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INFLUENCES ON ACHIEVEMENT: EPISTEMIC BELIEFS, EPISTEMIC MOTIVES,
& ACHIEVEMENT GOALS

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INFLUENCES ON ACHIEVEMENT: EPISTEMIC BELIEFS, EPISTEMIC MOTIVES,
& ACHIEVEMENT GOALS

A THESIS APPROVED FOR THE
DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

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Introduction

The complexity in examining the relationships among various factors that influence achievement and epistemic cognition has increased over the number of years since epistemological factors have become a subject of interest for educational psychologists. Past research has indicated that level of cognitive engagement has been influenced by epistemic beliefs (Hofer, 2001; Hofer & Pintrich, 1997; Ryan, 1984; Schommer, 1990), and achievement goals (Ames & Archer, 1988; Greene & Miller, 1996; Greene, Miller, Crowson, Duke, & Akey, 2004; Pintrich & DeGroot, 1990; Nolen, 1988), as well as motivational epistemic needs such as need for cognition (Kardash & Scholes, 1996; Cacioppo & Petty, 1982) and need for closure (DeBacker & Crowson, 2006; Freund, Kruglanski, & Shpitzajzen, 1985; Kruglanski & Webster, 1996). Researchers have recently discovered that the beliefs individuals have about knowledge influence achievement goal adoption as well (Bråten & Strømsø, 2004). However, research concerning the relationships among epistemic beliefs, epistemic motives, and achievement goals influencing level of cognitive engagement and achievement has not been heavily considered until recently (DeBacker & Crowson, 2006; Harlow, unpublished manuscript). Recent attempts to establish connections among these factors have shown both direct and indirect effects on cognitive engagement (DeBacker & Crowson, 2006; Ravindran, et al., 2005).

In the current study, I sought to extend upon previous research involving the influence of the epistemic motive, need for closure, and epistemic beliefs on achievement goal adoption and cognitive engagement. The current study extends upon research addressing the direct and indirect relationships among these factors, as well as provides

support for how these factors specifically influence *academic* thoughts and behaviors. Past studies have often used domain-general instruments to assess epistemic beliefs (Schommer, 1990; Schraw, Bendixen & Dunkle, 2002; Wood & Kardash, 2002). The current study used a more contextualized measure (Mansell, Crowson, DeBacker & Greene, in preparation) of epistemic beliefs that specifically focuses on the whether or not students believe knowledge relevant to academics is constructed or acquired through external sources. My study also included a more contextualized measure of need for closure addressing a student's needs for structure and certainty within the classroom. Targeted measures addressing epistemic beliefs and motives may help researchers better determine how these variables relate in context-specific situations.

In conceptualizing ways in which epistemic beliefs, motives, achievement goals, cognitive engagement, and achievement relate, I based my conceptual model (see Figure 1) on previous research linking these factors to cognitive engagement and performance. Research has indicated a direct relationship between epistemic beliefs and cognitive engagement (Ravindran, Greene, & DeBacker, 2005) as well as performance (Bendixen & Rule, 2004; Kardash & Howell, 2000; Schommer, 1990). Past research has also found a direct relationship between type of achievement goal and cognitive engagement (Nolan, 1988; Pintrich & DeGroot, 1990) and achievement goals and performance (Pintrich, 2000; Wolters, 2004). Need for closure has recently been found to be related to cognitive engagement as well (DeBacker & Crowson, 2006). In light of these findings, I considered the possibility that achievement goals (which appear to be more conscious and context specific) may serve as a mediator of tacit and dispositional factors such as epistemic beliefs and motives on cognitive engagement and performance. This study will serve to

sharpen the understanding of the relationships among these variables by using more contextualized measures of epistemic beliefs and motives as well as connect variables directly and indirectly to classroom performance.

Literature Review

Need for Closure

Need for closure is treated as a motivational dispositional need that reflects an individual's desire to obtain an answer to a question and avoid ambiguity on a specific or nonspecific issue (Kruglanski & Webster, 1991; 1996; Webster & Kruglanski, 1994). It is a key factor within Kruglanski's (1990) lay epistemic theory that influences the processes individuals undertake when forming and modifying knowledge. The theory claims that two epistemic functions, hypothesis generation and validation, are influenced by cognitive capability (how available and accessible related concepts are in memory) and epistemic motivations (i.e., need for closure).

