performance. Supporting the multiple goals perspective, the clusters indicated that there were groups of youth who were characterized by a single dominant goal, and others who were driven by multiple goals. Both groups were equally effective in producing benefits for achievement and emotional well-being. Moreover, the value and goal beliefs were more powerful together than either in isolation, supporting the idea that integrating motivational beliefs may prove beneficial. Bouffard and Couture (2003), also conducted a cluster analysis that integrated efficacy, goal, and value beliefs among adolescents in a Montreal high school on different educational tracks (i.e., accelerated, regular, and remedial for students with learning disabilities). They found that youth displayed several distinct profiles (i.e., high, low, and mixed) that were differentially yoked to performance across subjects and educational tracks. However, they also found that academic self-efficacy beliefs were a distinguishing factor, in that those with higher competence beliefs experienced greater academic success regardless of goal orientation. Daniels and colleagues (2008) conducted a cluster analysis on the multiple goals perspective among college students and compared the patterns of their relations with emotional well-being and performance. They found four profiles (i.e., high mastery and performance goals, high mastery only, high performance only, and low mastery and performance). The high groups exhibited equal levels of performance, but the students in the performance-approach and performance-avoidance only cluster were characterized by markedly lower emotional well-being.

While this research has been informative, our understanding of these patterns among adolescents remains limited. Variables used as cluster indicators have varied across studies, and
only a few investigations have attempted to integrate constructs across the dimensions of motivation (Bouffard & Couture, 2003; Conley, 2012; Liem & Nie, 2008; Roeser et al., 2008). Several of these studies have explored profiles among high school students, thereby addressing a major concern of the literature more broadly. However more work in this area is needed. In addition, the clustering techniques that have dominated are less than ideal for identifying profiles because of their reliance on highly subjective decision-making processes. As a result, instead of relying upon statistics to guide decisions, researchers typically examine different cluster solutions, relying on theory and their own judgment to make decisions concerning which clusters to interpret and how to interpret them. Klusmann, Kunter, Trautwein, Ludtke, and Baumert (2008) and Schwinger, Steinmayr, and Spinath (2012) noted that such analytical subjectivity makes it difficult to summarize across studies. The high subjectivity and poor generalizability of these cluster analytic approaches, and the recent availability of clustering software (which eases the computational burden of model-based procedures) have led some motivation researchers to turn to model-based cluster analytic techniques, such as latent profile analysis (see, Abar & Loken, 2010; Huang, Wang, Hsu, 2011; Liu, Wang, Tan, Koh, & Ee, 2009; Luo et al., 2011; Pastor et al., 2007; Schwinger et al., 2012; Tuominen-Soini et al., 2012).

**Latent Profile Analysis**

While latent profile analytic techniques have been available since the early 1970s, it is computationally intensive, particularly when introducing larger models with increasing numbers of parameters and bootstrapping procedures. Thus researchers are only beginning to employ these methods in their efforts to understand individual variability in patterns of responses with the relatively recent advent and availability of computers and software. Latent profile analysis is
a latent variable modeling technique that aims to identify the smallest number of clusters of observations that are qualitatively distinct from others, that is individuals in one cluster have similar values on cluster indicators compared to individuals from other clusters (Klusmann, Kunter, Trautwein, Ludtke, & Baumert, 2008; Vermunt & Magidson, 2002), however it offers several benefits traditional clustering techniques cannot.

One advantage of latent profile analysis is its model-based nature, and its relatively heavier reliance on fit statistics such as the Bayesian Information Criterion, Akaike Information Criteria, Sample-Size Adjusted Bayesian Information Criteria, and tests of model fit like the Lo-Mendell-Rubin likelihood test and the Bootstrap Likelihood Ratio Test in determining how well the models fit the data. The various information criteria can be used to compare the relative fit of models, with lower values representing models with better fit to the data than higher values. In the Lo-Mendell-Rubin and parametric bootstrap likelihood ratio test tests the loglikelihood values that are calculated for the respective nested models. The difference between them is calculated and compared to a chi-square distribution based on the difference in the degrees of freedom between the two models, and a p-value is calculated with values equal to or lower than .05 suggesting that the null model be rejected in favor of the alternative model (i.e., with the larger number of clusters). Similar to Lo-Mendell-Rubin test the parametric bootstrap likelihood ratio test calculates a test statistic of difference and a p-value for the nested models, but unlike the Lo-Mendell-Rubin it uses the model and the parameter estimates drawn based on the null model to calculate multiple datasets of values on the variables of interest. It then creates a mixture distribution of the parameter estimates derived from those data, and compares them to the parameter estimates created by the alternative model (Nylund, Asparouhov, & Muthén, 2007). This method has become increasingly popular and studies have compared this test to
others and found it to be the most robust and consistent even in smaller samples (e.g., \( n < 200 \), see Lanza, Tan & Bray, 2013), thus it will be relied upon in this analysis to help guide decisions about model fit and model selection, along with the various information criteria.

Latent profile analysis also produces classification statistics including class membership probabilities, conditional probabilities and summary classification entropy statistics, which assist in making decisions about how useful the models are for determining the prevalence and utility of the clusters (McCutheon, 2002; Vermunt & Magidson, 2002). The class probabilities provide the proportions of people in the sample who are members of the respective classes in the model and can be thought of as percentages. Because people are assigned to clusters based on probabilities, it is possible for them to be misclassified. Thus their conditional probabilities for being assigned to other classes are also calculated and used as an indication of how well the models classify individuals. Ideally the probability for being assigned to a class should be the highest for those who have been assigned to that class with values of .8 considered to be accurate, and values of .9 or higher considered highly accurate. Entropy statistics are used as a way of summarizing the overall classification utility of the model with values of .8 or higher considered highly accurate models. Each of these classification criteria will be used to guide decisions concerning the utility of the model.

**Latent Profile Analysis and Tests of Association With Outcomes**

Lastly latent profile analysis also offers the advantage of using posterior probabilities of class membership in tests of association between profile membership and various outcome variables. Here some outcome variable is regressed on class-membership (using the probabilities of being misclassified as error terms) to determine the extent to which class membership is
related to that outcome. Another important advantage of latent profile analysis over other clustering techniques is that it allows for the use of data that have been measured on different scales which is a factor in this study (i.e., 5 point scales for academic self-efficacy, mastery-approach, performance-approach, and performance-avoidance, and 7 point scales for mastery-avoidance, attainment-value, intrinsic-value, utility value, and each academic self-regulation indicator). Given its flexibility and model-based nature latent profile analysis has been chosen as the method to address the central questions and hypotheses of this paper.

**Research Questions and Hypotheses**

Recent emphasis in public education policy focuses the nation’s attention on enhancing our children’s abilities to think critically, solve problems, communicate, collaborate, and to be creative and innovative in an increasingly fast paced world in which relations between individuals and systems are proliferating. This state of affairs compels scholars to understand the world considering more than one factor at a time. Given this complexity this study asks whether adolescent motivation can be characterized by integrating motivational constructs across each of the areas of motivation. Toward this end, this exploratory study uses latent profile analysis to identify and explore the motivational profiles of high school students, using achievement goal orientation (i.e., mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance), academic self-efficacy, and task-value beliefs (i.e., utility, attainment, and intrinsic values) as variables. Based on earlier findings, the first hypothesis states that there are multiple patterns of students’ motivational beliefs that can be identified. As discussed above, earlier research has shown that individuals’ levels on these beliefs vary with some reporting high, moderate, or low scores on the respective constructs. Given the number of possible combinations and the lack of empirical evidence about motivational profiles, no further hypotheses are offered.
concerning exactly how belief patterns will manifest. However, the hope is that this strategy will speak to the types of motivational profiles that are naturally occurring, and may provide evidence that can inform discussions about how motivational frameworks can be integrated, and have practical implications as well.

