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ANALOGICAL REASONING IN A MODEL OF FUTURE-ORIENTED MOTIVATION AND SELF-REGULATION: AN EXPLORATION OF THE RELATIONSHIPS BETWEEN ANALOGICAL REASONING, INSTRUMENTALITY, AND SELF-REGULATION

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ANALOGICAL REASONING IN A MODEL OF FUTURE-ORIENTED MOTIVATION AND SELF-REGULATION: AN EXPLORATION OF THE RELATIONSHIPS BETWEEN ANALOGICAL REASONING, INSTRUMENTALITY, AND SELF-REGULATION

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

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DEDICATION

I would like to dedicate this dissertation to my family. To my parents Melva Howlett-Davis and Jimmie Danny Lorenzo Davis, who are the source of my work ethic, confidence, high value for education, love for learning, principled nature, strong primary cultural identification, and so much more, thus enabling who I am and continue to become, I say, “there aren’t enough moments in life to thank you.” Therefore, I also extend my deepest reverence to my grandmothers, Zelda Davis and Pauline Morgan, my grandfathers, Artie Howlett and Jimmie Davis, and all my ancestors. To my children, Antoinette Monae Davis and Kendrick Armand Davis Jr., you are the most amazing, brilliant, talented, down to earth, and truly inspiring people I know. You two have and will always be Daddy’s hearts! To my wife, Angela Osuna Davis, after it all I still find myself saying “let’s do it ALL over again for life times, you and I”, and only you can have me saying that, enough said. However, I will say just a little more. We have tons to do together, let’s do this “thang”! To my aforementioned “tree of life”, I love you all immensely, your support, encouragement, and love are unparalleled. Our principles express it well, so I will close with them. Love ourselves by; learning lot’s, working hard, believing in ourselves, being our best, and being positive, because it’s all about self-mastery!

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ABSTRACT

This study examined the role analogical reasoning plays in Miller and Brickman's (2004) model of future-oriented motivation and self-regulation. Analogical reasoning was tested in varied roles with three variables from the Miller and Brickman (2004) model of future-oriented motivation and self-regulation in an effort to assess whether a more significant proportion of variance is accounted for in academic achievement as a result of adding analogical reasoning to the aforementioned model. There were 192 college student participants from a large mid-western university involved in the present study. The results from zero order correlations employed in this study indicated that analogical reasoning was not statistically significantly related to the three Miller and Brickman variables, personally valued future goals, instrumentality of schooling, and self-regulation. However, results from alternative path analyses suggest a role for analogical reasoning in the Miller and Brickman (2004) model. Taken in conjunction with a statistically significant correlation between analogical reasoning and academic achievement, these research results warrant further investigation into the role analogical reasoning plays in the Miller and Brickman (2004) model and the resulting impact on academic achievement.

CHAPTER 1 – INTRODUCTION

There is ample evidence indicating motivation is important for learning (Pintrich & De Groot, 1990; Greene & Miller, 1996; Phalet, Andriessen & Lens, 2004; Andrieesen, Phalet & Lens, 2006). To be motivated for learning, and to sustain motivation for learning, there are multiple cognitive factors that must be coordinated. Reasoning and inferential processing are also important for learning (Cummins-Dellarosa, 1992). A major purpose of the present study is to examine the possibility that reasoning and inferential processing are necessary for the cognitive coordination involved in motivation for learning.

Although research has shown that self-regulation of learning is important for coordinating motivational factors (Pintrich & Garcia, 1991; Greene & Miller, 1996), self-regulation itself does not account for the reasoning and inferential processing involved in motivated learning behavior. Although there are cognitive models of motivation (Nuttin, 1985; Phalet, Andriessen & Lens, 2004; Ryan & Deci, 2000), they typically do not explain the reasoning processes that are required for successful motivation. The study presented in this dissertation was designed to explore the various roles that reasoning, motivation and self-regulation play in learning and achievement, as well as the role reasoning plays in motivated and self-regulated learning at the college level in particular.

Reasoning has been examined from many perspectives in educational research. Reasoning is considered an important component of intelligence and intelligent behavior (Goswami, 2001; English, 2004). As an example of its daily importance, we

can see reasoning in action anytime we draw conclusions, infer new knowledge, engage intellectual skills like making discriminations, acquiring concepts or learning and applying rules. Further, we can see the daily value of a particular type of reasoning, such as analogical reasoning, anytime we make decisions by drawing comparisons between the present scenario and something similar from the past (Sternberg, 1977). The main thesis here is that analogical reasoning is a necessary cognitive function that allows people to coordinate their motivated behaviors in order to be motivated for learning.

In considering the problem of students' lack of motivation for learning and resulting academic underachievement (Attewell & Lavin, 2007), partial explanations may stem from the lack of alignment between student thinking, behaviors related to academic achievement, and perceptions of the benefits of education. This lack of alignment is a problem with motivation and/or reasoning, in particular analogical reasoning. For example, a student may think she wants to be a nurse, but she rarely studies in college and does not recognize that her science and math classes are relevant. This common problem of not connecting future goals and school most likely explains why some students are not able to reach a long-term goal before their motivation falters. As a result of thinking that is insufficiently logical, underachieving youth are not adequately preparing to enter and persist through post-secondary educational institutions.

Motivation to learn has been examined in a variety of ways by different researchers (Miller, Greene, Montalvo, Ravindran & Nichols, 1996; Husman, Derryberry, Crowson, & Lomax, 2004; Simons, Vansteenkiste, Lens & Lacante, 2004).

For the present study I will examine motivation in terms of perceived instrumentality for academic achievement in college and future orientation toward education and careers (Miller & Brickman, 2004; Tabachnick, Miller, & Relyea, 2008). As an example of this type of motivation, let me again use the example of the college student who wants to be a nurse. If she believes her science courses to be instrumental in reaching that career goal, she then has connected present tasks with instrumental value to her future oriented career goal. While she might see the connection between coursework and the career goal and be motivated, she still needs knowledge of how to regulate her performance in the relevant classes if she is going to achieve at the level required for success. Essentially, self-regulation is the mechanism whereby people coordinate their behaviors in order to meet their short-term goals that lead to the more distant aspirations. It is defined as including the coordinated processes of goal setting, and monitoring and evaluating one's progress towards meeting the target goal (Zimmerman, 2002).

Although theory on student self-regulation and motivation suggests that when young people have academic future goals they are more likely to persist in school and achieve (Miller & Brickman, 2004), it also suggests that the lack of future goal commitments can be a detriment to the academic achievement of the learner (Phalet, Andriessen, & Lens, 2004). The cognitive activity to mapping future goals to current academic work often means that students develop short-term academic goals that keep them focused on how their present activities are linked to reaching their valued future goals. That youth are less likely to make the connection between current academic work and their futures means that they are also less likely to be focused on aligning their

present activities with positive outcomes for their futures. The present thesis is that this process of alignment, or lack of alignment, may be understood in terms of analogical reasoning ability. If our aspiring nurse is low on reasoning ability, she might not make the connection between her performance in her zoology class and her entry into a nursing program/school. As a result of this lack of analogical inference, she may not get the grades needed for admission into that competitive program. Analogical reasoning might very well be a requirement for the monitoring and evaluating processes of self-regulation.

Miller and Brickman (2004) proposed a model of future-oriented self-regulation and proximal self-regulation processes that provides an explanation for many of the relationships between motivation and self-regulation, except for the reasoning component. Miller and Brickman suggest that there are key relationships between factors significant to achievement-related activity. Their model provides an opportunity to explore patterns of processing in students that underlie their motivation to learn. Miller and Brickman's (2004) model illustrates (see Figure 1) how commitment to an imagined future goal can energize self-regulated learning behaviors that lead to achievement outcomes. When students commit to an imagined future goal, and have relevant knowledge, they are able to find tasks within the present learning context as instrumental to the attainment of their imagined future goal. From the Miller and Brickman model we see how learners must use complex linked subgoal systems to make connections between current behaviors and the desired future aspiration. I argue that in order for students to achieve academically they must at the minimum reason between relationships among schooling, future aspirations of personal value, the value

of tasks particularly in learning contexts, and processes of self-regulation. This is the argument tested in this dissertation study.

Although the Miller and Brickman (2004) model seems robust in accounting for academic achievement-related motivational and self-regulatory processing, it does not specify how reasoning processes take place in the model. Presumably, for learners to perceive the systematic relationships among self-regulatory factors both future and present, they must effectively exercise their ability to acquire and manipulate concepts defined by systematic relationships among multiple objects (Hummel & Holyoak, 2005) both within and across future-oriented and proximal self-regulatory systems. Hence, analogical reasoning, which is the symbolic ability to think about relational patterns (Gentner, Holyoak, & Kokinov, 2001), is potentially useful in further developing our understanding of student self-regulation and motivation for learning. The Miller and Brickman model has not been tested as a whole, so a preliminary purpose of the dissertation study is to test the relationships between multiple factors within the Miller and Brickman (2004) model. The primary purpose of the dissertation study is to investigate the role of analogical reasoning in Miller and Brickman's (2004) model of future oriented motivation and self-regulation.

The following chapter will begin with an overview of theory and research on analogical reasoning. Then an overview of the Miller and Brickman (2004) model will be presented and accompanied by suggested relationships with analogical reasoning. Theory and research related to the Miller and Brickman (2004) model, and the significance of personally valued future goals to the study of student motivation for learning, is discussed. Each of the four major constructs – analogical reasoning,

personally valued future goals, instrumentality and self-regulated learning - are defined and discussed in terms of their hypothesized inter-relationships. Measures of each construct are provided following each review of literature for that particular construct. A description of how analogical reasoning can be integrated within the model of future-oriented motivation and proximal self-regulation follows. The chapter ends with a summary that leads to the research questions driving the present study.

CHAPTER 2 – LITERATURE REVIEW

Analogical Reasoning and its Component Processes

Analogical reasoning has been reported to be a core component of human cognition (Goswami, 2001). Analogical reasoning is defined as the comparison of conceptual and perceptual experiences based on recognized relationships or shared attributes (English, 2004). Analogies involve reasoning about relations, in particular about relational similarity, so that a correspondence is established between one set of relations and another. The established correspondences between relations are often at the level of attributes and their assigned values. The activity of establishing correspondences between attributes and values is undertaken during the process of analogical mapping and often relies on higher order relations or relations between relations (Gentner, Holyoak, & Kokinov, 2001). Analogical or relational reasoning represents a particular type of information processing whereby systematic relations are drawn between information processed in the moment and stored long-term, or between various units of information stored in long-term memory. Analogical reasoning captures the type of iterative knowledge symbolization and application essential to coordinating, through inference making, future-oriented and proximal based self-regulation involved in achievement-related success of students.

To make the case for the importance of analogical reasoning to the present study let us bring back our aspiring nurse. Our nurse's learning experiences require the student to make meaningful higher order connections between information based in analogs related to student, clinician, and practitioner domains for success. Essentially,

our aspiring nurse must analogically reason between analogs or systems, particularly nursing student, clinician and practitioner analogs, wherein analogs can be events, objects, systems, or highly complex systematically organized events, objects, and systems. This type of iterative thinking between analogs captured by analogical reasoning seems critical to the cognitive activity involved in our aspiring nurse's present and future success.

A Contrast of Analogical Reasoning Theories

Now that a working definition of analogical reasoning has been provided with a brief explanation of its importance to motivated and self-regulated learning behavior, the construct of analogical reasoning will be reviewed. Analogical reasoning will be reviewed first in terms of a componential theory and then a general model of analogical reasoning. The objective is to discriminate between the two theoretical accounts and accompanying measures.

Reasoning by analogy represents a special type of symbolic ability – the ability to perceive and explicitly represent relational patterns (Holyoak et al., 2001). Consensus can be found among cognitive psychologists regarding the component processes of analogical reasoning (Sternberg, 1977). While there are a handful of competing theories detailing component processes, it is important to note that all current computational models of analogical reasoning deal with some subset of the same basic component processes. Whether studying the relationship of analogical reasoning with academic achievement-related variables, memory processing speeds, problem solving abilities or inductive reasoning, the following six processes encompass what it means to reason

analogically: accessing; mapping; inferring; learning; evaluating; and adapting (Kokinov 2001; Hummel & Holyoak, 2003).