Just as some individuals have a high need for closure because of the urgency to know, individuals may also have a strong need to avoid closure (a need to avoid certain answers) when the cost of knowing becomes too much to handle, especially when the cost one anticipates to be negative (Kruglanski & Webster, 1996). For example, if an individual's validity, worth, or self-esteem is connected to the outcome of a specific event or task, such as a performance measure or the anticipated response when asking another individual to dinner, then the need to avoid closure or to avoid an answer may be increased.

Individuals with a heightened need for closure have a tendency to *seize* or grasp onto information encountered early in the process of knowledge formation and

modification due to their urgency for an answer. They also may have a tendency to *freeze* or cling to existing information, refusing to modify existing conceptions to account for new information after closure has been reached. If an individual is unable to obtain an answer when the need for closure is high, a negative affect such as increased anxiety may result. In the same sense, once the urgency to know is reduced when receiving sought after information, a positive affect should result (Kruglanski & Webster, 1996).

Influence on social cognition. Past research indicates that need for closure influences interpersonal processes. For example, individuals high in need for closure have been found to process less information before determining a judgment (Mayseless & Kruglanski, 1987), be more resistant to persuasion (Kruglanski, Webster, & Klem, 1993), base judgments on stereotypes (Dijksterhuis, Van Knippenberg, Kruglanski, & Schaper, 1996), demonstrate higher confidence in claims (Webster, Kruglanski & Pattison, 1997), demonstrate in-group biases (Shah, Kruglanski, & Thompson, 1998), and base judgments on information encountered early rather than late in a decision-making process (Kruglanski & Freund, 1983). For example, Webster & Kruglanski (1994) tested how primacy effects (tendency to base judgment on early information) were influenced by high need for closure in college students. Students were asked to rank a job candidate's qualification for company president after receiving information about the candidate. It was hypothesized that students with a high need for closure would rate the candidate more positively if receiving positive information relevant to the candidate first and more negatively if receiving negative information first. Results indicated that primacy effects (representing an individual's tendency to seize upon information gathered first) were greater in students with a high versus low need for closure. Kruglanski and colleagues

(Kruglanski et al., 1993) have also discovered that individuals possessing a high need for closure are less likely to be persuaded if they have already formed an opinion based on access to prior information concerning an issue. However, participants with high closure needs who have not already formed a judgment on an issue tended to be more easily persuaded in one direction. Therefore, individuals who already have formed an opinion are more likely to *freeze* or cling to the opinion whereas those who do not have an opinion yet formed are most likely to *seize* or grasp on to the first information provided in order to satisfy one's need for closure.

Relevance to academic context. Until recently, need for closure effects have been connected only with research in social settings or situations (DeBacker & Crowson, 2006; Harlow, unpublished manuscript). It is also plausible that need for closure may impact the way in which students process academic information as well. For example, students possessing a high need for closure may tend to cling to surface information relevant to various academic concepts when learning thus limiting one's cognitive engagement. For example, students who have a strong urgency to know an answer on a given topic may be more inclined to *seize and freeze* on early or prior information in order to avoid any ambiguity associated with a given topic. The "desire to know" may be fulfilled through shallow learning processes such as memorization. As a result, academic learning may be limited (DeBacker & Crowson, 2006).

Influence on achievement-related cognition. To determine the effect of need for closure in academic settings, DeBacker & Crowson (2006) measured three facets of Kruglanski's (Webster & Kruglanski, 1994) Need for Closure scale (preference for order, preference for predictability, and discomfort with ambiguity) and discovered that naïve epistemic

beliefs were positively correlated with preference for order and predictability. Given that naïve beliefs about knowledge and high need for closure have each been associated with shallow processing of information (DeBacker & Crowson, in review; Mayseless & Kruglanski, 1987; Ravindran, et al., 2005) the tendency for an individual to demonstrate both characteristics is unsurprising. Preference for predictability has been found to be negatively correlated with meaningful cognitive engagement as well (DeBacker & Crowson, 2006). Students preferring predictable assignments or environment may be less inclined to put forth the effort needed to understand information effectively given that meaningful engagement will most likely lead to the unpredictable nature of knowledge (Bendixen & Rule, 2004).