The second research question asks what proportions of the sample can be accurately described by these profiles in order to shed light on the extent to which these patterns manifest in the population. Numerous profiles could potentially be identified and there is a dearth of evidence that speaks to this issue thus no hypotheses are offered concerning the proportions of the sample that can be classified accurately by these profiles.

The associations that these profiles have with academic self-regulation and academic achievement is the last central concern of this study and the final research question asks whether and how the respective motivational profiles are related to various academic self-regulation indices and achievement, in order to speak to their relative levels of adaptiveness for academic outcomes. One hypothesis is that profile membership will relate to academic achievement and academic self-regulation. Along these lines, I propose that there are multiple motivational profiles that are equally effective at producing similar academic self-regulation and achievement outcome levels. As it is not clear how the patterns will manifest no hypotheses are offered concerning how they will relate to outcomes.
Chapter 3

Methods

School Context

Data for this study were collected as part of the Teen Student Beliefs and Practices Survey which examined the motivational beliefs, behaviors, and performance of high school students in the middle of the fall 2013 semester (i.e., grade point average in the Fall 1st quarter) and at the conclusion of the prior semester (i.e., Spring 4th quarter). Students were recruited from a high school in the Midwestern United States, in a predominantly low-income non-metropolitan urban community. The average rate of eligibility for free or reduced-fee lunch was 65%. The school population was characterized as 37% African American students, 4% Asian American, 42% European American, 10% Latino American, and 7% other.

Participants

This high school study included 297 student participants (55% females, 45% males) from each grade (26% freshmen, 44% sophomores, 11% juniors, 18% seniors) across academic ability groupings. The sample was comprised of 27% African Americans, 4% Asian Americans, 37% European Americans, 6% Latino Americans, and 20% other, and the mean participant age was 15.4 years old. These demographic data were not included in the analyses.

Procedure

If caregivers did not want their student to participate in the study, they were asked to return the signed opt-out parental consent forms to their student’s classroom, to contact the
school, or members of the research team. Less than 1% of the forms were returned and student assent was obtained from all participants. Students were surveyed in the school’s computer lab in one 40-minute session during regular class periods in the first quarter of the fall 2013 semester. Instructions and items were read aloud while students read along and responded. An additional administrator scanned the room for assistance. Students were told that the purpose of the survey was to find out about their beliefs and behaviors, that participation was voluntary, and that the information in the survey was confidential (i.e., de-identified, secured, and reported in aggregate). One additional session was scheduled to administer surveys for students who were absent for the initial administration.

Measures

**Demographics.** Gender (female = 0, male = 1), race/ethnicity (1 = African American, 2 = Asian American, 3 = European American, 4 = Indian American, 5 = Latino American, 6 = Native American, 7 = Native Hawaiian, 9 = other), age (13-18), and year in school (freshman = 1, sophomore = 2, junior = 3, and senior = 4) were the only demographic data collected.

**Academic self-efficacy.** The measure of students’ academic self-efficacy (5 items, alpha = .78) rates students’ judgments of their capability to complete their schoolwork successfully and was taken from the *Patterns of Adaptive Learning Survey* (Midgley et al., 2000). A sample item is “I’m certain I can figure out how to do even the most difficult school work.” Beliefs were measured on a five-point likert scale (1 = “Not at all true,” 3 = “Somewhat true,” and 5 = “Very true”).

**Subjective task-values.** This study uses the *Self- and Task-Perception Questionnaire* to measure students’ general academic task-value beliefs, including utility-value (2 items, alpha =
.62), attainment value (3 items, alpha = .70), and intrinsic value beliefs (2 items, alpha = .76). A seven-point likert scale is used for each of these variables. An example of attainment value is, “I feel that, to me, being good at solving problems is,”… (1 = not at all important, to 7 = very important). “How useful is what you learn in high school for your daily life outside school?” (1 = not at all useful, to 7 = very useful), and “In general, I find working on school assignments (1 = very boring, to 5 = very interesting) are examples of utility value and intrinsic value (respectively) assessed across academic subjects.

Achievement goal orientations. The measures of students’ mastery-approach, performance-approach, and performance-avoidance goal orientations are adapted from the Patterns of Adaptive Learning Strategies questionnaire (Midgley et al., 2000), and the mastery-avoidance goal orientation scale is taken from the Achievement Goal Questionnaire (Elliot & McGregor, 2001). Mastery-approach goal orientation is assessed with a five-item scale (alpha = .85), and a sample item says, “An important reason I do my class work is because I enjoy it.” Performance-approach goal orientation is measured by 5 items (alpha = .89), and an example is, “I would feel successful in class if I did better than most of the other students.” Performance-avoidance goals capture students’ desire to avoid the demonstration of incompetence, and it is captured via a 4-item scale (alpha = .74). An example is, “One of my main goals is to avoid looking like I can’t do my work.” Each goal is measured on a five-point likert scale (1 = “not at all true of me, to 5 = “very true of me”). Mastery-avoidance orientation is assessed using an adapted version of the three-item scale from the Achievement Goal Questionnaire (Elliot & McGregor, 2001) which measures beliefs using a 7-point likert scale (1 = not at all true of me, to 7 = very true of me) and an example item says, “I am definitely concerned that I may not learn all that I can this semester.” The adaptations included measuring general beliefs related to
academics and using more accessible language for high school students (Finney et al., 2004). This scale has been validated in US and international samples, with diverse ethnic groups, and found to be reliable (alpha = .88).

**Academic self-regulation.** The final cluster solutions were examined for differences in their relations with academic self-regulation indices. Students reported on eight facets of their academic self-regulation: rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, resource management (i.e., time and study environment), peer learning, and effort regulation. Items from the *Motivated Strategies for Learning Questionnaire* were used (see Pintrich et al., 1993). A sample item for rehearsal is “When I study for my classes, I practice saying the material to myself over and over.” The scale has 4 items and was found to be reliable (alpha = .69). Students’ elaboration was assessed using a 6-item scale (alpha = .76), and an example item says, “When reading for my classes, I try to relate the material to what I already know.” Organization was assessed using a 4-item scale (alpha = .64), asking questions like, “When I study for my courses, I go over my notes and make an outline of important concepts.” “I often find myself questioning things I hear or read in my course to decide if I find them convincing,” is one item of 5 (alpha = .80) used to explore critical thinking. The metacognitive self-regulation scale has 12 items (alpha = .79), including “When studying for my courses I try to determine which concepts I don't understand well.” Students must be able to manage and regulate their time and their study environments, so to assess time and study environment the *Motivated Strategies for Learning Questionnaire* employs an 8-item scale (alpha = .76). “Time and study environment” was measured with items such as “I attend classes regularly,” and “I make good use of my study time for my courses.” Effort regulation is measured using a 4-item scale (alpha = .69), and “I work hard to do well in my classes even if I don't like what we are
doing,” is a sample item. Peer learning, that is collaborating with one's peers, has been found to have positive effects on achievement, and is measured by a 3-item scale (alpha = .76). A sample item is, “When studying for my courses, I often set aside time to discuss the course material with a group of students from my classes.”

Each of the items associated with the respective academic motivational beliefs and self-regulatory scales were summed for an overall sum-scale score, rather than using averages as these may result in attenuated parameter estimates (Bolck, Croon, & Hagenaars, 2004).