Hummel and Holyoak (2005) tested differences in analogical accessing and mapping with their computer simulation program LISA (Learning and Inference with Schemas and Analogies). According to Hummel and Holyoak (2005), LISA is designed to represent propositional knowledge both dynamically in working memory and statistically in long-term memory. Both accessing and mapping are considered guided by selective pattern classification wherein correspondences are established between source and target analogs (Hummel & Holyoak, 2005). As you may recall, analogs represent events, objects, or systems and their attributes or properties. In typical reasoning scenarios access is posited as an initial component process whereby one or more relevant analogs (Holyoak et al., 2001), episodes (Kokinov, 2001), or schemas stored in long-term memory must be accessed to initiate reasoning (Sternberg & Rifkin, 1979; Hummel & Holyoak, 2005) and correspondences can then be mapped from the source analog to the target analog, or novel problem to be solved.

Results from research conducted by Hummel and Holyoak (2003) indicate differences between analogical accessing and mapping as a result of the presence of similar meaning attributes between analogs, which is referred to as a semantic similarity constraint. Here the semantic properties between the initial cue analog and the analog accessed from long-term memory are highly dependent upon sharing strong similarities in meaning classification (Hummel & Holyoak, 2005). Hummel and Holyoak (2005) also reported that research has shown analogical mapping to rely more heavily on an additional isomorphism constraint than analogical accessing. While the findings from

the Hummel & Holyoak study provide interesting information regarding each process, what is important to note from their findings is that accessing and mapping are impacted differentially by constraints, which helps to establish each as a distinct component process of analogical reasoning.

The result of undertaking the initial two component processes of analogical reasoning – accessing and mapping – provides a foundation for inferences to be made between the established systematic correspondences generated from accessing and mapping information. Lee and Holyoak (2007) argued that research demonstrated a role for causal modeling in analogical inferring. Over the course of two experiments, Lee and Holyoak (2007) tested whether people used causal models to guide analogical inferences. In their (2007) studies Lee and Holyoak tested a prior prediction suggesting increases in the strength of an analogical inference anytime a causal relation is shared between a source and target analog based upon *copy with substitution and generation* (CWSG).

The CWSG process suggests that analogical inferring is guided by iterative mapping from the source analogs to target analogs by one-to-one correspondences between properties and attributes of each analog system (Lee & Holyoak, 2007). The competing causal model theory of analogical inferring Lee and Holyoak test (2007) explains analogical inferences as guided by causal modeling based upon mapping one-to-one correspondences between generative and preventive properties of analogs. The causal model of analogical inferring consists in mappings between both, generative causes that increase the probability of effects happening, and preventive causes that decrease the probability of effects from happening (Lee & Holyoak, 2007). Results

from both experiments suggest that analogical inferences are guided by causal modeling as opposed to copy with substitution and generation (Lee & Holyoak, 2007).

Research has established that accessing and mapping lead to analogical inferring created to fill gaps in understanding and result in new knowledge. Hummel and Holyoak (2005) noted that, given the relationships between the initial three component processes of analogical reasoning, the processing of those relationships can result in a more general schema, which captures the learning resulting from analogical reasoning. Learning represents the fourth component process of analogical reasoning wherein information acquired from relational patterns among systems is stored and applied to future encounters to which it applies. The final two component processes, evaluating and adapting, result from the need to evaluate and possibly adapt inferences to fit novel requirements of targets.

Research on analogical reasoning can be divided into two camps on the basis of measures. Measures of component processes of analogical reasoning, mentioned above, are based on Sternberg's *people piece* analogies test (1977), and are often modified to fit the particular process being investigated. Typically, participants are given problems containing characters with varying attributes in their attire, which require pattern completion solutions resulting from effective analogical processing. By contrast, general analogical reasoning ability is often measured by tests like Miller's Analogy Test, and Ravens Progressive Matrices. A criticism of some general ability tests like Miller's Analogy test is the additional role that verbal knowledge plays in completing the test. Raven's Progressive Matrices removes all influences of verbal knowledge from

their general analogical reasoning ability test and is widely used by researchers and practitioners as a highly reliable measure.

Sternberg (1977) noted that as early as 1938 Raven was defining general intellectual ability as a person's capacity to form comparisons, reason by analogy and develop a logical way of thinking regardless of previously acquired information. It is important to contrast Raven's account with the account of component processes offered above. Raven's account is capturing the general ability to reason analogically opposed to a set of, categorically distinct, interrelated, and interdependent underlying processes, which capture what it means to engage in the cognitive activity of analogically reasoning. As a result of this theoretical difference, there are measures of general analogical reasoning ability on the one hand, and measures of component processes on the other.

General analogical reasoning ability tests, such as Raven's Advanced Progressive Matrices, capture learners' general analogical reasoning ability by having learners solve analogical puzzles, which require the participant to attend to relationships between objects and their properties and note changes in the objects and properties across rows and columns to analogically infer the most likely solution to the puzzle (Raven, Raven, & Court, 1998). By contrast, component processes tests, like the analogical inferring tests used by Lee and Holyoak (2007), are often designed to assess a process underlying the general ability to analogically reason by measuring processing rates, frequency of response to distractors, and frequency of problems answered correctly. Data remains forthcoming in supporting the correlation between general analogical reasoning ability measures and measures of component processes of

analogical reasoning. However, it is reasonable to explore the relationship between the theoretical construct of analogical reasoning each measure is alleged to assess, and the variables of interest, motivation, self-regulation and academic achievement, with a test of general analogical reasoning ability. For the present study, the goal was to examine general analogical reasoning ability as a potential contributor to the understanding of relationships among future oriented motivation, self-regulation, and academic achievement.

Research reviewed from factor analytic studies on Raven's Advanced Progressive Matrices (RAPM) suggests that two distinguishable processing abilities are assessed by the measure (Mackintosh & Bennett, 2005). While debate continues over the dimensionality of Raven's test, many researchers of analogical reasoning agree with Mackintosh and Bennett's (2005) explanation that Raven's test measures perceptual ability and analogical ability. As a measure of general analogical reasoning ability, Raven's test is both, highly recommended by researchers in the field, and from a personal assessment of Raven's items, consistent from the theoretical construct of analogical reasoning to the cognitive activity Raven's test requires for completion. As a result, RAPM was used as a measure of general analogical reasoning ability in this dissertation.

An overview of Miller & Brickman's (2004) model of Future-Oriented Motivation and Self-Regulation

Now that the theoretical concept of analogical reasoning has been reviewed, it is important to describe the model of motivation and self-regulation to which reasoning is being added. The Miller Brickman (2004) model is an account of future based self-

regulation aligned with proximal self-regulation, as a primary function of personally valued future goals linked to perceptions of instrumentality. This account is potentially a powerful way to understand students' retention of information in college, which we know is related to their academic achievement and important for future life success. Essentially, future oriented self-regulatory factors are depicted as actively influencing student degrees of proximal self-regulatory behavior (see Figure 1). With our aspiring nurse as an example we can see that her level of commitment to and investment in reaching her future aspiration actively influences how self-regulated and motivated she is in immediate learning contexts.

Commitment to a personally valued future goal (such as attending a nursing program, owning a business, etc) initiates the construction of paths to future goals that are required if the goals are to be attained. Miller and Brickman (2004) refer to such paths as sub-goal systems. Sub-goal systems can be viewed as pieces of larger goals, as well as source and target analog systems, which are attainable in more immediate futures. As a result, learners with personally valued future goals and linked sub-goal systems are then capable of viewing tasks available in immediate contexts as instrumental to future goal attainment, and worthy of investing energy toward their completion. Essentially, sub-goal systems are broken down into smaller goal units that can then be pursued by learners in immediate contexts. Future goals or aspirations initiate the coordination between future-oriented self-regulation and proximal self-regulation. Within proximal or immediate learning contexts, smaller goal units are referred to as outcome expectations, or the targets that proximal self-regulated learning behaviors are aimed toward (Miller & Brickman, 2004). The dual incentives generated

by student anticipation of positive outcomes, and anticipation of affective self-reactions from proximal goal attainment, are each important self-regulatory factors in human functioning (Miller & Brickman, 2004). However, coordination between future and proximal self-regulation is accomplished only through adopted personally valued future goals, leading to proximal subgoal systems, leading to perceptions of task instrumentality (see Figure 1). As a result of their significant roles in aligning self-regulation and motivation to learn, perceptions of task instrumentality and proximal self-regulated learning behaviors are also achievement-related factors influenced by personally valued future goals, and central to the present research and integrated theory proposal. Theory and research supporting the significance of personally valued future goals to the development of our understanding of student motivation for learning will be summarized next.

Theory and Research on Personally Valued Future Goals

To account for factors influential in student's motivation to learn and academically achieve, Miller and Brickman (2004) integrated a number of theoretical perspectives in their model. The model includes Social Cognitive Theory (Bandura, 1986), Self-Determination Theory (Deci & Ryan, 1985), Personal Investment Theory (Maehr, 1984), Future-Time Perspective Theory (Nuttin, 1985), and the future-oriented extension of Achievement Motivation Theory (Raynor, 1974). Their model of future-oriented self-regulation and proximal self-regulation centers around goals, which are future based with varying extensions into the future (Nuttin, 1985; Miller & Brickman, 2004). An emphasis is placed on future goals that essentially represent the persons we mentally and physically work to become. The goals being referred to are personally

valued future goals, which enable autonomous or self-determined behaviors (Ryan & Deci, 2000). When learners have self-determined goals they are more likely to put forth effort in the classes they believe are important to achieving those goals. For example, the aspiring nursing student will work hard in her math and sciences classes when she perceives them as important for obtaining her future goal.

To account for some of the ways personally valued future goals uniquely contribute to student motivation to learn and achieve, Miller and Brickman contrast personally valued future goals with achievement goals (2004). Although achievement goals will not be examined in the present study, they will be discussed briefly here because they are an important aspect of proximal motivation and have been linked to perceived instrumentality (e.g., Greene, Miller, Crowson, Duke and Akey, 2004). Achievement goals capture goals driven by a desire to appear competent or avoid appearing incompetent to important others, referred to as performance or ego goals, and a desire to improve one's competence referred to as a learning or mastery goal (e.g., Greene & Miller, 1996; Meece, Blumenfeld, & Hoyle, 1988; Miller, DeBacker, & Greene, 1999; Miller et al., 1996; Nolen, 1988; Pintrich & Garcia, 1991). Performance goals, both approach-type and avoidance-type, have been associated with greater use of shallow processing strategies when compared to mastery goals (e.g., Elliot, McGregor & Cable, 1999; Church, Elliot, & Gable, 2001; Greene & Miller, 1996; Meece et al., 1988; Miller et al., 1996; Miller et al., 1999; Nolen, 1988; Pintrich & Garcia, 1991). According to Miller and Brickman (2004), while learning or mastery goals are the type of achievement goals that produce greater motivation to learn, they are not goals pursued by students in all learning environments. Importantly, it is in those

environments in which learning is perceived as valuable to the personal development of the student by the student that learning or mastery goals are active (Greene et al., 2004; Miller & Brickman, 2004). As the research below will show, future oriented motives are often positively related to other adaptive aspects of motivation.

Greene et al. (2004) looked at the impact of classroom structures, including student perceptions of task instrumentality, on the academic motivation of 220 suburban high school students. The researchers hypothesized that perceptions of instrumentality influence the type of achievement goal students adopt in immediate achievement contexts. The influence of perceived instrumentality on achievement goals is argued to be a function of the influence personally valued future goals have on what students perceive as instrumental to attaining their valued future goals (Greene et al., 2004). This argument was supported by the findings in the Greene et al. study (2004) that perceived instrumentality was important for the prediction of academic achievement by virtue of direct influences on mastery goals and strategy use. The findings suggest that instrumentality of present learning tasks for obtaining future goals is another source of student motivation to learn, beyond that of achievement goals. This is consistent with earlier work by Miller and colleagues (Miller et al., 1996) that also showed a significant contribution of future goals to the prediction of academic achievement.