Recent research using a more contextualized measure of need for closure influences on academic situations, have found more connections between need for closure and other learning variables (DeBacker & Crowson, in review; Harlow, unpublished manuscript). For example, students with a heightened need for certainty, a facet of need for closure, have a tendency to score high on performance goals and lower on mastery goals. These findings suggest that students with a high need for closure may have a tendency to either be focused on demonstrating competence to others or avoid demonstrating competence rather than mastery of material in academic settings. Perhaps the need for certainty is satisfied by comparing one's performance to an external standard (a specific measure of performance) rather than an internal standard which the student may view as unsure or ambiguous. Recent studies have also shown preference for certainty to be negatively related to beliefs in the constructed nature of knowledge. Both preference for certainty and preference for structure, another facet of need for closure,

have been associated with other naïve epistemic beliefs (DeBacker & Crowson, in review). Students who have a high need for certainty may be less inclined to believe that knowledge is constructed by the learner and that a learner plays a role in what he or she learns. Students with a high need for certainty and structure in their academic environment are also more inclined to believe that knowledge is simple and that learning happens quickly or not at all.

Measuring need for closure. In order to assess the level of need for closure in individuals, past research in social decision-making has used the Need for Closure Scale (NFCS) (Webster & Kruglanski, 1994). The measure consists of five subscales assessing one's preference for order (desire for order and structure within environment), preference for predictability (desire to know what to expect), decisiveness (desire to quickly make decisions), discomfort with ambiguity (desire to avoid uncertainty), and close-mindedness (desire to refrain from considering alternative opinions or evidence).

Although past research has provided evidence for the validity and reliability of the Need for Closure Scale (NFCS) (Webster & Kruglanski, 1994), this has been challenged by other researchers (Mannetti, Pierro, Kruglanski, Taris, & Bezinovic, 2002; Neuberg, Judice, & West, 1997) who had validity-related concerns about the subscale measurements. Research results have indicated that three of the five facets (preference for order, preference for predictability, and discomfort with ambiguity) were found to be related to each other. However, measurement concerns of how well decisiveness and close-mindedness facets loaded onto the need for closure construct during factor analysis were brought to attention leading researchers to question the unidimensionality of the need for closure scale. Reliability concerns with the close-mindedness measurement

(Neuberg, Judice, & West, 1997) appeared questioning how adequate this component was at assessing need for closure as well. Therefore, recent researchers have disregarded the decisiveness and close-mindedness subscales (DeBacker & Crowson, 2006) in order to better represent the latent variable (need for closure).

Given that Kruglanski's measure of need for closure was designed to measure need for closure effects in nonspecific social situations, there are limitations associated with measuring need for closure in learning environments (DeBacker & Crowson, in review; Harlow, unpublished manuscript). After considering Kruglanski's scale to be too broad of a measure to best capture need for closure within academic situations, DeBacker & Crowson (in review) created a newly conceptualized measure entitled Opinions about Learning and Studying (OLS). Drawing from Kruglanski's conceptualization of need for closure, the OLS consists of two subscales (preference for structure and preference for certainty) representing need for closure as it relates to classroom experiences. Preference for structure items (similar to Kruglanski's preference for order and predictability) address a student's desire for organization and stability in regard to classroom assignments, schedule, and task expectation. Preference for certainty (similar to Kruglanski's discomfort with ambiguity) represents a student's desire to avoid ambiguity, confusion, or controversy when dealing with specific academic content (DeBacker & Crowson, in review; Harlow, unpublished manuscript). For the purposes of the study, I used the OLS to assess student's need for closure in the classroom.

Epistemic Beliefs

Given the connections found among epistemic beliefs, level of cognitive processing, and achievement goals (DeBacker & Crowson, 2006; Ravindran, et al., 2005)

and performance (Hofer, 2000), I chose to study the influence epistemic beliefs on the latter factors to provide further support the relevance of epistemic beliefs to learning.

The conceptualization of epistemic beliefs in relation to learning has evolved over several decades (Hofer & Pintrich, 1997; Schommer, 1993). While some researchers conceptualized epistemic beliefs as general beliefs about knowledge that change developmentally over time (Kitchener & King, 1981; Kuhn & Weinstock, 2002; Perry, 1970) others have studied epistemology as a set of independent beliefs (Schommer, 1990; Schommer-Aikins, 2002; Schraw, Bendixen, & Dunkle, 2002). Early theorists such as William Perry (1970) connected epistemic beliefs with learning behavior. Perry discovered that undergraduate students entering college tended to possess naïve beliefs about the certainty of knowledge whereas older students tended to believe knowledge to be more malleable in nature and obtained through reason. Many theorists and researchers have since used Perry's work in conceptualizing epistemic beliefs (Buehl & Alexander, 2001). For example, other developmental models concerning various aspects of epistemic beliefs have been established such as "Women's Ways of Knowing" (Belenky, Clinchy, Goldberger, & Tarule, 1986; Hofer & Pintrich, 1997), the Epistemological Reflection Model (Baxter Magolda, 1992), the Reflective Judgment Model (King & Kitchener, 1994), and the Argumentative Reasoning Model (Kuhn, 1991).