**Achievement.** Students self-reported their estimated quarterly grade point average for the first quarter of the Fall 2013, and Spring 2013 semesters. Grade point average in the Fall was assessed by asking respondents, “Over all of your courses, your average grade for this quarter (1st quarter Fall 2013) was…” Students reported grades A+ to F (scored 14 to 1).

**Analysis Plan**

To address the central questions of this study, a four-step statistical analysis was performed. In the preliminary analysis the means, standard deviations, and sum scale scores were calculated and a missing data analysis was performed in IBM SPSS22. Missing data were then imputed using the expectation-maximization algorithm. In the second step, a series of exploratory latent profile analyses were conducted using Mplus (version 7.11; Muthén & Muthén, 1998–2013) to identify motivational profiles based on student data on the mastery-approach, mastery-avoidance, performance-approach, performance-avoidance, academic self-efficacy, attainment-value, intrinsic-value, and utility-value scales’ respective sum scores. The number of profiles explored ranged from 2-6, based on previous research that identified up to 7 profiles (Conley, 2012; Pastor et al., 2007; Tuominen-Soini et al., 2012). The posterior
probabilities and entropy statistics computed in this analysis were used to determine how accurately the model classified students into profiles, in the third step. Lastly based on the latent profile analysis results, using methods developed by Lanza and colleagues (2013) and Asparouhov and Muthen (2013), a series of Wald’s tests of association were conducted in which each of the academic self-regulation and academic achievement indices was related to profile membership. Given the relatively moderate sample size ($n = 273$) .05 was used as the criterion of significance.
Chapter 4

Results

This study was designed to answer three research questions related to high-school students’ motivation to learn. First, what profiles can be found using students’ achievement goals, subjective task values, and academic self-efficacy beliefs? Second, this study asks how prevalent are these profiles in the student population. Third, in order to speak to whether the respective profiles have implications for student outcomes, this study explores how they relate to academic self-regulation and achievement. The following sections provide the results of the missing data analysis and a discussion of the data imputation process employed in this study. Subsequently the results from the latent profile analyses are provided. Here the process for selecting the final model is discussed, and a description of the profiles identified by the model are given (i.e., respective profile beliefs and their means). Following this, entropy statistics for the model are discussed in order to address the second research question concerning profile prevalence. Lastly, the results of a series of Wald’s tests of association are enumerated in efforts to address the final hypothesis that the respective profiles will relate to the outcome variables (i.e., academic self-regulation indices and self-reported grade point average).

Step 1: Missing Data Analysis

Step 1 of the data analysis revealed that of the 297 participants surveyed, 16 students only entered their names and no other information, so they were deleted listwise from the analyses, resulting in a sample size of 273. Some of the remaining students failed to report data for at least some of the items in the analyses, and missing data analyses were performed in IBM SPSS22. For every variable, missing values were assigned a value (-99). Descriptive statistical analysis
revealed that less than 5% of the total responses were missing. Missing value pattern graphs revealed no monotonicity, and no associations with any of the variables in the analysis (i.e., the data were missing at random). Little’s (1998) missing completely at random chi-square tests of the means and correlations revealed no significant differences on any of the variables ($\chi^2 = 12187.243$, $df = 11881$, $p$-value = .21). Given, the small percentage of missing scores across all items and the data’s patterns of missingness, data imputation was unnecessary (Rubin, 1987). However, in order to safeguard against the probability of making a type II error, maximum-likelihood imputation (via the expectation-maximization method) was performed to estimate the missing data and then imputed (Rubin, 1987). Imputed data were constrained to the ranges of possible responses on the respective variables. The descriptive statistics for the each of the variables are reported in Table A2 (Appendix A), which contains the means, standard deviations, and correlations for all of the variables. The newly completed data set was imported into Mplus 7.11 (Muthén & Muthén, 2013) for subsequent analysis.

**Step 2: Latent Profile Solutions for the 2-, 3-, 4-, 5-, and 6-Cluster Models**

The second step involved using Mplus 7.11 (Muthén & Muthén, 2003) to conduct a series of exploratory latent profile analyses to address the first hypothesis of the study that there are multiple profiles of beliefs, and to explore the patterns of the within-cluster beliefs among participants. In order to ease interpretation of the graphs the values were standardized, but sum scores are used in reporting the results for the latent profile analyses. The latent profile analyses relied on expectation-maximization to determine the maximum likelihood of the parameters (Goodman, 2002) using a range of start values to obtain the global maximum. In every model means, variances, and covariances were allowed to differ. The model that fit the data best was
determined in part by using the Akaike’s information criteria, the Bayesian information criteria, and the sample-size-adjusted Bayesian information criteria fit statistics, as these have been shown to be robust with respect to sample size and the number of parameters included in the models (Nylund et al., 2007). In latent profile analysis as each class is added in successive models, decreases in the Bayesian information criteria and sample size adjusted Bayesian information criteria fit statistics indicate a better fitting model. While these fit statistics are useful in distinguishing the fit of models, the parametric bootstrap likelihood ratio tests are more appropriate for determining whether the differences in fit between successive models are statistically significant, and these were used to assist in model selection. Five different models were fit, each differing in the number of profiles specified (i.e., 2-6 inclusive), based on earlier research in which up to seven profiles were identified (Conley, 2012). For the present study, the variables in the analyses included academic self-efficacy, the approach and avoidance forms of both approach and avoidance forms of mastery and performance goals, academic self-efficacy, utility-, attainment-, and intrinsic-values. Profiles were added in steps until the model failed to improve in terms of its fit to the data. Analyses were stopped at the 6-profile solution as the parametric bootstrap likelihood ratio tests failed to replicate across sample draws in the 5-, and 6-profile solutions.

Hypothesis 1 was supported as the 3-profile solution provided the best fit according to the Akaike’s information criteria, the Bayesian information criteria, and the sample-size-adjusted Bayesian information criteria, the entropy statistic, and the parametric bootstrap likelihood ratio test (see Appendix A, Table A2). While the fit statistics were lower (i.e., suggested improved fit) and the parametric bootstrap likelihood ratio test was significant for the 4-cluster solution, its entropy was very low (.78) indicating that it was not able to accurately classify students into
classes. Entropy statistics approaching 1 indicate no overlap between class-membership. In addition, inspection of the Lo-Mendell-Rubin likelihood ratio test revealed that this model did not fit the data (95.887, \( p \)-value = .2480) and it was dropped as a viable model-solution. The entropy statistic (i.e., overall measure of model classification utility) produced by the final model solution was .81, indicating a good model classification accuracy for each profile. Given these findings, the 3-profile solution was adopted as the best fitting model, each characterized by different mean levels on the respective motivational variables, and this solution was subjected to further analysis.

**Profile Descriptions and Classification Utility**

A graphic representation of the three-profile solution can be seen in the plot in Figure A1 (Appendix A). Note that z-score transformed data are used to produce the plot in order to ease the interpretation of results. The first profile discussed was labeled the “green” group (see Appendix A, Table A3, class 3). It appears that students in this group do not strongly desire to master tasks, improve themselves, or avoid losing skills and competence via academic effort but that they do not wholeheartedly reject these notions, as indicated by their average mastery-approach and mastery-avoidance scores (i.e., 21.83, and 12.24 respectively). In addition they are moderately confident in their abilities to perform well as indicated by their average academic self-efficacy scores (20.84). This group was also characterized by extremely low performance goals. In fact it reports the lowest performance-approach and performance-avoidance goals of all profiles (10.67, and 9.38 respectively). The classification probability for most likely class membership associated with this profile was .928, indicating that students were accurately placed
in this profile (see Appendix A, Table A4 for a summary). Note that values at .8 or higher indicate high classification accuracy.