Personally valued future goals are sometimes contrasted with intrinsic motivation to provide greater understanding of the unique and important contribution future goals bring to the study of student motivation to learn (Miller & Brickman, 2004; Tabachnick et al., 2008). Intrinsic motivation encourages behavior that is driven by personal enjoyment and an internal drive, while extrinsic motivation supports behavior

that is based on external concerns and rewards (Ryan & Deci, 2000). Miller and Brickman (2004) note, that intrinsic motives must have some personal value to the individual and extend beyond the moment for learners to find intrinsic interest in academic tasks.

Creten, Lens and Simons (2001) looked at the role of perceptions of instrumentality on student motivation in 733 high school students attending a vocational school in Belgium. The researchers were concerned with addressing trends of devaluing academics among vocational school students. The students were described as having prior difficulties with their motivation for learning resulting in various disruptive, truant, and demotivated behaviors (Creten et al., 2001). According to Creten et al. vocational school students had been found to study for extrinsic reasons versus intrinsic reasons, if they studied at all. Creten et al. (2001) were interested in testing whether or not student's motivation could be enhanced by increasing their perceived instrumentality of schoolwork for attaining their future goals in general, and attaining their professional future goals in particular. Results from the Creten et al. (2001) study indicated a positive correlation between student motivation and their perceptions that courses are valuable for reaching future goals. Students perceived practical courses to be more instrumental to their future goals than theoretical courses, which resulted in increased motivation to study practical over theoretical course work (Creten et al., 2001). Overall, the Creten et al. study provides support for the importance of valued future goals to the study of student motivation for learning, beyond that of existing motivational factors such as learner's intrinsic and extrinsic motives.

In another study on valued future goals, Tabachnick, Miller and Relyea (2008) examined relationships among future-oriented goals and subgoals, perceptions of task instrumentality and task oriented self-regulation strategies in 421 college students. Tabachnick et al. (2008) defined and measured future-oriented goals in terms of intrinsic and extrinsic future aspirations. So, a student with an intrinsic future aspiration may aspire to be a veterinarian to help people's pets to be healthy. Whereas a student with an extrinsic future aspiration may aspire to be a veterinarian so that family members will be proud of her accomplishment and she will earn a high wage. In testing relationships between future goals, college graduation subgoal, perceptions of task instrumentality and self-regulation strategies, Tabachnick et al. (2008) found future goals to have significant direct and indirect effects on the remaining three variables. While future goals had significant effects on the remaining variables as predicted, intrinsic future goals was a stronger predictor over extrinsic future goals (Tabachnick et al., 2008), providing support for the value and time extensions future goals of personal value bring to intrinsic motivation. Support is also generated for the differential effects of intrinsic versus extrinsic future goals on motivation to learn (Tabachnick et al., 2008). The Tabachnick et al. (2008) study further supports the importance of personally valued future goals for our understanding of students' motivation for learning. As Miller and Brickman (2004) noted, personal value adds to the explanation of how students are intrinsically motivated to learn some things and not all things.

Andriessen, Phalet, and Lens (2006) looked at the motivational impact of future goal setting on students from disadvantaged minority groups on school achievement. Andriessen et al. (2006) explored whether a strong and positive future orientation can

indeed protect minority youth from disengagement in learning. They found that learners who value distant future goals and perceive connections between present school tasks and future goals develop increased interest in schoolwork. As a result of the development of increased interest in schoolwork, motivation toward effective learning in the classroom is enabled. Essentially, Andriessen et al. (2006) demonstrated how future goals are important in school motivation for minority and non-minority students wherein interest and motivation to learn are increased and disengagement decreased.

In a related study Simons, Dewitte and Lens (2004) explored patterns of increases in student achievement via future goals. Simons et al. (2004) looked at types of instrumentality and their variable effects on motivation, cognitive strategy use, study habits and academic performance by integrating Future Time Perspective Theory (Husman & Lens, 1999; Lens, Simons & Dewitte, 2002) with Achievement Goal Theory (Devolder & Lens, 1982; Elliot, & Harackiewicz, 1996). The types of instrumentality tested were generated from combining goals with proximal or distal extensions with external or internal regulation. Hence four instrumentality types were generated for their study, proximal external, proximal internal, distal external, and distal internal. Simons et al. (2004) found that the type of instrumentality that combined distal utility valuing with internal regulation of goals were generated by learners who were more excited about the course they were in, persisted longer in the face of difficulties, studied more regularly and performed best in comparison to learners with other types of instrumentality perceptions of schooling. The Simons et al. (2004) study provides additional support for the importance in considering future goals of personal value in further developing our understanding of student motivation for learning.

Overall, research on personally valued future goals demonstrates that when students connect tasks in their school environments with future aspirations they experience increases in interest, greater persistence in the face of difficulties, increased studying and greater motivation for learning (Simons, Vansteenkiste, Lens & Lacante, 2004; Simons, DeWitte & Lens, 2004). Research also demonstrates that students with more self-determined mindsets experience increased interest and develop more effective motivation to learn (Andriessen, Phalet, & Lens, 2006). Students with linked future aspirations to school tasks have enough confidence to work at challenging learning tasks, monitor their progress toward goals and make corrections when required (Miller et al., 1996). Generally, students with academically based future aspirations adopt and commit to motivational and self-regulatory behaviors, which result in higher levels of academic performance (Simons, Vansteenkiste, Lens & Lacante, 2004).

Instrumentality of Schooling

Now that the distinct and unique significance of personally valued future goals to motivation for learning has been reviewed it is natural to explicitly discuss student perceptions of instrumentality. The notion of perceiving a task as instrumental to a valued future goal is presumably tied to notions of perceiving a task as having value in general - whether driven internally or socially (Miller, DeBacker & Greene, 1999; Husman, Derryberry, Crowson & Lomax, 2004). Both instrumentality and utility valuing address the perception that performance of a task is useful for achieving something in the future. However, while Wigfield and Eccles' use of utility value is open to future goals, whether proximal or distal, extrinsic or intrinsic in value, Miller

and Brickman have restricted their use of instrumentality to future goals of a personally valued nature. So, what supports the Miller and Brickman restriction?

When active in a learning environment there are a number of tasks students can perform with instrumental or utility value that are essentially proximal, such as course and exam grades and social statuses among peers and authority figures. Miller and Brickman (2004) suggests that if tasks are also perceived to be instrumental to personally valued future goals, performance on those tasks in turn will have additional utility value beyond that of tasks perceived to have proximal utility value alone.

Evidence of the distinction drawn between instrumentality and utility or task valuing can be found in studies like Tabachnick (2008). Tabachnick et al. (2008) tested aspects of the Miller and Brickman (2004) model when looking at the directions of influence between personally valued future goals, proximal subgoals and perceptions of task instrumentality in a college population of over 400 attending a large southern urban university. Tabachnick et al. (2008) administered items measuring student degree of agreement with statements regarding their future life goals on both intrinsic and extrinsic dimensions. In the same study perceived task instrumentality was measured by the extent to which students perceived work on academic tasks as instrumental to their self-determined future. When addressing the significance of tasks being connected to a self-determined future by contrasting perceived instrumentality with utility valuing, Tabachnick's use of perceived instrumentality is consistent with Miller and Brickman's (2004) use.

Essentially, general task value produces increases in motivation and study outcomes, which is consistent with notions of utility value from expectancy-value theory. By contrast, you have task value associated with attaining specific types of future goals, wherein increases in motivation and study outcomes are a function of the special relationship between attaining the future goal and what is deemed valuable to undertake in an immediate learning context. The later description is more aligned with what Miller and Brickman (2004) referred to as perceived instrumentality in their model. As a result, in the present study I will interpret perceptions of instrumentality as a special type of utility value whereby immediate context activities are perceived as being instrumental to the attainment of a self-determined or personally valued future goal.

Theory and Research on Self-Regulated Learning Behaviors

Increasing student motivation for learning has been demonstrated to be a function of students' perceptions of the connection between academic tasks and the students' valued future goals (Andriessen, et al., 2006). The perception that completion of a task will directly increase the probability of achieving a future goal (Husman, et al., 2004) is an account of the motivational construct of perceived instrumentality. However, to increase academic achievement, self-regulatory behaviors that directly account for differences in how learners prepare for academic tasks associated with academic achievement are hypothesized to be impacted by instrumentality perceptions (Husman, et al., 2004). It is only through the role instrumentality plays in future thinking, and the resulting benefit to motivated learning behaviors, that student's self-directed efforts to transform their mental abilities into academic skills are impacted

(Zimmerman, 2002). In other words, self-regulation is impacted when the value of a learning task is perceived as important to complete for now and the future.

Simons, Dewitte and Lens (2004) looked at the differing effects of types of instrumentality and regulation on motivational, cognitive and behavioral factors in adult nursing students. The four types of instrumentality used in the Simons et al. study (2004) were created by crossing proximal and distal instrumental valuing with dimensions of internal and external regulation. A particular point of interest involved the utilization of path modeling to test the influence of type of instrumentality on academic performance through motivational components and study strategies (Simons et al., 2004). The findings from the Simons et al. study (2004) indicated that students who were internally regulated, that is students who emphasized personal development when studying for the course, and students who had distal instrumental value for the course, students who saw completion of course tasks as valuable to distant future goals, studied more regularly and scored higher on the exam than all other students in the course. The Simons et al. (2004) study provides support for the influence of instrumentality of schooling perceptions on self-regulatory factors such as study time.

In the Tabachnick et al. study (2008), self-regulation represents the conscious attention to, evaluation of, and reaction to goal pursuits, mental processing and resulting behaviors. Self-regulation was measured using the task-oriented self-regulation strategy scale, a subset of the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia & McKeachie, 1991). Aside from looking at future goal and subgoals as predictors of task instrumentality, Tabachnick et al. (2008) sought to examine the relationship between task instrumentality and self-regulation strategies. Results from the

Tabachnick et al. (2008) study indicated that perceptions of instrumentality were highly correlated with self-regulation strategies and perceptions of instrumentality were significant predictors of self-regulation strategies. Both the Simons et al. (2004) and Tabachnick et al. (2008) studies support a direction of influence from perceptions of instrumentality to self-regulation.

In the aforementioned Simons et al. (2004) study, the roles of types of instrumentality on motivational and self-regulatory factors were explored. Simons et al., made several predictions, in particular they predicted that students with the type of instrumentality that combined distal aspirations with internal regulation would be more motivated learners. Results from the Simons et al. (2004) study indicated that students who found coursework useful for their future jobs and for personal development scored higher on measures of task orientation, excitement about the course, persistence, study time regularity and academic performance than did students with other instrumentality combinations.

Self-Regulated Learning Behaviors & Academic Achievement

Academic self-regulation is a process, or set of processes, in which a student attempts to coordinate his/her behavior to reach personally valued academic goals (Zimmerman, 2002). Self-regulation consists of reciprocal iterations between behaviors, environmental variables, and personal factors (cognitions), whereby self-generated behaviors that are systematically oriented toward the attainment of student learning goals are achieved (Schunk, 1989). Effective use of self-regulatory processes leads to the development of knowledge, acquisition of new skill, and performance on complex tasks (Kanfer & Ackerman, 1989).

Eshel and Kohavi (2003) investigated the role of self-regulated learning strategies in mathematics achievement of sixth graders from low socio-economic backgrounds, hypothesizing that when student perceptions of control over learning are highest when both teacher and student control is high. Net effect of student control is interpreted to consist in four combinations of high to low student versus teacher controls considered in the study, wherein self-regulated learning strategies are highest when student control is high and teacher control is low. Eshel and Kohavi (2003) further hypothesized that self-regulated learning strategies would be linked to net effect of student control. Eshel and Kohavi's (2003) hypothesis was supported – all student attributes were significantly and positively related to mathematics achievement. Significant use of self-regulated learning strategies was contingent on perceived classroom control.