A second profile (see Appendix A, Table A3, class 1) was identified, and labeled the red group, as they reported very low levels on every motivational belief. They held a low desire to master skills and to avoid losing them as indicated by their mastery-approach and mastery-avoidance averages (16.4, and 9.78, respectively). In addition they held low performance-approach and performance-avoidance goals (12.14, and 10.71 respectively). Youth in the red group also reported low levels of academic self-efficacy (i.e., 16.55), and subjective task-value beliefs (i.e., attainment value = 12.7, intrinsic value = 4.14, and utility value = 7.39). The average posterior probability for most likely class membership associated with this profile was .93, indicating that students were accurately placed in this profile.

The third group, profile three, was labeled the “blue” group and members reported above average scores on all of the variables included in the model (see Appendix A, Table A3, class 2). For example, they reported high mastery and performance goals (mastery-approach = 22.48, mastery-avoidance = 14.12, performance-approach = 19.31, performance-avoidance = 15.12, respectively). These students also believe in their ability to perform well as indicated by high academic self-efficacy averages (21.1). Lastly they believe that learning in school has relevance for their contemporary and future lives outside of school (attainment-value = 7.89, and utility value = 6.56), and is intrinsically valuable and interesting (intrinsic value = 7.02). The average posterior probability for most likely class membership associated with this profile was .875, indicating that students were accurately placed in this profile.

Overall, these results support the hypothesis that there are multiple configurations or patterns of motivational beliefs among students, or that there are multiple ways to be oriented
toward school learning and performance as indicated by number of motivational profiles, and the profile-specific scores on variables from each area of motivation. Results of the latent profile analyses indicated that the classes in the 3-cluster solution were clearly defined with differences on the means of most variables included in the model (see Appendix A, Table A3). A discussion of the theoretical and practical implications of these profiles is provided in the discussion section.

**Step 3: Profile Prevalence of the 3-Class Solution**

In order to address the second research question concerning the extent to which the respective profiles are represented in the population, the average posterior probabilities and entropy statistics were used. Determinations about profile prevalence are made by examining the posterior probabilities of the respective clusters, which act as weights in the calculation of the sample statistics for each profile. The most prevalent group was the blue or highly motivated group \((n = 155)\), which comprised 57% of the sample. The second most prevalent group was the red or low motivation profile (class 1), which represented 22% of the sample \((n = 61)\). The green group (class 3) was marginally smaller than the red group, representing 21% of the sample \((n = 57)\). Based on the entropy statistic, and the average posterior probabilities for most likely class membership for each profile (reported in Appendix A, Table A4), it is clear that these profiles represent significant proportions of the student population.

Overall, the results of this latent profile analysis helps us to understand the characteristics of the students in our sample by identifying subgroups of students that are similar on the motivational beliefs, and the proportions of the sample characterized by the respective patterns. However additional tests are required in order to speak to the utility of using profile membership
to understand student academic achievement or the academic self-regulatory practices that produce achievement outcomes.

**Step 4: Wald’s Tests of Association Between Profile Membership and Achievement Outcomes (Academic Self-Regulation and Fall 2013 First Quarter Grade Point Average)**

In the fourth and final step, Wald’s tests of association were conducted in Mplus to explore the relationship between the academic self-regulation and achievement indices (i.e., the dependent variables) and class-membership (i.e., the independent variable), using the DCON method develop by Lanza and colleagues (2013), and modified by Asparouhov and Muthén (2013) in order to address the final hypothesis that each profile would relate to the respective academic outcomes. Each of the overall approximate chi-square tests for class differences on each of the dependent variables was significant, suggesting that indeed class membership did matter for all self-regulatory and achievement indices. These results were mirrored by the class-specific tests of mean differences as well, and are discussed for each of the academic self-regulation and achievement outcomes in turn below.

**Rehearsal and profile membership.** The overall test of the approximate chi-square indicated that class membership was associated with rehearsal ($\chi^2 = 128.037, p$-value = .000). Membership in the blue group (class 2) was associated with higher average scores on rehearsal than membership in the red group ($\chi^2 = 73.80, p$-value = .000), and the green class ($\chi^2 = 84.09, p$-value = .000). Green group membership (class 3) was associated with higher rehearsal scores than membership in the red group (class 1) group ($\chi^2 = 12.68, p$-value = .000). These results provide evidence that confirms the hypothesis that the respective motivational profiles are tied to rehearsal. Moreover they suggest that those students who have membership in the groups with
characteristically higher motivation are more likely to use rehearsal as a learning strategy in comparison to those in groups with characteristically lower across these beliefs.

**Elaboration and profile membership.** Class membership was associated with elaboration in the overall test of the approximate chi-square ($\chi^2 = 202.56$, $p$-value = .000). Membership in the highly motivated blue group was associated with higher average scores on elaboration than membership in the red ($\chi^2 = 173.44$, $p$-value = .000), and the green class ($\chi^2 = 99.49$, $p$-value = .000). Lastly, green group membership was associated with higher elaboration scores than was membership in the red group ($\chi^2 = 40.87$, $p$-value = .000). These results suggest that motivational profile membership was tied to elaboration and that those students who have characteristically high motivation are more likely to use it as a learning strategy in comparison to those with low or moderate levels of motivation.

**Organization and profile membership.** The overall test of the approximate chi-square indicated that class membership was associated with organization ($\chi^2 = 171.39$, $p$-value = .000). Membership in the highly motivated group was associated with higher average scores on organization than membership in the red class ($\chi^2 = 126.94$, $p$-value = .000), and the green class ($\chi^2 = 96.27$, $p$-value = .000). Green group membership was associated with higher organization scores than in the red group membership ($\chi^2 = 17.73$, $p$-value = .000). Again the second hypothesis is confirmed, as these results suggest that the motivational belief patterns were tied to organization, and that those students who have characteristically higher motivation are more likely to use it as a learning strategy in comparison to those who are more poorly motivated.

**Critical thinking and profile membership.** Critical thinking was associated with class-membership in the overall test of the approximate chi-square ($\chi^2 = 179.17$, $p$-value = .000). Blue group membership was associated with higher average scores on critical thinking than
membership in the red ($\chi^2 = 149.30$, $p$-value = .000), and green classes ($\chi^2 = 94.39$, $p$-value = .000). Green group membership was associated with higher critical thinking scores than the disengaged group membership ($\chi^2 = 24.84$, $p$-value = .000). Similar to the other academic self-regulation indices, these results indicate that group membership was tied to critical thinking. In addition, those students with higher motivation beliefs are more likely to use it as a learning strategy in comparison to those who are moderately or poorly motivated.

**Metacognitive self-regulation and profile membership.** The overall test of the approximate chi-square indicated that class membership was associated with metacognitive self-regulation ($\chi^2 = 222.49$, $p$-value = .000). Membership in the highly motivated blue group was associated with higher average scores on metacognitive self-regulation than membership in the red class ($\chi^2 = 154.96$, $p$-value = .000), and green class ($\chi^2 = 135.00$, $p$-value = .000). Green group membership was associated with higher metacognitive self-regulation scores than red group membership ($\chi^2 = 24.37$, $p$-value = .000). These results suggest that the multiple motivational beliefs are tied to metacognitive self-regulation and that those students who have characteristically high motivation are more likely to use it as a learning strategy in comparison to those who are characteristically low or moderately motivated.