Pintrich and De Groot (1990) looked at relationships between motivational orientation, self-regulated learning and classroom academic performance within a sample of 173 seventh graders. Pintrich and De Groot defined self-regulation in terms of three components. Their initial component of self-regulation consists in student's metacognitive strategies for planning, monitoring, and modifying their cognition (Pintrich & De Groot, 1990). Their second component of self-regulation consists in student's management and control of their effort on classroom academic tasks (Pintrich & De Groot, 1990). The final component of self-regulation proposed by Pintrich and De Groot (1990) consist in student's cognitive strategies used to learn, remember, and understand material. Pintrich and De Groot (1990) found that students who reported higher levels of self-regulated learning also had higher levels of cognitive strategy use

and higher levels of intrinsic value for learning. Self-regulated learning was found to be the best predictor of academic performance in the Pintrich and De Groot (1990) study.

Pintrich and De Groot (1990) measures of the initial metacognitive strategies component of self-regulation consist of items students rate on a 1 to 7 scale about their planning, skimming and comprehension monitoring strategies for learning. An example item is as follows, "I ask myself questions to make sure I know the material I have been studying". Measures of the effort management strategies component of self-regulation were adapted from Zimmerman and Pons (1990) and capture student's degree of persistence at difficult or boring tasks and student's diligence at work (Pintrich & De Groot, 1990). An example item is as follows, "Even when study materials are dull and uninteresting, I keep working until I finish" (Pintrich & De Groot, 1990). Measures of the final cognitive strategies component of self-regulation consist of statements regarding student's rehearsal strategies (Pintrich & De Groot, 1990). An example item is as follows, "When I read material for science class, I say words over and over to myself to help me remember" (Pintrich & De Groot, 1990). The Pintrich and De Groot (1990) use of self-regulation is consistent with the triadic social-cognitive account of self-regulation (Bandura, 1986; Zimmerman, 2002).

Jones noted (2002) that the various theories of self-regulation have similar features, which include goal setting, monitoring, cognitive strategy use and self-evaluation. Jones (2002) looked at the relationship between self-regulation, motivational factors, and learning outcomes in a training context. Consistent with social-cognitive accounts, Jones (2002) defined self-regulation in terms of the coordination of the three sub-processes; self-observation, self-judgment and self-

reaction, toward the attainment of specific goals. The Jones (2002) account of self-regulation is taken directly from Bandura's (1986) Social Cognitive Theory and is consistent with the Miller and Brickman (2004) account of proximal self-regulatory processes. Items on the Self-Regulation Questionnaire (SRQ) are highly similar to items used in the Pintrich and De Groot study (1990) to capture the metacognitive strategies component of self-regulation. Items in Jones (2002) have students rate their agreement with statements on a 1 to 5 scale. Example item stems are as follows, "Before a quiz or exam, I plan out how I will study the material," "I organize my study time well for class". Both the Jones (2002) and Pintrich and De Groot (1990) uses of self-regulation are social-cognitive in nature and consistent with the Miller and Brickman account (2004) adopted for the present study. Further Jones (2002) use of the SRQ has been found to be a reasonably reliable measure of self-regulation ($\alpha = .84$), is consistent with the theoretical account of self-regulation used in the present study, and requires minimal modifications for the present study. Essentially, there is sufficient warrant for use of the SRQ to measure self-regulation in the present study.

Summary and Overview of the planned study

In summary, Miller and Brickman's (2004) model captures the coordination of future-oriented self-regulation with proximal self-regulatory processes. In optimal cases, one's in which none of the factors in either regulatory system are missing or mis-configured, students are considered motivated and self-regulated learners (Miller & Brickman, 2004). Self-regulated and motivated students are this way as a function of aligning and coordinating factors in self-regulatory systems with future and present bases. The alignment is explained in part through future aspirations and instrumentality

perceptions, yet leaves open a role for explaining how reasoning takes place between systems for effective coordination. Specifically, the bridge between both regulatory systems, future and proximal processes, is a function of instrumentality perceptions. So, what influences the likelihood that a learner will find tasks in a proximal context as instrumental?

The Miller and Brickman (2004) model bridges the future-oriented regulatory system with the system of proximal self-regulation processes through a system of proximal subgoals which lead to the personally valued future goal. Developing a proximal system of subgoals increases the likelihood that proximal tasks are perceived as instrumental to attaining personally valued future goals (Miller & Brickman, 2004). Further, proximal tasks perceived as instrumental to personally valued future goals have greater incentive and meaning than proximal tasks that lack that instrumental component (Miller & Brickman, 2004). Herein lies the initial role for analogical reasoning.

The alignment between personally valued future goals, resulting subgoal systems, and perceived instrumentality of available tasks must contain commonalities based on shared similarities between each set of factors and their attributes. For example, during the course of a middle school day an 8th grade student finds himself a bit more engaged in his Algebra I class than in his six other courses. He has adopted the personally valued future goal of becoming an engineer, which was influenced by having a drive for building and learning math, and having an uncle who is a successful engineer. The aspiring engineer develops subgoals for learning Math well throughout Middle and High schools, which are further broken down into the subgoal of earning an

A in his present Algebra I course impacting his desire to regularly attend and perform well in class. Mathematics is significant to his personally valued future goal of going to college and majoring in Engineering, which enables subgoals systems with Mathematical emphases to be developed and impact perceptions of task instrumentality in proximal contexts. To develop well articulated subgoal systems, as those shared by our aspiring engineer, related information had to be analogically processed from math based classroom tasks, to course achievement goals, to future college goals wherein discriminations are made, concepts are acquired and rules are applied toward the development of subgoal systems. At some point in the information processing activity engaged in by our aspiring engineer all six analogical reasoning processes had to be active for successful alignment between future and proximal regulatory systems.

In response to the question, "what influences the likelihood that a learner will find tasks in a proximal context instrumental?" Miller and Brickman (2004) suggest that well-articulated paths to subgoals are what influence the likelihood that a learner will find tasks in a proximal context as instrumental. Antecedents to developing a well-articulated subgoal system are the function of the cognitive coordination between; knowledge of possibilities for action, personally valued future goal, and general and task-specific problem solving and learning strategies (Miller & Brickman, 2004). So, our aspiring nurse and engineer must analogically reason between goal related competence, adopted personally valued future goals, and knowledge of possible actions to undertake toward their goals. Both the processes of developing well-articulated subgoals, and the impact of well-articulated subgoal systems on proximal tasks through perceptions of instrumentality require cognitive coordination of an analogical nature.

It is presently argued that the roles played by future orientation, subgoal systems and instrumentality perceptions are aided by necessary inferential connections made between interrelated factors in each self-regulatory system for effective alignment and coordination. The activity of making inferences between systems and related factors seems consistent with the definitions of analogical reasoning offered above. Inquiries into how this analogical or inferential activity takes place can begin with an examination of important relationships between general analogical reasoning ability, systems of self-regulation and perceptions of instrumentality.

Research Questions

What role does analogical reasoning play in Miller and Brickman's (2004) model of future-oriented motivation and self-regulation?

1. Basic Correlations Tests:
    a. Are analogical reasoning scores positively correlated with future orientation scores?
    b. Are analogical reasoning scores positively correlated with instrumentality of schooling scores when controlling for future orientation?
    c. Are instrumentality of schooling scores positively correlated with self-regulation scores when controlling for future orientation scores?
    d. Are self-regulation scores positively correlated with academic achievement measures when controlling for future orientation, analogical reasoning and instrumentality of schooling scores?

    e. Are analogical reasoning scores positively correlated with academic achievement measures when controlling for future orientation, instrumentality of schooling and self-regulation?

2. Mediator model
    a. Does analogical reasoning mediate between future orientation and instrumentality of schooling?
3. Moderator model
    a. Does analogical reasoning moderate between future orientation and instrumentality of schooling?
4. Is there added explanatory power in an integrated model of analogical reasoning with future-oriented motivation and self-regulation, whether mediated or moderated, over the original model without analogical reasoning?

CHAPTER 3 – METHODOLOGY

Overview

The previous chapter provided an overview of the constructs of interest: future orientation, instrumentality of schooling, self-regulation and analogical reasoning, and ended with the research questions for this dissertation study. This chapter will provide an overview of the research design and the details related to the participants, materials, and procedures.

Research Design

A correlational design was employed to address the research questions. And, three a priori path models and two post-hoc path models were tested (see attached path models). Analogical reasoning was tested in varied roles with variables central to Miller and Brickman's (2004) model of future-oriented motivation and self-regulation.

Sample

Participants were college students from Freshmen to Seniors attending a large mid-western university. The average participant was 18 – 24. Students were recruited from the following; their classes, academic merit based programs wherein student participants are referred to as 'scholars', and social organizations housed within the University's Student Services Department. A total of 373 participants were initially entered into a data set for analyses. Instruments were administered to participants during the Spring 2009 semester, either in large class factor courses, which contain 120 to 200 or more students per administration period, or in a reserved university lab with a capacity of 15 student participants per administration period.

About one-third of the students reported having at least one parent with a Bachelor's degree and another twenty-five percent reported having at least one parent with an Associate's degree. Nearly half of the sample had taken 1 – 4 courses in their major, and almost thirty percent of students had taken 5 – 11 courses in their majors, meaning that almost seventy percent of the sample had taken at least one course in their major. Approximately seventy-five percent of the students in the present sample reported considering 1 to 2 majors of study.

Measures

The variables were future orientation, general analogical reasoning ability, instrumentality of schooling, self-regulation and academic achievement. Each of the instruments used to measure these variables will be described next. Each instrument, or an example of it, is also provided in the Appendix.

Future orientation. The present use of future orientation is intended to represent particular types of personally valued future goals, anticipated future outcomes or future aspirations (Miller & Brickman, 2004). Orientation to the future happens within particular social, cultural and historical contexts, which in turn influence conceptions of what is possible and desirable in the future (Nurmi, 1993; Nurmi, Poole & Kalakoski, 1994). Future orientation has typically been defined and measured according to two aspects, thematic structure of future orientation, and temporal extension of future orientation (Nurmi, 1993; Nurmi, Poole & Kalakoski, 1994; Seginer, 2000). The thematic structure of future orientation consists in various interest, goals and expectations people have regarding their futures, which has been investigated in domains of personal concern like education and the military (Seginer, 2000). Future

extension is the other aspect of future orientation often measured, and both aspects of future orientation bear conceptual closeness to the theoretical account of personally valued future goals provided by Miller and Brickman (2004). Thus, a modified version of Seginer's (2000) Future Orientation: The Prospective Life Course Questionnaire was used for the present study.

The Prospective Life Course Questionnaire measures learner's future aspirations on two thematic structure dimensions, education and career. Future aspirations were also measured on the level or degree of commitment the student has toward their prospective life course as opposed to measuring the extension of the aspiration into the future. Items captured the thematic structure dimensions of education and career by inviting students to consider their level of commitment toward future educational and career aspirations and the frequency with which students engage in planning and considering future educational and career aspirations. Students' level of commitment toward the future aspiration under consideration was captured by having students respond with levels of commitment that state they are "not at all committed" to "very committed" to the educational or career aspiration considered. The Prospective Life Course Questionnaire (2000) invites participants to consider their opinions and thoughts about the future. Participants are told they are being presented with questions that have no right or wrong answers. Participants are asked to circle the answer that best fits their personal beliefs by indicating how much they agree with statements regarding the way they think about their futures. Participant agreement is rated on a 5-point scale. Examples of prospective life course stems are as follows:

1. In thinking of your future education, which of these statements describes you best? Please circle one number.
    1. I have not yet thought about matters relating to my future education.
    2. Sometimes I look at one possibility or another relating to my future education.
    3. I am seriously looking into several possibilities concerning my future education.
    4. I am looking into one serious possibility concerning my future education.

10. When you think about matters concerning your future career which of the following statements best describes your situation? Please circle your response.

    (1) I have not yet thought about matters relating to my future career.
    (2) Sometimes I look at one possibility or another concerning my future career.
    (3) I am seriously looking into several possibilities concerning my future career.
    (4) I am looking into one serious possibility concerning my future career.
    (5) After looking into several possibilities concerning my future career, I am focusing on one serious possibility.

Scores from items on both the educational and career aspirations subscales were averaged. Items numbered one through nine are averaged to generate a future educational aspirations score and items ten through twenty are averaged to generate a future work and career aspirations score.

Instrumentality of schooling. The measure of perceptions of instrumentality of schooling is based on the Perceived Instrumentality Scale (Miller et al, 1999; Greene et al., 2004; Tabachnick, 2008). Items on the Perceived Instrumentality Scale were modified from having students consider the instrumentality of a particular class to having students consider the instrumentality of college classes in their respective majors and college courses more generally. Studies using the Perceived Instrumentality Scale (Miller et al, 1999; Greene et al., 2004; Tabachnick, 2008) have yielded alpha reliability coefficients of .91, .90 and .91 respectively. This index was designed to measure student perceptions of the utility of knowledge constructed in college courses toward the

attainment of valued future goals. Modified item sets include modifications to the item stem and motives. Both versions appear below with the modified version displayed second:

Original version example:

"I do the work in my science class because….."

- my performance in my science classes is important for becoming the person I want to be.
- my achievement in science classes plays a role in reaching my future goals.

Modified version example:

"I do my college work during the semester because…"

- my performances on coursework in courses within my major are important for becoming the person I want to be.
- my scores and grades in courses within my major play a role in reaching my future goals.

Scores from items on the Instrumentality of Schooling Scale (ISS) were averaged to generate a composite instrumentality variable.

Self-regulation. The Self-Regulation Questionnaire (SRQ) consists of 14 items providing an overall measure of self-regulation within a learning context. In past studies the Jones and Greene (2002) measure yielded an alpha reliability coefficient of .84 (Jones, 2002). The SRQ invites participants to rate their agreement with statements

regarding their study habits on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree). Items invite participants to consider specific behaviors they may or may not exhibit while studying and learning. SRQ item stems are stated as follows:

1) Before a quiz or exam in my college courses, I plan out how I will study the material.

Items are scored by average wherein averages can range between 1 and 5. The higher the average the stronger the participant is expressing agreement with the statement under consideration.

General analogical reasoning ability. Analytic intelligence (Carpenter, Just & Shell, 1990), general fluid ability, and inductive reasoning (Sternberg, 1977) are all arguably highly related conceptions of the human ability to reason between relations, correlations or analogies to arrive at inferred conclusions of pragmatic significance regarding future outcomes. In a study on intelligence tests (Hunt, 1990), the Raven's Advanced Progressive Matrices (RAPM) was held to be one of the best single measures of general fluid ability (Gf). Suggested uses of Raven's APM are for measurement of a participant's ability to form perceptual relations and reason by analogy (Mackintosh & Bennett, 2005). Test-retest reliability coefficients of .88 for students over 13 years of age, and .93 for participants under the age of 30, have been obtained (Mackintosh & Bennett, 2005). Use of the Raven's APM has provided reliable measures for the majority of participants well within the age range of participants for the present study. Over greater periods of time, such as several weeks, internal consistency ratings of the Raven's are smaller but still reliable. Thus, Raven's (APM) was administered as a measure of general analogical reasoning ability in the present study. Items on the

RAPM invite participants to complete spatially patterned puzzles by attending to properties of objects in columns and rows and using that information to select the 1 out of 8 options that best completes the pattern set. Items contain no verbal content whatsoever. Raven's APM items are scored based on total number of problems solved correctly, with 1 point for each problem correct, and no points for incorrect answers.

In the present study a short form of Raven's Advanced Progressive Matrices (RAPM) was utilized, consisting of 12 of the original 36 RAPM items. Short form items consisted of progressively more difficult items consistent with the full RAPM. Cronbach's alpha, the mean and standard deviation for the 12-item short form of RAPM parts 1 and 2 can be found in Table 1. RAPM scores range from zero correct to 12 correct wherein scores indicate the number of RAPM items answered correctly.

Academic achievement. The achievement outcome measure is end of the semester GPA. These data were obtained from the Records Office. Permission to use student academic records was received from administrative personnel in the Records Office prior to submitting and receiving institutional approval to conduct the dissertation study. Academic records were retrieved from the Records Office at the end of the Spring semester, and were only released to the primary investigator of the study with university identification, a copy of the informed consent form, and a copy of the institutional approval letter. For data analyses semester GPAs were coded numerically based upon a traditional grading scale then averaged. As such, 'A = 4', 'B = 3', 'C = 2', 'D = 1', and 'F = 0'.

Procedure

Institutional approval was obtained February 18th, 2009. The approved recruitment script for the dissertation study was emailed to professors and instructors of targeted courses. Students were recruited for participation in the present study through verbal recruitment within each of their courses. The primary investigator obtained instructor permission to visit courses and offer students an opportunity to participate in the study. Students were provided an overview of the study from the informed consent and given the opportunity to sign-up for the study. Data were collected on two separate occasions during the semester. Data were entered in bunches within 3 hours of being collected, according to the data administration plan for the dissertation, which was implemented over the course of three months during the Spring 2009 semester. As the data were entered the file was checked for extraneous values. Prior to conducting statistical analyses on the data student names were used to match responses on scales from administration phase one with their responses to scales administered at the end of the semester, which was phase two. Once GPAs were obtained and matched with respondent scale packets, names were removed from all data sets. Numerical codes were provided to identify students' data so that data was matched from time 1 to time 2.

Students who agreed to volunteer for the study were asked to complete paper and pencil scales in the study packet at two separate times during the semester. For time 1 data collection, during the first half of the semester, participants completed a demographic form and two scales; the Prospective Life-Course Questionnaire (PLCQ) for college students, and Raven's Advanced Progressive Matrices (RAPM, 1998). Students were given an estimated time of completion for all three time-1 scales of 1 hour (5 minutes for demographics, 15 minutes for RAPM, and 40 minutes for the

PLCQ). For time-2 data collection, just prior to finals week, participants completed the Instrumentality of Schooling (ISS) scale, and the Self-Regulation Questionnaire (SRQ). Students completed both time-2 scales within 15 minutes (5 minutes for the ISS, and 10 minutes for the SRQ).

Plans for Analyses

After scale reliabilities were computed for each of the four aforementioned constructs, tests of basic correlations were undertaken between future orientation, analogical reasoning, instrumentality of schooling, self-regulation and academic achievement. Then, multiple path models were tested including replication efforts involving the Miller and Brickman variables. As the figures suggest analogical reasoning is tested in varied roles with variables central to Miller and Brickman's (2004) model of future-oriented motivation and self-regulation.

Three a priori path models are tested with varying associations between future orientation, analogical reasoning, instrumentality of schooling, self-regulation and academic achievement. (see Figures 2 & 3) Future-oriented motivation serves as the sole exogenous variable in two of the three path models tested and academic achievement is the primary learning outcome of interest in all three models. The first path model tested is a replication of the Miller and Brickman (2004) model, future-orientation serves as the sole exogenous variable and is tested as having a direct effect on instrumentality of schooling, and an indirect effect on self-regulation through instrumentality of schooling, instrumentality of schooling is tested as having a direct effect on self-regulation and an indirect effect on academic achievement through self-regulation, and self-regulation is tested as having a direct effect on academic

achievement. The next path model, the mediated model, tests direct effects from future-orientation to analogical reasoning and instrumentality of schooling, and an indirect effect of future-orientation on instrumentality of schooling through analogical reasoning, a direct effect of analogical reasoning on instrumentality of schooling, a direct effect of instrumentality of schooling on self-regulation and an indirect effect of analogical reasoning on self-regulation through instrumentality of schooling, a direct effect of self-regulation on academic achievement, and an indirect effect of instrumentality of schooling on academic achievement through self-regulation. The final path model, the moderator model, tests a direct effect from future-orientation to instrumentality of schooling, a direct effect of a moderator term which is an interaction between future-orientation and analogical reasoning to instrumentality of schooling, a direct effect of analogical reasoning to instrumentality of schooling, a direct effect of instrumentality of schooling to self-regulation, an indirect effect of instrumentality of schooling to academic achievement, and a direct effect of self-regulation on academic achievement.

Additionally, two alternative path models were tested to increase fit indices. The additional path models were generated directly from re-analyzing the Miller and Brickman (2004) model of future-oriented motivation and self-regulation in relation to zero order correlations obtained from the present study. The two post-hoc path models, which included analogical reasoning, differed from the mediated and moderated models in a few ways. In particular, analogical reasoning was tested as an additional exogenous variable twice and an endogenous variable once. The final significant differences between the a priori path models tested and the post-hoc path models tested are based in

two of the post-hoc models containing a non-recursive loop between the three Miller and Brickman variables in the study, and only the mediated a priori model contains a non-recursive loop, which is between future-orientation, analogical reasoning, and instrumentality of schooling.

CHAPTER 4 – RESULTS

The goal of the present study was to explore the role analogical reasoning plays in the Miller and Brickman (2004) model. Data that were collected and analyzed to address research questions for the present study are presented below. The chapter begins with preliminary analyses, which include data inspection and demographic data reports. The next section contains instrument reliability results. Correlations between the variables significant to this study are then reported. Finally, path analyses, path coefficients, and fit indices are presented with the related research questions.

Preliminary Analyses

Handling missing data. Once the data were collected the file was analyzed for extraneous values and general outliers. Relevant statistical assumptions were tested as well. The original sample for the present study consisted of 373 undergraduate students, but a total of 181 cases were removed for having incomplete questionnaires, no time 2 data, and /or lack of signed consent. Listwise deletion was applied to the data resulting in a complete data set of 192, which was used for all analyses.

Scale Reliability and Other Descriptive Data

The Cronbach alpha tests of internal reliability were computed for each scale and subscale (see Table 1). Most of the reliability estimates were in the acceptable range (.77 to .82). The future orientation variable and analogical reasoning variable, measured by the Raven's test, had marginally acceptable estimates (respectively, .63, .67). The means and standard deviations are also shown in Table 1.

Table 1

Summary of Means, Standard Deviations, and Cronbach's Alpha Reliabilities for Variables

Variable	Variable Description	Mean	SD	Alpha
ISTOT	Instrumentality of Schooling	4.4573	.55245	.820
SRQTOT	Self-Regulation	3.8225	.48045	.803
RAPMSUM	Analogical Reasoning	7.5363	2.39574	.671
FOTOT	Future-Orientation	4.0641	.39156	.839
SPR_GPA	Spring grade point average	3.2570	.66039	N/A
FOED	Future-Oriented Education	3.9268	.44034	.717
FOCAR	Future-Oriented Career	4.1983	.43013	.774

Correlations and Research Questions

Research questions 1a-1e basic correlations. The first task was to test relationships between the predictor variables, future-oriented motivation, analogical reasoning, instrumentality of schooling, self-regulated learning behaviors and the outcome variable academic achievement. Bivariate correlations between future-oriented motivation and analogical reasoning, analogical reasoning and instrumentality of schooling, instrumentality of schooling and self-regulation, were assessed for positive associations (see Table 2).

Analogical reasoning, future-orientation, instrumentality of schooling, and self-regulation correlated positively and significantly with academic achievement as measured by Spring GPA (see Table 2), though, the correlation between analogical

reasoning and GPA was only .16. The correlations between analogical reasoning and the other predictor variables were all close to zero; therefore , the answer to research questions 1a through 1c is no. The fact that each correlation coefficient associated with analogical reasoning is close to zero, suggests that there is little if any relationship between RAPM, used as a measure of analogical reasoning, and the self-report measures used to represent the constructs future-orientation, instrumentality of schooling and self-regulation.

In regards to research questions 1d and 1e, both self-regulation and analogical reasoning were statistically significantly correlated with academic achievement (Spring GPA), as were future-orientation and instrumentality of schooling (see Table 2). These findings are consistent with past research which suggested a significant relationship between future-orientation and academic achievement (Miller et al., 1996; Tabachnick et al., 2008).

Table 2

Pearson Product Moment Correlations for All Variables

	ISTOT	SRQTOT	RAPM SUM	FOTOT	SPR_GPA	FOED	FOCAR
ISTOT	-						
SRQTOT	.410**	-					
RAPM SUM	.068	-.019	-				
FOTOT	.394**	.384**	-.029	-			
SPR_GPA	.197**	.346**	.205**	.136	-		
FOED	.340**	.372**	.010	.898**	.169*	-	
FOCAR	.366**	.314**	-.064	.890**	.073	.597**	-

Note: **. Correlation $p <$ 0.01 level (1-tailed) *. Correlation $p <$ .05 0.05 level (1-tailed). Listwise deletion N= 192. ISTOT = instrumentality of schooling, SRQTOT = self-regulation, RAPMSUM = analogical reasoning, FOTOT = future-orientation, Spring GPA = Spring semester's grade point averages, FOED = future-oriented education, FOCAR = future-oriented career.