**Time and study environment and profile membership.** The overall test of the approximate chi-square indicated that class membership was associated with time study environment ($\chi^2 = 92.17$, $p$-value = .000). Membership in the blue highly motivated group was associated with higher average scores on time and study environment than membership in the red class ($\chi^2 = 65.85$, $p$-value = .000), and the green class ($\chi^2 = 49.77$, $p$-value = .000). Also, green group membership was associated with higher time and study environment scores than red group membership ($\chi^2 = 11.66$, $p$-value = .000). Motivational belief profile membership was tied to
time and study environment, such that students in groups with higher motivation beliefs were more likely to use it as a learning strategy in comparison to those with lower levels of motivation.

**Effort regulation and profile membership.** The overall test of the approximate chi-square indicated that class membership was associated with effort regulation ($\chi^2 = 104.16, p$-value = .000). Membership in the highly motivated blue group was associated with higher average scores on effort regulation than membership in the red class ($\chi^2 = 79.72, p$-value = .000), and green class ($\chi^2 = 60.30, p$-value = .000). Green group membership was associated with higher effort regulation scores than red group membership ($\chi^2 = 10.91, p$-value = .000). Once more, profile membership was tied to the academic self-regulation indicator, as those students who had characteristically high motivation (blue group members) were more likely to use effort regulation as a learning strategy than those who reported lower levels of motivation.

**Peer learning and profile membership.** Peer learning is the last academic self-regulation indicator included in Wald’s overall test of the approximate chi-square. Results indicated that class membership was associated with peer learning ($\chi^2 = 84.72, p$-value = .000). More specifically, membership in the blue highly motivated group was associated with higher average scores on peer learning than membership in the red class ($\chi^2 = 48.25, p$-value = .000), and green class ($\chi^2 = 54.56, p$-value = .000). Green group membership was associated with higher peer learning scores than red group membership ($\chi^2 = 5.41, p$-value = .020). These results demonstrated that membership in each profile was associated with peer learning, and more specifically that membership in groups with higher levels of beliefs was associated with increasingly higher rates of peer learning.
**Grade point average (Fall 2013) and profile membership.** In the test of the association between class membership and Fall 2013 first quarter grade point average, the results indicated that class membership was associated with fall 2013 grade point average ($\chi^2 = 23.08$, $p$-value = .000), where membership in the blue highly motivated group was associated with higher average first quarter fall grades than membership in the red class ($\chi^2 = 15.63$, $p$-value = .000), and the green class ($\chi^2 = 10.78$, $p$-value = .000). Green group membership was associated with higher grades than red group membership ($\chi^2 = 4.48$, $p$-value = .000). These results confirm the hypothesis that the respective belief patterns were tied to grades and that those students in groups with characteristically higher motivation were more likely to report higher grades in comparison to those in groups with lower levels of these beliefs.

**Summary.** In summation, the results of these advanced mixture-model based clustering analyses supported the study hypothesis that among high school students, multiple distinct patterns of motivational beliefs could be identified or that there were multiple ways to be oriented toward school learning and performance as indicated by the number of motivational profiles, and the profile-specific means on each of the motivation variables.

Additionally, the prevalence rate of each of the profiles was identified, and large portions of the sample were be characterized by each profile, 57% for the blue or highly motivated group ($n = 155$), the red or low motivation profile represented 22% of the sample ($n = 61$) and the green group represented 21% of the sample ($n = 57$). Moreover the average posterior probabilities and the overall entropy statistics indicated that this 3-profile model solution accurately classified students into the respective profiles, lending further credence to reliability of the identified prevalence rates.
Overall, Wald’s tests of association demonstrated that class membership was positively associated with academic self-regulation and achievement. Results also indicated that membership in each of the profiles demonstrated significant positive relations with the respective academic self-regulation indicators and grade point average (fall first quarter 2013). Another important question asked in this study was whether the respective patterns would be equally yoked to academic self-regulation and achievement indices. Along these lines, as level of motivation increased, as indicated by membership in the respective profiles, the associations with the respective self-reported academic self-regulation and achievement indices were strengthened, suggesting that some patterns were better for academic achievement and self-regulation than others. More specifically, being in the blue group (with the highest averages on all motivational variables) was most strongly associated with academic achievement and each of the self-regulatory practices. Membership in the green group was also positively and significantly linked to these outcomes but not as strongly as blue group membership. Weakest associations were exhibited between membership in the red group and the various self-regulation and grade point average (Fall 2013). Though caution is warranted given that the data emerge from a single school, each of these findings has important implications for motivational theory and for our general understanding of motivation among secondary school students in the USA.
Chapter 5

Discussion

One of the main purposes of this study was to contribute to the adolescent motivational literature and expand our understanding of whether and how various social-cognitive motivational beliefs manifest together among high school students. Toward this end, an advanced mixture-modeling technique, latent profile analysis was used to classify students into subgroups characterized uniquely by their achievement goal orientations, academic self-efficacy, and subjective task-value beliefs. The analysis identified three groups, a highly motivated “blue” profile, a moderately motivated “green” profile, and a group with characteristically low levels on all of the motivational beliefs, labeled the “red” group. Students in the blue profile represented 57% of the sample and were characterized by relatively strong beliefs on each of the motivational variables. Their mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance beliefs were similar in level, with both performance goals being slightly higher than either of the mastery beliefs. The red profile was characterized by relatively low scores on each of the motivational variables and was the second most prevalent group (22%). This group could be thought of as an unmotivated class because they did not have any strong achievement goals, they lacked confidence in their academic abilities, and did not believe that education held any value for either themselves or their future outcomes. Least prevalent (21%), was a group labeled “green,” where students were similar to the highly motivated blue group on most beliefs (i.e., high mastery-approach, mastery-avoidance, academic self-efficacy, attainment-values, intrinsic values and utility values), and similar to the “red” profile on others (low performance-approach and performance-avoidance goals). Overall, this study contributes to our broad understanding of the motivational landscape of adolescence by identifying these
motivational patterns among high school students (see, Conley, 2012; Tuominen-Soini et al., 2012 for exceptions).

**Implications for Achievement Goals**

These findings have several implications for our understanding of motivation among high school students and challenge popular conceptions about adolescents as well. First, for a vast majority of students (i.e., a combined 79% for the red and blue groups) these beliefs tended to hang together, that is teens that reported high beliefs on one construct reported high levels across the motivational spectrum, and those that reported low levels on one belief were likely to report low levels on the others as well. This evidence substantiates the claims of social-cognitive theories of motivation, which espouse notions of individuals as rational actors whose beliefs are likely to align to produce results. Another finding worthy of noting concerns the prevalence rate of the highly motivated blue group (57%), which indicated that the majority of our high school students were highly motivated across all of the beliefs included in this analysis. This finding runs counter to the popular narratives about adolescents as generally academically disinterested and disengaged. Though this data come from one sample in one high school, they support findings from other studies that have employed similar person-centered approaches to understanding adolescent motivation. For example, Daniels and colleagues (2008) identified a high mastery and performance goals group, a high mastery only group, a high performance only group, and a low mastery and performance goals group. Given the limited number of studies that have taken this approach more research on these patterns among this population is needed. While identifying these profiles is promising for our general understanding of the adolescent motivational landscape, these findings also contribute to the literature via their implications for
debates concerning mastery-avoidance, performance goals, multiple goals, subjective task-values, academic self-efficacy, their inter-relations, and associations with academic outcomes.

Mastery-avoidance has been underutilized in research, in part because it is a relatively newer construct, and because of concerns about it being indistinguishable from other goals (Bodmann, Hulleman, & Schrager, 2007; Madjar, Kaplan, & Weinstock, 2011; Pintrich, 2003). Based on findings from earlier studies, researchers contended that mastery-avoidance goals might be more appropriate for older adolescents than for young children who may not have developed enough skill and experience to fret over losing them. Red group members had a considerably lower average score on mastery-avoidance than on the other goals, and green group members’ average mastery-avoidance was considerably higher than the other goals (see Appendix A, Figure A1). These results provided evidence that mastery-avoidance was distinct from the other goal orientation beliefs among a significant portion of the high school sample (approximately 43% combined). Mastery-avoidance and the other goal orientation beliefs were endorsed with equal strength in the highly motivated blue group (57% of the sample), thus it is not clear what roles mastery-avoidance and other goal orientation beliefs are playing. However, the reliability estimates from this study (reported above) also suggested that mastery-avoidance goals were distinct, and existed alongside the other goal orientations. Please note that no formal tests of the benefit of including this variable in the analyses were conducted, thus no definitive statements about this matter can be made, and should be a focus of subsequent research that uses latent profile analytic techniques. As a whole, the reliability estimates, the different levels reported for mastery-avoidance and the other goal orientation beliefs, the importance of this belief for goal orientation theory, and the under-representation of secondary school aged
adolescents in mastery-avoidance research, this study offers support for continuing to explore the role of this goal among these youth.

Performance goal related results from this study were also interesting and have implications for the practical concerns of schools and policy makers, and subsequent research as well. Exploration of performance goals revealed that within each group, the average levels of performance-approach and performance-avoidance goals were similar. Students in the red and green groups tended to report relatively low performance goals, intimating that they were either unimportant or outright rejected by a number of students. Based on the combined proportion of the sample represented by these groups (43% of the sample), these findings are important to note particularly for schools and policy makers. Given that so many students are not inclined towards these beliefs, the emphasis placed on performance and competition in secondary educational contexts and contemporary educational policies may be detrimental for a significant proportion of high school students. These findings imply that it may prove beneficial for schools and policy makers to find ways to emphasize and enhance academic excellence without relying so heavily on socially comparative and competitive standards and practices. In this regard this study echoes the claims of earlier studies that future research might be well served by exploring performance goals in contexts in which there is less emphasis on social comparison and competition in order to draw more definitive conclusions.

Closer inspection of the respective sub-groups of this sample also revealed some of the inconsistencies that have been found in previous research concerning the relations between mastery and performance goals (Hulleman et al., 2010; Pastor et al., 2007). As noted above, some studies have found that mastery-approach and performance-approach goals are correlated particularly for college-aged students (Elliot & Church, 1997; Elliot & Harackiewicz, 1996),
where others have found low or insignificant relations. Mastery goals have also exhibited
negative and null relations with performance-avoidance goals (Dweck & Leggett, 1988;
Harackiewicz et al., 1997). Some have proposed that this variation might be due to the extent to
which schools, and/or classrooms, peers, and other environments emphasize performance goals
via what have been labeled performance structures (e.g., tracking, class rank, norm-referenced
grading, etc.). The contradictory findings of earlier research are mirrored in this study, as the
relations between goal orientation beliefs differed depending upon students’ subgroup
membership. For example, in the red and blue groups mastery-approach goals appear to be
positively related to both performance goals, whereas in the green group both mastery goals
appear negatively related to both performance goals. While this study demonstrates this variation
within one school, it did not explore the reasons for this variation, and subsequent research
would benefit from more in-depth qualitative and quantitative inquiry.

As noted above the multiple goals perspective holds that goal orientation beliefs may
operate simultaneously, and in various patterns (Pintrich, 2000c). This appears to be the case for
the students in this school, as three distinct patterns of goal emerged. In the blue group each of
the goal orientations were high. Representing a second pattern, both mastery goals were high,
and both performance goals were low in the green group. The third pattern emerged in the red
group where students reported low levels on all beliefs with mastery-avoidance being especially
low. This study is one of a few in which the findings support the multiple goals perspective by
demonstrating that for these students not only do the distinct goal orientation beliefs operate
simultaneously, but also that there are various levels at which they operate in each pattern. This
study is limited in that there was no attempt to analyze the contributions that the respective
beliefs made to the overall fit of the model to the data. Subsequent studies of the multiple goals
or multiple beliefs patterns should work to include these analyses in order to better understand whether more parsimonious models would be beneficial.

**Implications for Subjective Task-values**

Like achievement goals, subjective task-values exhibited three distinct patterns as well. In the red group, each of the value beliefs were below average, with attainment-value being reported at the lowest level. In the green group attainment-value was above average, whereas intrinsic-value and utility-value were lower but not different from the sample average. Adolescents in the blue group reported above average means on each of the subjective task-value beliefs. These findings challenge popular conceptions about the majority of adolescents as disinterested and undervaluing learning. The reliabilities revealed (reported in the methods section) indicated that these constructs were distinct for these students, and for a vast majority (i.e., a combined 78% for the green and blue groups) these beliefs tended to hang together, that is teens that reported high beliefs on one construct also reported high levels on the others, and those that reported low levels on any value belief were likely to report low levels on the others as well. These findings are not surprising given the reports of earlier research but provide much needed evidence that these are reliable and valid constructs among the understudied high school aged population.

Earlier research also generated a number of findings where approach goals were positively related to subjective task-value beliefs (Conley, 2012; Hulleman et al., 2008; Liem & Nie, 2008). Across groups mastery approach was reported at the same levels as intrinsic values, perhaps due to their emphasis on self-referenced standards, interest, and enjoyment. In this study, examination of the blue group revealed that youth exhibited patterns where both high mastery-
approach and performance approach goals were reported at similar levels to each of the subjective task value beliefs, however for students in the red and green groups the story is more complicated. Red group members reported low mastery-approach and performance-approach goals as well as low values, but levels on each of the values were lower than the respective goal beliefs (save for mastery-avoidance goals). For those in the green group, while mastery-approach was reported at a level similar to each of the values, the performance-approach goals were considerably lower than any of the value beliefs by comparison. It is not entirely clear why approach valence goals would be reported at levels similar to subjective-task values, and even less clear why there would be profile or group-based variation. Social-cognitive motivation research would benefit from a well-defined articulation of the relations between achievement goals and values, given that they both speak to the same dimension of motivation. Again similar to the study’s analytical approach to achievement goals, no formal tests of the benefit of including values in the analyses were conducted, thus no definitive statements about this matter can be made, and should be a focus of subsequent research. As a whole, the different levels reported for subjective task-value beliefs, the importance of this belief for goal orientation theory, and the under-representation of secondary school aged adolescents in research, this study offers support for continuing to explore the role of these values among older adolescents.