Path models – Tests of research models. While zero order correlations provide some indication of relationships between variables, one-to-one correspondences between two variables capture simple associations not the more complex relationships described in theory. Therefore, my initial research consideration was to test Miller and Brickman's theoretical model of future-oriented motivation and proximal self-regulatory processes. Three key variables (future-orientation, instrumentality of

schooling, and self-regulation) from Miller and Brickman's (2004) model were entered into a path model analysis with academic achievement as the outcome (Spring GPA). Future-orientation was tested as an exogenous variable directly linked to instrumentality of schooling. Instrumentality of schooling was tested as an endogenous variable directly linked to self-regulation. Self-regulation was tested as an endogenous variable directly related to academic achievement (see Figure 2). The path coefficients ranged from .36 to .58 with all paths significant ($p < .001$). However, the portions of the Miller and Brickman model tested in the present study produced poor fit of the data to the model (see Table 3). Obtaining results of significant path coefficients and poor fit indices warrant deeper investigation into the additional theoretical explanatory power, if any, analogical reasoning brings to the Miller and Brickman (2004) model.

The subsequent path models contain the same three Miller and Brickman variables, academic achievement, and the addition of analogical reasoning. Analogical reasoning was tested as a mediator (see Figure 3) and moderator (see Figure 4) to address research questions two, three, and the fourth and final question, "Is there added explanatory power in an integrated model of analogical reasoning with future-oriented motivation and self-regulation, whether mediated or moderated, over the original model without analogical reasoning?" To that end analogical reasoning was tested as transmitting or mediating effects from future-orientation to instrumentality of schooling. The mediated model includes future-orientation as the sole exogenous variable, directly linked to analogical reasoning and instrumentality of schooling and indirectly linked to instrumentality of schooling through analogical reasoning. Analogical reasoning is tested as directly linked to instrumentality of schooling, instrumentality of schooling is

tested as directly linked to self-regulation, and self-regulation is tested as directly linked to academic achievement (see Figure 3).The paths between Miller and Brickman variables, future-orientation, instrumentality of schooling, and self-regulation to academic achievement produced statistically significant path coefficients ($p < .001$). However, the paths from future-orientation to analogical reasoning, and from analogical reasoning to instrumentality were non-significant ($p = .684$, $p = .227$, respectively). Results produced poor fit of the data to the mediated model (see Table 3).

The final a priori path model tested the moderator model, which contains an interaction term generated from combining future-orientation with analogical reasoning. To account for risks of multicollinearity between future-orientation, analogical reasoning and the resulting moderator each of the three variables were centered (Judd, & Kenny, 2010). After centering the aforementioned variables, the new centered interaction term and original variables were entered into the final path analyses. The moderator model contains three exogenous variables, future-orientation, the moderator variable, and analogical reasoning. The three aforementioned exogenous variables are tested as directly linked to the endogenous variable instrumentality of schooling, which is tested as directly related to self-regulation, which is tested as directly linked to academic achievement (see Figure 4). As with the previous path models, path coefficients obtained from paths between Miller and Brickman variables to academic achievement were all significant ($p < .001$). However, both paths from analogical reasoning to instrumentality, and the moderator term to instrumentality, were non-significant (see Figure 4). Results from the path analysis produced poor fit of data to the moderated model, with fit indices becoming increasingly poor from the Miller and

Brickman, to the mediated, to the moderated models (see Table 3). Therefore, based on theory, primarily Miller and Brickman's (2004) model, and correlational results from the present study, two post-hoc path models were tested.

The two post-hoc path models tested include a non-recursive loop between the three Miller and Brickman variables. An additional direct path from analogical reasoning to academic achievement is included (see Figure 5). The path model generates good fit (CMIN = 1.7, *p* ns, see Table 3 for all fit indices). Additionally, all path coefficients are significant ($p < .001$, see Figure 5 for path coefficients). After the aforementioned post-hoc path model produced good fit indices a final post-hoc path model was tested. The final post-hoc path model tested was identical to the first with an additional direct path from analogical reasoning to instrumentality of schooling (see Figure 6). All path coefficients were significant ($p < .001$), with the exception of the path from analogical reasoning to instrumentality ($p = .244$). This model also produced good fit indices (i.e., CMIN = 0.6, *ns*, see Table 3 for complete fit indices).

Table 3

Fit Statistics for Path Models CMIN df NFI CFI RMSEA

Models	*df*	CMIN	NFI	CFI	RMSEA
Miller Brickman Model	3	14.8**	.861	.883	.143
Mediator Model	5	24.6**	.791	.818	.143
Moderator Model	10	38.0**	.712	.747	.121
Alternative Model 5	5	2.30	.981	1.00	.000
Alternative Model 7	4	0.95	.992	1.00	.000

Note. For the CMIN test, (**) denotes $p < .001$. For the NFI, CFI, and RMSEA all values were within acceptable limits. The sample used in all analyses was 192.

CHAPTER 5 – DISCUSSION

Overview

The final chapter begins with a discussion and review of the findings. The subsequent section addresses the limitations of the study. Then, a discussion of the implications for future research is presented. Finally, the dissertation ends with a summary and conclusion.

Review of the Findings

Zero order correlations were undertaken between three Miller and Brickman variables, analogical reasoning, and academic achievement to address the initial research questions for the study. Analogical reasoning correlated with academic achievement, but failed to correlate with future orientation, instrumentality of schooling, and self-regulation. The zero order correlations between analogical reasoning and future-orientation, analogical reasoning and instrumentality of schooling, and analogical reasoning and self-regulation all came close to zero, which suggests analogical reasoning is not related to the three Miller and Brickman variables future-orientation, instrumentality of schooling and self-regulation. To be specific, Raven's Advanced Progressive Matrices, which was used as a measure of analogical reasoning, was not related to self-report measures of future-orientation, instrumentality of schooling and self-regulation. Notably, it is always possible that measurement error, in either case, could be the explanation.

Additional zero order correlations between the three Miller and Brickman variables and academic achievement were positive and consistent with related past research findings (Pintrich & De Groot 1990; Miller et al., 1996; Creten et al. 2001;

Eshel & Kohavi 2003; Greene et al.2004; Tabachnick et al., 2008). Consistent with the Greene et al. study (2004), perceived instrumentality was positively correlated with academic achievement. A positive correlation was found with future orientation and academic achievement, which is consistent with results from the Creten et al. (2001) study indicating a positive correlation between student motivation and their perceptions that courses are valuable for reaching future goals. A positive correlation was found between self-regulation and academic achievement consistent with Eshel and Kohavi's (2003) results of significant use of self-regulated learning strategies being correlated with higher academic performance. Not only were all three Miller and Brickman variables positively correlated with academic achievement, they were also positively inter-correlated. As such, these final zero order correlational results are consistent with studies like Simons et al. (2004), which provides support for the influence of instrumentality of schooling perceptions on self-regulatory factors such as study time. Lastly, in the present study self-regulation produced the strongest correlation with academic achievement, which is consistent with the Pintrich and De Groot (1990) study wherein self-regulated learning was found to be the best predictor of academic performance.

In addition to testing whether an association exists between analogical reasoning and the three Miller and Brickman variables, three path models were tested. The initial model contained the three Miller and Brickman variables, future-orientation, instrumentality of schooling, and self-regulation with the outcome variable academic achievement. All three path models tested produced poor fit of the data to the a priori path models. However, two post-hoc path models were tested based on theoretical

inferences made from the Miller and Brickman (2004) model, and correlational findings from the present study.

Upon reviewing Miller and Brickman's (2004) model it became clear that recursion was an overlooked component of the model. The a priori models tested were all of a recursive nature, with the exception of the mediated model, which contains a non-recursive loop between future-orientation, analogical reasoning, and instrumentality of schooling. However, after identifying links from the proximal self-regulatory processes system back to the future-oriented self-regulatory system (see Figure 1, Miller and Brickman, 2004), it became logical to test two non-recursive post-hoc path models with links between the three Miller and Brickman variables. The final post-hoc path models tested included analogical reasoning directly linked to academic achievement and instrumentality of schooling. In response to Miller and Brickman's (2004) discussion of well articulated subgoal systems increasing the likelihood learners will find tasks in a proximal context instrumental, analogical reasoning was tested as directly linked to instrumentality of schooling.

The first post-hoc model tested consisted of non-recursive links between future-orientation, instrumentality of schooling and self-regulation, a direct path from self-regulation to academic achievement, and a direct path from analogical reasoning to academic achievement (see Figure 5). The first post-hoc model is the more parsimonious model of the final two post-hoc path models, so I will refer to it as the parsimonious model. The parsimonious model contains paths from future-orientation to instrumentality of schooling, from instrumentality of schooling to self-regulation, from self-regulation back to future-orientation, and from self-regulation to academic

achievement as depicted in the Miller and Brickman (2004) model. Analogical reasoning is included as an additional exogenous variable linked to academic achievement.

By comparison, the final post-hoc path model, I will call it the Miller Brickman Davis (MBD) model, includes an additional path from analogical reasoning to instrumentality of schooling. While the path coefficient is low (.02) and not significant, it warrants further investigation into a role for Analogical Reasoning in the Miller and Brickman (2004) model, particularly since Instrumentality of Schooling served as an in-direct measure of Sub-goal Systems.

The two post-hoc path models tested with analogical reasoning were based on correlational results indicating a statistically significant relationship between the variables (see Table 2). Further, additional paths tested were inferred from Miller and Brickman's (2004) model. In particular, Miller and Brickman depict a non-recursive model wherein self-reactions from completing tasks perceived as instrumental link to the future-oriented regulatory system through general and task specific learning strategies and problem solving abilities, and self-concept of ability. The final aforementioned factors link to personally valued future goals, which link to subgoal systems and back to perceptions of task instrumentality (see Figure 1). This non-recursive link depicted in the Miller and Brickman (2004) model is what supports the path from self-regulation back to future-orientation. Both aforementioned factors, theoretical support for the addition of non-recursion and data that support the addition of a direct path from analogical reasoning to academic achievement, were the bases for

the final post-hoc path models tested. These path models and supporting elements will be discussed below.

As mentioned at the close of Chapter 2, Analogical Reasoning is likely to link to the Miller and Brickman (2004) model through the factors that bridge the future-oriented regulatory system with proximal self-regulatory processes. I argued that the factors involved in the process of developing subgoal systems, and the factors involved in the process of applying well-articulated subgoal systems to tasks perceived as containing instrumental value, are of an analogical nature. This argument implies a link from analogical reasoning to subgoal systems directly, and perhaps a path to perceptions of instrumentality whether directly or indirectly. As such, the theoretically inferred argument provided the support for testing the final direct path in the MBD path model from analogical reasoning to academic achievement.

Measures of subgoal systems are likely to be the missing piece between future-orientation, and instrumentality of schooling to better explain how analogical reasoning is linked to the Miller and Brickman (2004) model. Further, the development of subgoal systems via the antecedent factors mentioned above could be moderated by analogical reasoning. Follow-up research is being planned to explore the relationships between future-orientation, subgoal systems, instrumentality of schooling, analogical reasoning, and academic achievement, which also points to some limitations of the present study.

Limitations of the Study

Important Miller and Brickman variables were not included in the present research study to better obtain model parsimony. A measure of subgoal systems and a measure of self-efficacy were left out of the present study, yet both are key to the Miller

and Brickman (2004) model, and would likely provide stronger path models to test, producing greater fit indices and more explanatory power. To be clear, subgoal systems are central to the theory development underway, whereas, self-efficacy is a factor to be considered in later research.

As a measure of analogical reasoning a short form of RAPM consisting of 12 items was employed. While the short form was employed for study time constraints, the form produced only a marginally acceptable reliability coefficient (see Table 1). Whether employing the short form or the full version, results from correlations between RAPM and the measures of Miller and Brickman variables were so close to zero that an alternative measure of analogical reasoning is required. Employing an alternative measure of analogical reasoning may enable relationships to be identified between analogical reasoning and Miller and Brickman variables. However, other types of reasoning may need to be considered, such as critical reasoning to better capture the relationships between personally valued future goals, subgoal systems, instrumentality and reasoning.

While effort was made to guard against various method biases, a critical point must be made. Use of self-report measures have been criticized for several method biases, in particular when measuring different constructs with the same method such as self-report, a proportion of variation may be the result of the constructs sharing the same measuring method (Podsakoff, 2003). However, it must be acknowledged that generating measures other than self-report for constructs such as Instrumentality of Schooling are difficult.

Three a priori path models were employed primarily based upon interpretations made from theoretical accounts with non-significant results. To assess ways of improving model fit two post-hoc path models were tested based upon theoretically supported, and data supported, paths. While it appears that analogical reasoning may provide added explanatory power to Miller and Brickman's (2004) model of future-oriented motivation and self-regulation in relation to achievement, the aforementioned study limitations must be addressed to further expand our understanding of the relationships between motivation, reasoning, self-regulation and achievement.

Implications for Future Research

Miller and Brickman clearly have a useful model. There are strong correlations between all Miller and Brickman variables and with academic achievement, which support past findings with motivational variables, self-regulation and achievement (Miller et al., 1996; Simons et al., 2004; Andriessen et al., 2006; Tabachnick et al., 2008). Additionally, results from the present study are consistent with past research which provided support for direct and indirect effects from future-orientation to instrumentality of schooling and self-regulation (Tabachnick et al., 2008), and direct effects from instrumentality of schooling to self-regulation (Simons et al., 2004). These relationships support the role future aspiring plays on daily classroom learning behavior and processing. Our aspiring nurse and engineer benefit from adopting and committing to the pursuit of each of their personally valued future goals within their proximal learning contexts. The Miller and Brickman model suggests that the development of well-articulated subgoal systems are undertaken as a result of adopting and committing to future goals of personal value (2004). This is initially where it appears analogical

reasoning is active in the Miller and Brickman (2004) model. To continue with our aspiring students, as they are developing subgoal systems both our nurse and engineer are mentally equipped to find tasks in their respective proximal learning contexts as instrumental to attaining their valued future goals. The results from the present study and theory (Miller and Brickman, 2004) suggest a need to explore the relationship between analogical reasoning and the development of subgoal systems. Essentially, there is a need to explore the role reasoning plays in the development of subgoal systems in general.

Results from the present study suggest future research to be undertaken adding measures of subgoal systems and reasoning. The correlation coefficients produced by the RAPM short form in conjunction with the Miller and Brickman variables warrants including an alternative measure of analogical reasoning, as well as, a measure of critical reasoning in future research. Additionally, multiple path analyses with the same core variables should be run while being mindful of statistical suggestions for improving fit and theoretical grounds for exploring paths under alternative considerations.

Summary and Conclusion

While limitations were a factor in the present study and the primary variable added to the theoretical model failed to correlate with other variables from the Miller and Brickman (2004) model, the present study does provide empirical support for further exploration into the role of reasoning in the Miller and Brickman (2004) model of Future-Oriented Motivation and Self-Regulation. The two post-hoc path models produced good fit and were statistically significant, even with limited variables from the

Miller and Brickman model included, and all variables were inter-correlated and correlated with academic achievement. Additionally, analogical reasoning was correlated with academic achievement. As such, support provided by the present study for expanding the Miller and Brickman (2004) model was obtained, albeit the data were not unequivocal in support of the expected relations. Essentially, this dissertation study demonstrated the need for further research to be undertaken to improve our understanding of the interaction between reasoning, motivation, self-regulation and performance outcomes of importance.

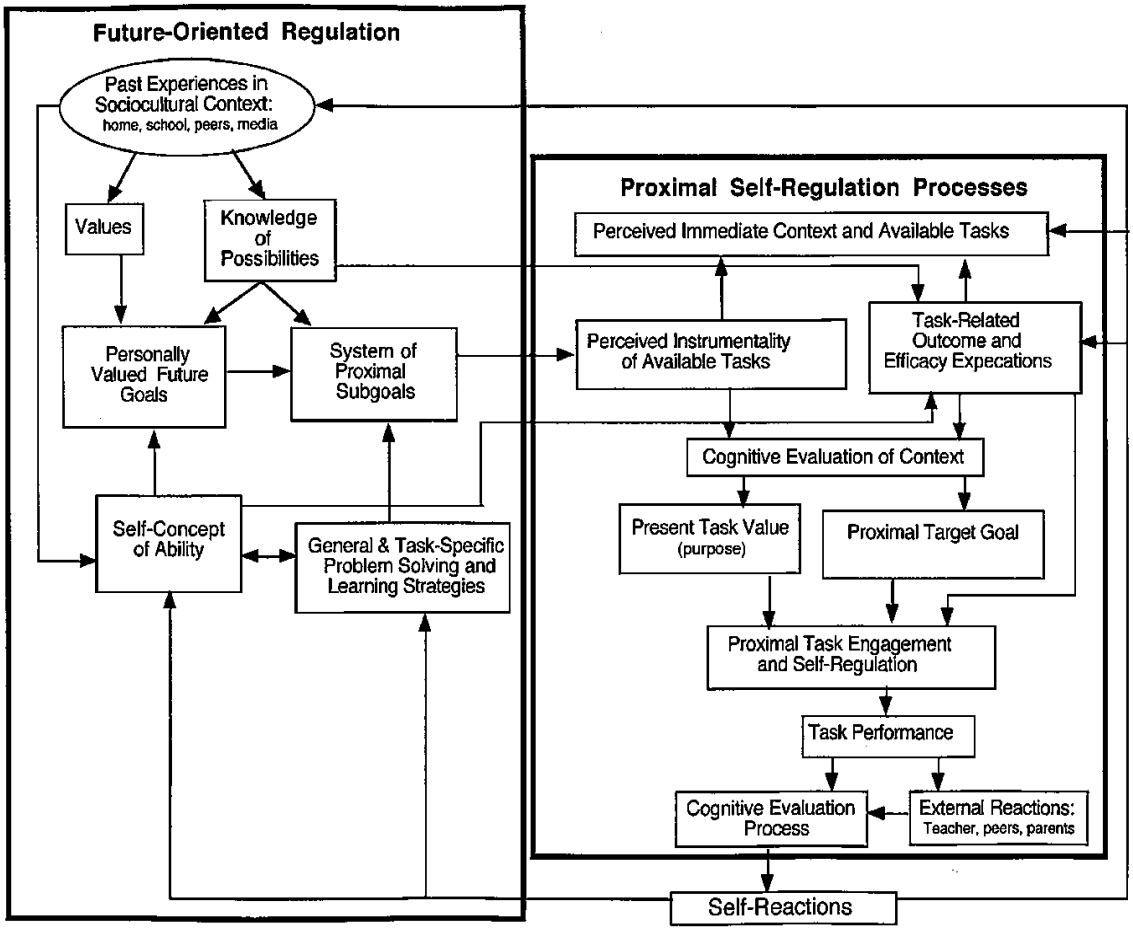

Figure 1. The Miller and Brickman (2004) model.

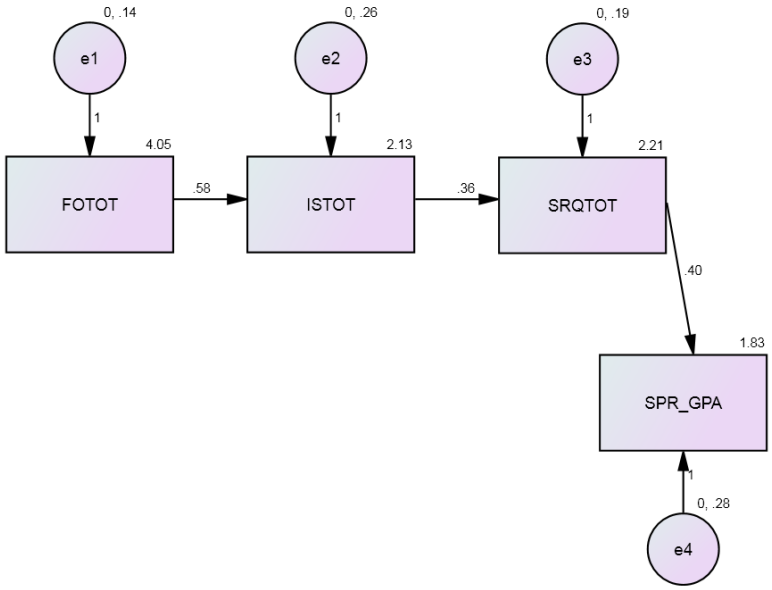

Figure 2. The Miller and Brickman path model. The model being tested above contains three key variables from the Miller and Brickman (2004) model, future-orientation, instrumentality, and self-regulation.

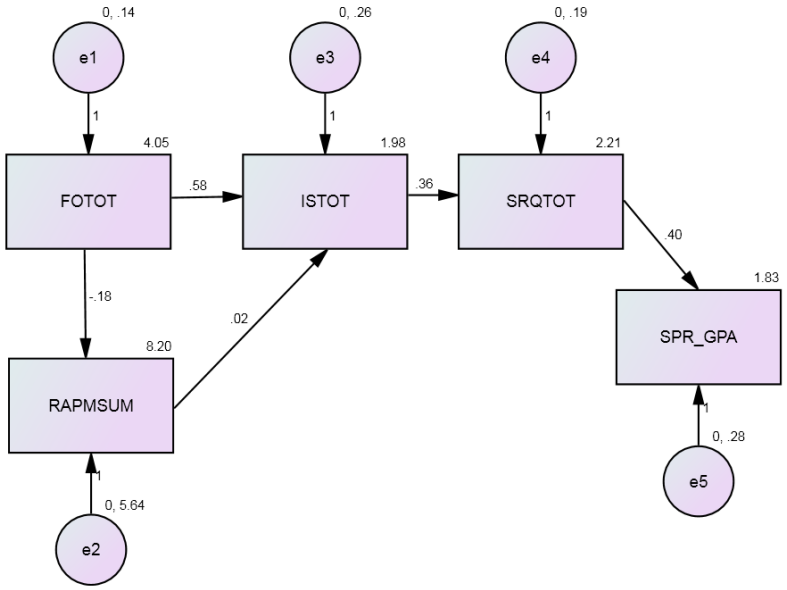

Figure 3. The Miller and Brickman mediated path model. The model being tested above contains three key variables from the Miller and Brickman (2004) model, future-orientation, instrumentality, and self-regulation. The addition of analogical reasoning is tested in a mediated role between future-orientation and instrumentality of schooling.

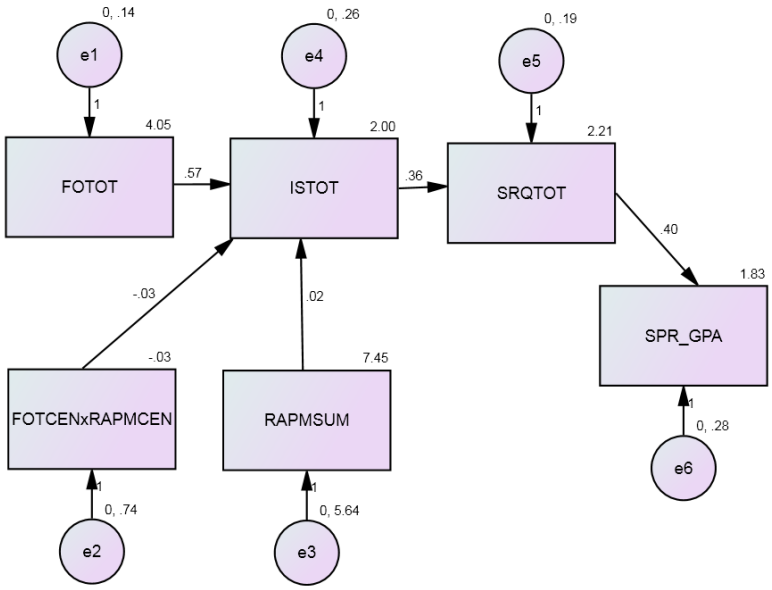

Figure 4. The Miller and Brickman moderated path model. The model being tested above contains same three key variables from the Miller and Brickman (2004) model, future-orientation, instrumentality, and self-regulation. The addition of analogical reasoning is tested in a moderated role wherein an interaction terms is generated between future-orientation and analogical reasoning.