Implications for Self-Efficacy

Academic self-efficacy was included as a representation of the capacity beliefs in this study. Students in the blue and green groups reported similar above average scores (blue scores were slightly higher), while the red group’s efficacy scores were the lowest, and considerably below the sample average. These findings take on greater meaning when viewed in relation the
other motivational beliefs. Within each of the groups, academic self-efficacy was reported at the same level as intrinsic-value, utility-value, and attainment value which supports findings from previous research and theoretical propositions about these constructs (Bong, 2001; Eccles et al., 1993). Relations between achievement goals and academic self-efficacy in this study reveal a more complex picture. For example, academic self-efficacy was also reported at the same levels as mastery-approach and mastery-avoidance goals in the blue group, but in the green group only mastery-avoidance was reported at the same level as efficacy beliefs, and in the red group no goals were reported at the same level as efficacy beliefs (though all beliefs were endorsed at low levels). With respect to performance goals, academic self-efficacy was reported at lower levels than both performance-approach and performance-avoidance goals for most students (within the blue and red groups), suggesting that these youth may lack the confidence to meet these goals, further suggesting that performance goals may have deleterious effects on other aspects of motivation and self-perceptions. Only in the green group were performance goals reported at a lower level than efficacy beliefs. Again, performance goals appear to be exerting a negative influence on students even the highly motivated group, and again suggests a need for a more in-depth exploration of how students experience performance goals, and the features of their environments that engender these relations, and/or the adoption of these goals. While these findings have implications for social-cognitive motivational theories, and debates about multiple beliefs (i.e., multiple values, multiple goals) and integrating beliefs across motivational frameworks, this study also sought to contribute to the literature by determining whether these profiles had implications for student academic self-regulation and achievement.
Relations Between Profile Membership and Academic Outcomes (Academic Self-Regulation and Achievement)

This study also contributes to the literature by demonstrating that class membership was related to academic self-regulation and achievement among high school students. When the various academic self-regulation and achievement indicators were regressed on profile membership patterns emerged that suggested that for each group motivational beliefs (in combination) related to each of the outcomes positively. This finding supports the hypothesis that profile membership would relate to the outcomes, and corroborates findings from other studies but does so in a more nuanced and person-centered fashion, which has not been the focus of most of the earlier studies.

As is indicated in Table A5 (Appendix A), it is clear that the relationship of being in the highly motivated blue profile was positive for each measure of academic self-regulation and achievement. Moreover this class demonstrated significantly higher mean scores on all of these outcome variables when compared to the red and green groups, confirming theoretical predictions that the most motivated students are likely to perform better and adopt practices that will lead to better performance at higher rates.

Membership in the moderate motivation group (green) was related positively to academic self-regulation and achievement, and the means on these outcomes were significantly higher than those of students in the low-motivation class (red profile). This profile differed from the blue and red groups in their reporting of the lowest performance-approach and performance-avoidance goals of all groups. Performance-approach and performance-avoidance goals may therefore be playing an especially important role in outcomes, which supports the conclusions of other earlier
studies about the importance of these goals for achievement. However, as was also noted earlier it will be important for future research to specifically test what each variable contributes.
Chapter 6

Conclusion

Social-cognitive motivation theories have proposed individuals’ motivational beliefs are not suspended in adolescents’ minds detached from other beliefs and thoughts, but rather are likely to function together to shape outcomes. Thus understanding individuals can be best accomplished by considering various personally held motivational beliefs, as they do not function or develop in isolation. Similarly, Along these lines, the separate relations that the motivational beliefs included in this study have with achievement and self-regulatory outcomes are well documented, but considerably less attention has been directed at understanding whether and how these beliefs manifest concomitantly to shape outcomes. By making a comprehensive person-centered examination of motivation among older adolescents, the current study contributes to the motivation literature in ways that have implications for achievement goal orientation (i.e., mastery avoidance, the importance of performance goals, multiple goals debate), subjective task-values, and our understanding of the overall motivational landscape of high school adolescents. It is also one of only a few studies to explore these naturally occurring patterns from a person-centered perspective among high school adolescents, thereby expanding the literature base about motivation as it naturally occurs during this critical period.

Findings from this study also have several theoretical implications. First it intimated that exploring mastery-avoidance goals might be important for understanding students with lower levels of motivation, and who perform more poorly. Performance-goals’ contributions to performance and self-regulation have been under debate for over a decade. This research suggests that these goals are especially important for self-regulation and achievement, particularly for high performing students. Support for the multiple goals perspective is also
provided by the findings as the respective classes exhibited multiple patterns of goal orientation beliefs. Moreover, the findings confirmed that efficacy and value beliefs hang together with goals, particularly mastery goals. Given the complexities of adolescents’ developing brains and minds, and the effects each of these beliefs has, research must continue to explore the ways that these beliefs manifest together. This investigation also speaks to the soundness of these social-cognitive theories of motivation, which have proposed reciprocal, direct, and indirect relations among these constructs as well (Bandura, 2012; Conley, 2012; Durik et al., 2006; Pintrich, 2000c; Wigfield & Cambria, 2010; Zimmerman, 2000).

There are, however, several limitations to this study. First, the measures of academic achievement may not have been reliable as students were asked to self-report their “expected” grades. As this was based on speculation, considerable measurement error may have affected the results of these analyses. In addition, the measure of mastery-avoidance incorporated in this study would likely have benefited from some other related measure of this construct as a check on the accuracy of this measure. However, given recent work on the validity and reliability of this construct provided by Baranik, Stanley, Bynum, and Lance (2010), the results are likely trustworthy. Lastly a fourth cluster was identified but the results of the significance tests and cluster probabilities the class was too small to include, thus a larger sample might have assisted in identifying this and perhaps other classes. Notwithstanding these concerns, this study contributes to the overall understanding of motivation among the severely understudied high school population and points the way forward for future research.
References


Appendix A

Results Tables and Figure

Table A1

*Latent Profile Analysis Fit Indices and Classification Quality Statistics*

<table>
<thead>
<tr>
<th>Number of clusters</th>
<th>Akaike’s information criteria</th>
<th>Bayesian information criteria</th>
<th>Sample-size adjusted Bayesian information criteria</th>
<th>Bootstrap likelihood Ratio Test</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>5827.229</td>
<td>5917.465</td>
<td>5838.197</td>
<td><strong>412.640</strong></td>
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<tr>
<td>3</td>
<td>5756.612</td>
<td>5879.334</td>
<td>5771.529</td>
<td><strong>88.617</strong></td>
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<tr>
<td>4</td>
<td>5676.826</td>
<td>5832.033</td>
<td>5695.690</td>
<td>Not replicated</td>
</tr>
<tr>
<td>5</td>
<td>5627.079</td>
<td>5814.772</td>
<td>5649.892</td>
<td>Not replicated</td>
</tr>
<tr>
<td>6</td>
<td>5592.913</td>
<td>5813.091</td>
<td>5619.675</td>
<td>Not replicated</td>
</tr>
</tbody>
</table>

*Note.* Numbers in bold represent parametric bootstrap likelihood ratio test values significant at the .01 level. Smallest numbers for the respective information criteria indicates best relative fit.
Table A2

Means, Standard Deviations, and Correlations Among Variables

| Variables | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1. Mastery approach | -- |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2. Mastery avoidance | .302** | -- |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 3. Performance approach | .381** | .266** | -- |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 4. Performance avoidance | .317** | .210** | .692** | -- |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 5. Academic self-efficacy | .541** | .012 | .226** | .099 | -- |    |    |    |    |    |    |    |    |    |    |    |    |
| 6. Attainment values | .554** | .344** | .257** | .195** | .399** | -- |    |    |    |    |    |    |    |    |    |    |    |
| 7. Intrinsic value | .412** | .319** | .285** | .153** | .369** | .463** | -- |    |    |    |    |    |    |    |    |    |    |
| 8. Intrinsic value | .359** | .325** | .214** | .166** | .294** | .506** | .405** | -- |    |    |    |    |    |    |    |    |    |
| 9. Rehearsal | .477** | .270** | .390** | .170** | .308** | .351** | .443** | .281** | -- |    |    |    |    |    |    |    |    |    |
| 10. Elaboration | .552** | .253** | .398** | .236** | .441** | .426** | .499** | .330** | .681** | -- |    |    |    |    |    |    |    |    |
| 11. Organization | .481** | .214** | .364** | .161** | .375** | .355** | .517** | .366** | .735** | .730** | -- |    |    |    |    |    |    |    |
| 12. Critical thinking | .480** | .248** | .420** | .** | .368** | .367** | .449** | .348** | .524** | .788** | .661** | -- |    |    |    |    |    |    |
| 13. Meta-cognitive self-regulation | .547** | .263** | .373** | .197** | .441** | .481** | .502** | .412** | .652** | .729** | .715** | .725** | -- |    |    |    |    |
| 14. Resource management (time and study environment) | .432** | .002 | .142* | .117 | .352** | .390** | .408** | .286** | .464** | .400** | .463** | .271** | .512** | -- |    |    |    |
| 15. Effort regulation | .473** | .062 | .060 | .011 | .435** | .418** | .387** | .252** | .316** | .385** | .335** | .293** | .516** | .690** | -- |    |    |
| 16. Peer learning | .376** | .309** | .394** | .243** | .341** | .256** | .399** | .263** | .494** | .516** | .533** | .510** | .529** | .257** | .191** | -- |    |