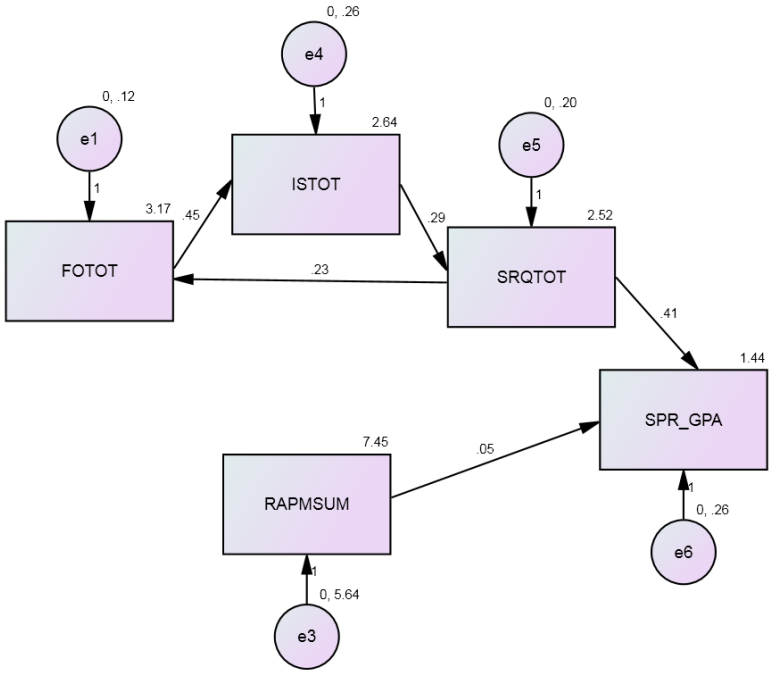

Figure 5. The parsimonious model. The alternative path model being tested above contains same three key variables from the Miller and Brickman (2004) model, future-orientation, instrumentality, and self-regulation. The addition of analogical reasoning is tested as directly linked to academic achievement.

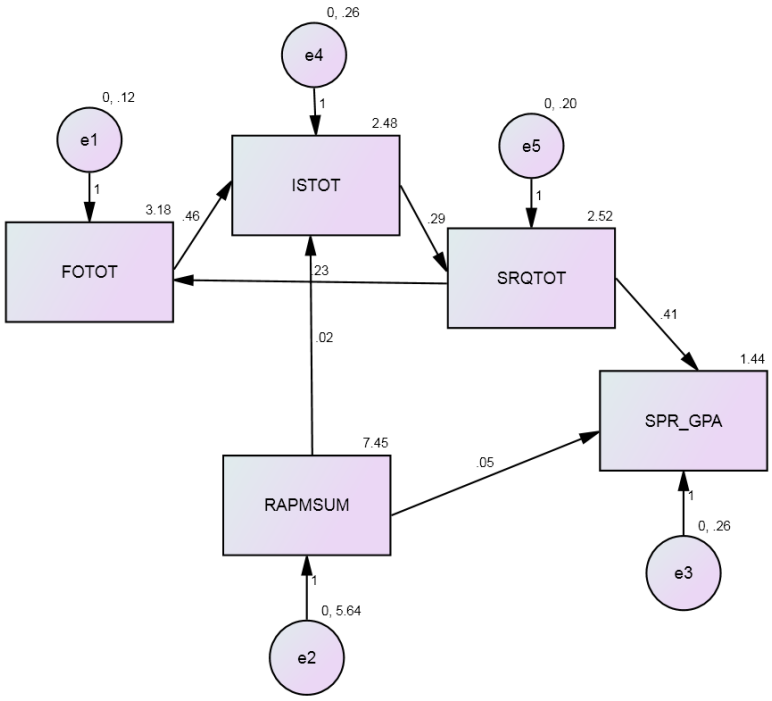

Figure 6. The MBD (Miller-Brickman-Davis) model. The alternative path model being tested above contains same three key variables from the Miller and Brickman (2004) model, future-orientation, instrumentality, and self-regulation. The addition of analogical reasoning is tested as directly linked to academic achievement and instrumentality of schooling.

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APPENDIX

Instruments

The Prospective Life Course Questionnaire (Nurmi, et al., 1991; Seginer, et al., 1994; Kerpelman & Mosher, 2004)

Raven's Advanced Progressive Matrices (J. Raven, J.C. Raven, & Court, 1988)

Note: To avoid copyright violations, a copy of RAPM is not included in the Appendix.

Instrumentality of Schooling, modified from the Perceived Instrumentality Scale (Miller et al, 1999; Greene et al., 2004; Tabachnick, 2008)

Self-Regulation (Jones, 2002; Jones & Greene, 2002)

Future Orientation: The Prospective Life Course Questionnaire

(Kerpelman & Mosher, 2004; Nurmi, Seginer, & Poole, 1991; Seginer, Nurmi, & Poole, 1994)

Directions: These questions ask your opinions and thoughts about the future. These questions have no right or wrong answers. Therefore, I would like you to circle the answer that best fits your personal beliefs. Read each statement and indicate how much you agree that the statement is true of the way you think about your future. Use the 5-point scales below to indicate your response.

Future Education

1. In thinking of your future education, which of these statements describes you best? Please circle one number.
   1. I have not yet thought about matters relating to my future education.
   2. Sometimes I look at one possibility or another relating to my future education.
   3. I am seriously looking into several possibilities concerning my future education.
   4. I am looking into one serious possibility concerning my future education.
   5. After looking into several possibilities concerning my future education, I am focusing on one serious possibility.

2. How often do you think about or plan your studies and plan your future education? Please circle your response.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Daily

3. When you think of your plans for future education, which of these statements below describes you best? Please circle your response.

   (1) It is completely clear that I will not continue in higher education.
   (2) It is quite clear that I will not continue in higher education.
   (3) I am not yet sure whether I will continue in higher education or not.
   (4) It is quite clear that I will continue in higher education.
   (5) It is completely clear that I will continue in higher education.

4. How determined are you to fulfill your plans about future education after completing your Bachelor's degree? Please circle your response.

1	2	3	4	5
Definitely	Probably	Maybe Yes	Probably	Definitely

Not	Not	Maybe Not	Yes	Yes

5. How likely do you think it is that your educational plans will happen? Please circle your response.

1	2	3	4	5
Definitely will not happen	Quite sure will not happen	Maybe yes maybe not	Quite sure will happen	Definitely Yes

6. How important a role do you think education plays in your future life? Please circle your response.

1	2	3	4	5
Not at all important	Not very important	Somewhat important	Rather important	Very important

7. How often do you find yourself doing something to bring you closer to your educational goals? Please circle your response.

1	2	3	4	5
Never	Rarely	Sometimes	Often	Daily

8. How important to you is it that your learning be for the betterment of society?

1	2	3	4	5
Not at all important	Not very important	Somewhat important	Rather important	Very important

9. Which of the following statements best fits how you feel about matters relating to your education? Please circle a number.

(1) I believe that everything will progress in the best possible way.
(2) Generally everything will go well despite some small difficulties.
(3) At certain times matters will progress well and at other times less well.
(4) Generally things will not proceed in the most desirable way although there will also be some successes.
(5) Everything will fail.

Future Work and Career

10. When you think about matters concerning your future career which of the following statements best describes your situation? Please circle your response.

(1) I have not yet thought about matters relating to my future career.
(2) Sometimes I look at one possibility or another concerning my future career.
(3) I am seriously looking into several possibilities concerning my future career.
(4) I am looking into one serious possibility concerning my future career.
(5) After looking into several possibilities concerning my future career, I am focusing on one serious possibility.

11. How often do you think about or plan your future career?

1	2	3	4	5
Never	Rarely	Sometimes	Often	Daily

12. How important is it for you to achieve your career goals?

1	2	3	4	5
Not at all important	Not very important	Somewhat important	Rather important	Very important

13. In thinking of matters relating to your future career, which of the following alternatives best describes you? Please circle one.

(1) There are so many different alternatives on my mind, that I have a bad time choosing one.
(2) There are many alternatives on my mind and they all seem possible.
(3) There are some alternatives on my mind that seem possible.
(4) There are two alternatives on my mind and I plan on choosing one.
(5) I have already reached a decision concerning my future career.

14. In your opinion, how much information on various careers do you have?

1	2	3	4	5
None	Not a lot	Some	Quite a bit	A lot

15. When you think about your plans for a future career, which of these statements describes you best? Please circle one.

(1) It is completely clear that I will not develop one specific career.
(2) It is quite clear that I will not develop one specific career.
(3) I am not yet sure whether I will develop one specific career or not.
(4) It is quite clear that I will develop one specific career.
(5) It is completely clear that I will develop one specific career.

16. How determined are you to fulfill your plans about future work and career?

1	2	3	4	5
Definitely Not	Probably Not	Maybe Yes Maybe Not	Probably Yes	Definitely Yes

17. How likely do you think it is that your career plans will happen?

1	2	3	4	5
Definitely will not happen	Quite sure will not happen	Maybe Yes Maybe Not	Quite sure will happen	Completely sure will happen

18. How important of a role do you think you work and career play in your future life?

1	2	3	4	5
Not at all important	Not very important	Somewhat important	Rather important	Very important

19. When thinking about your future career, can you say that you actually have done something to bring you closer to your goals? How often do you find yourself doing that?

1	2	3	4	5
Never	Rarely	Sometimes	Often	Daily

20. How important to you is it that your work be for the betterment of society?

1	2	3	4	5
Not at all important	Not very important	Somewhat important	Rather important	Very important

Instrumentality of Schooling Scale

Directions: Think about courses you have taken, are taking, or plan to take in college. Then read the statements below and rate the statements based on how accurately they match your value for learning and future outcomes. Use the 5-point scale below and circle your response on the line following the item.

Strongly Disagree = 1 **Strongly Agree = 5**

1 2 3 4 5

		SD				**SA**
1	My performances on coursework in my college courses are important for becoming the person I want to be.	1	2	3	4	5
2	My scores and grades in my college courses play a role in reaching my future goals.	1	2	3	4	5
3	Mastering the ideas and skills taught in my college courses will help me in the future.	1	2	3	4	5
4	Understanding the ideas and skills taught in my college courses is important for becoming the person I want to be.	1	2	3	4	5
5	Learning the ideas and skills taught in my college courses is important for achieving my dreams in the future.	1	2	3	4	5

Self-Regulation Questionnaire

Directions: The following statements ask about some of your specific behaviors as you study and learn. Respond to the statements along the following 5-point scale. Circle your response on the line following the item.

Strongly Disagree = 1 **Strongly Agree = 5**

1 2 3 4 5

		SD				**SA**
1	Before a quiz or exam, I plan out how I will study the material.	1	2	3	4	5
2	When I finish working I check my work for errors.	1	2	3	4	5
3	I organize my study time well for my college courses.	1	2	3	4	5
4	It is easy for me to establish goals for learning in my college courses.	1	2	3	4	5
5	I am usually aware of how I am performing on an activity in my college courses.	1	2	3	4	5
6	I have a clear idea of what I am trying to accomplish in my college courses.	1	2	3	4	5
7	I try to organize an approach in my mind before I actually start to execute a task.	1	2	3	4	5
8	When I study I take notes of the material I have or have not mastered.	1	2	3	4	5
9	I try to keep track of how well I am learning while I am studying.	1	2	3	4	5
10	I set goals for what I want to learn and accomplish in my college courses.	1	2	3	4	5
11	I plan how I can accomplish my goals.	1	2	3	4	5
12	I usually act before I think.	1	2	3	4	5
13	I reward myself when I reach a goal.	1	2	3	4	5
14	While studying, I stop to ask myself whether or not I am understanding the material.	1	2	3	4	5