(continued)
Table A2 (continued)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Grade point average (4th qtr Spring 2013)</td>
<td>.319**</td>
<td>.037</td>
<td>.155*</td>
<td>.124*</td>
<td>.289**</td>
<td>.381**</td>
<td>.225**</td>
<td>.189**</td>
<td>.174**</td>
<td>.184**</td>
<td>.131*</td>
<td>.149*</td>
<td>.235**</td>
<td>.310**</td>
<td>.383**</td>
<td>.157**</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>18. Grade point average (1st qtr Fall 2013)</td>
<td>.190**</td>
<td>-.031</td>
<td>.147*</td>
<td>.083</td>
<td>.193**</td>
<td>.336**</td>
<td>.119*</td>
<td>.138*</td>
<td>.126*</td>
<td>.093</td>
<td>.123*</td>
<td>.081</td>
<td>.205**</td>
<td>.246**</td>
<td>.262**</td>
<td>.042</td>
<td>.628**</td>
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<tr>
<td>M</td>
<td>20.96</td>
<td>12.71</td>
<td>15.75</td>
<td>12.84</td>
<td>20.01</td>
<td>16.86</td>
<td>6.50</td>
<td>10.10</td>
<td>18.18</td>
<td>22.25</td>
<td>17.01</td>
<td>21.50</td>
<td>51.94</td>
<td>35.65</td>
<td>18.05</td>
<td>12.17</td>
<td>10.43</td>
<td>10.29</td>
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<tr>
<td>SD</td>
<td>3.53</td>
<td>5.01</td>
<td>5.38</td>
<td>4.05</td>
<td>3.7</td>
<td>3.61</td>
<td>2.99</td>
<td>2.94</td>
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<td>5.17</td>
<td>5.66</td>
<td>11.67</td>
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<td>5.21</td>
<td>3.93</td>
<td>2.5</td>
<td>2.52</td>
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<td>Reliability</td>
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<td>.88</td>
<td>.88</td>
<td>.72</td>
<td>.84</td>
<td>.73</td>
<td>.83</td>
<td>.71</td>
<td>.74</td>
<td>.71</td>
<td>.70</td>
<td>.71</td>
<td>.79</td>
<td>.65</td>
<td>.71</td>
<td>.59</td>
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<td>1</td>
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* p < .05. ** p < .01.
Table A3

*Class Specific Motivational Belief Means for the 3-Class Solution*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cluster membership</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Red group (Class 1)</td>
<td>Blue group (Class 2)</td>
<td>Green group (Class 3)</td>
</tr>
<tr>
<td>Mastery-approach</td>
<td>16.44 (-0.585)</td>
<td>22.48 (0.281)</td>
<td>21.83 (-0.093)</td>
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</tr>
<tr>
<td>Mastery-avoidance</td>
<td>9.78 (-1.281)</td>
<td>14.12 (0.432)</td>
<td>12.24 (0.248)</td>
<td></td>
</tr>
<tr>
<td>Performance-approach</td>
<td>12.14 (-0.670)</td>
<td>19.31 (0.661)</td>
<td>10.67 (-0.945)</td>
<td></td>
</tr>
<tr>
<td>Performance-avoidance</td>
<td>10.71 (-0.527)</td>
<td>15.12 (0.564)</td>
<td>9.38 (-0.855)</td>
<td></td>
</tr>
<tr>
<td>Academic self-efficacy</td>
<td>16.55 (-0.937)</td>
<td>21.11 (0.296)</td>
<td>20.84 (0.225)</td>
<td></td>
</tr>
<tr>
<td>Attainment-value</td>
<td>12.70 (-1.151)</td>
<td>18.03 (0.323)</td>
<td>18.23 (0.379)</td>
<td></td>
</tr>
<tr>
<td>Intrinsic-value</td>
<td>4.14 (-0.789)</td>
<td>7.54 (0.349)</td>
<td>6.37 (-0.045)</td>
<td></td>
</tr>
<tr>
<td>Utility-value</td>
<td>7.393 (-0.890)</td>
<td>10.91 (0.307)</td>
<td>10.46 (0.152)</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Values in the table represent sum score profile specific means. Values in parentheses represent z-transformed cluster specific means.
Table A4

Classification Table for the 3-Class Solution

<table>
<thead>
<tr>
<th>Cluster</th>
<th>N</th>
<th>Average posterior probability associated with class membership</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>61</td>
<td>0.928</td>
</tr>
<tr>
<td>2</td>
<td>155</td>
<td>0.018</td>
</tr>
<tr>
<td>3</td>
<td>57</td>
<td>0.051</td>
</tr>
</tbody>
</table>

*Note.* Values in bold represent the average posterior probability associated with the clusters to which students were assigned.
Table A5

*Equality-Tests of Means Across Classes*

<table>
<thead>
<tr>
<th>Equality-tests</th>
<th>Blue group (Class 2)</th>
<th>Green group (Class 3)</th>
<th>Red group (Class 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehearsal</td>
<td>20.83&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>15.15&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12.43</td>
</tr>
<tr>
<td>Elaboration</td>
<td>26.49&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>20.86&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15.77</td>
</tr>
<tr>
<td>Organization</td>
<td>20.01&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>14.79&lt;sup&gt;b&lt;/sup&gt;</td>
<td>11.52</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>25.34&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>19.69&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15.84</td>
</tr>
<tr>
<td>Metacognitive self-regulation</td>
<td>60.22&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>47.55&lt;sup&gt;b&lt;/sup&gt;</td>
<td>39.07</td>
</tr>
<tr>
<td>Time study environment</td>
<td>38.84&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>32.82&lt;sup&gt;b&lt;/sup&gt;</td>
<td>28.12</td>
</tr>
<tr>
<td>Effort regulation</td>
<td>20.83&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>16.33&lt;sup&gt;b&lt;/sup&gt;</td>
<td>13.65</td>
</tr>
<tr>
<td>Peer learning</td>
<td>13.82&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>10.48&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.66</td>
</tr>
<tr>
<td>Grade point average (Spring 2013)</td>
<td>11.07&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>9.99&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.27</td>
</tr>
<tr>
<td>Grade point average (1&lt;sup&gt;st&lt;/sup&gt; quarter Fall 2013)</td>
<td>10.88&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>9.82&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.44</td>
</tr>
</tbody>
</table>

*Note.* Superscripts in bold indicate significant class differences at the .05 level, whereas superscripts that are not in bold are significant at the .01 level.

<sup>a</sup>Significant differences between the blue and red groups.

<sup>b</sup>Significant difference between the green and red groups.

<sup>c</sup>Significant differences between the blue and green groups.
Figure A1. A graphic representation of the three-profile solution.