In taking a new and different approach to how epistemic beliefs are conceptualized, Marlene Schommer (1990) proposed that epistemic beliefs are a set of independent beliefs that influence learning. The current study follows somewhat from Schommer's conceptual framework in defining epistemic beliefs as a set of independent beliefs about knowledge regarding the structure of knowledge (whether knowledge is

thought of as simple versus complex), the certainty of knowledge (whether knowledge is thought to be certain/absolute versus malleable/evolving), and the source of knowledge (whether it is thought to be transmitted externally from authority figures versus constructed by individual). Other dimensions associated with defining epistemic beliefs have included beliefs that learning happens quickly or not at all and whether learning ability is either innate or changeable (Hofer, 2001; 2004; Hofer & Pintrich, 1997; Schommer, 1990).

A key issue related to the conceptualization of epistemic beliefs is whether or not epistemic beliefs should be viewed as domain-specific or domain-general (Buehl & Alexander, 2001). Past epistemic researchers have often used a general approach when assessing epistemic beliefs, assuming these beliefs to be independent of specific domains. More recently, studies were created to address the domain-specificity of beliefs about knowledge only to lead researchers to debate over whether or not these beliefs are really domain-general or domain-specific. From one perspective, individuals may vary in naïve to sophisticated epistemic beliefs depending on what domain (e.g. history or math) they serve to influence (Buehl & Alexander, 2001; Schommer, 1993). For example, an individual may believe knowledge to be more certain in a subject area such as math but also believe knowledge to be less certain in a subject area such as psychology or history. Several studies (Hofer, 2000; Schommer & Walker, 1995) have indicated that students differ in how they conceptualize knowledge between subjects and that these beliefs were related to level of performance.

Despite support for epistemic beliefs being domain-specific, past research also suggests that beliefs about knowledge may be consistent across domains as well (Buehl

& Alexander, 2001; Schommer & Walker, 1995; Muis, Bendixen & Haerle, 2006). Hofer (2000) found that students held similar beliefs across subjects and found that general beliefs about knowledge were related to overall academic performance as well. This has led several researchers to conclude that epistemic beliefs may serve to influence both domain-general and domain-specific tasks (Buehl & Alexander, 2001). Schraw (2001) suggests that domain-specific epistemic cognition may influence specific task assignments whereas general epistemic beliefs may influence a learner's motivation for learning and level of academic engagement. Possible reasons for mixed research findings include that epistemic beliefs are multidimensional and can be measured at different levels (general epistemic beliefs, academic epistemic beliefs, and domain-specific beliefs) and how an academic subject is structured, and pedagogical applications (Buehl & Alexander, 2001; Harlow, unpublished manuscript). For example, if a student considers a subject (e.g., math) to be more integrated and defined than another subject (e.g., history) then epistemic beliefs may vary as a result. An instructor who presents subject matter as simple and certain versus complex may influence epistemic beliefs in students as well.

Influence on achievement-related cognition. In researching epistemic beliefs as a set of independent beliefs, studies have shown that these beliefs not only influence cognitive engagement (Ravindran, et al., 2005; Ryan, 1984; Schreiber & Shinn, 2003; Tsai, 1998), but also critical thinking (Schommer-Aikins & Hutter, 2002), conceptual change (Dole & Sinatra, 1998; Pintrich, Marx, & Boyle, 1993; Qian & Alvermann, 1995) and academic performance (Bendixen & Rule, 2004; Kardash & Howell, 2000; Schommer, 1990; Schommer, Crouse, & Rhodes, 1992) as well as achievement goals

(Bråten & Strømsø, 2004; DeBacker & Crowson, 2006; Ravindran, et al., 2005). These findings demonstrate that epistemic beliefs are important factors when considering learning and achievement.

In regard to cognitive processing, studies attempting to determine whether or not epistemological reasoning had an impact on student learning strategies (Dahl, Bals, & Turi, 2005; Schreiber & Shinn, 2003) have shown that students who are more inclined to believe in simple knowledge are more likely to use shallow learning strategies. If one believes knowledge to be simple, then he or she may be inclined to avoid meaningful learning strategies, believing extra effort is unnecessary to increase one's understanding.

Academic performance as measured by a student's grade point average (GPA) and test performance scores have also been linked to sophisticated epistemic beliefs (Schommer, 1993; Schommer, Calvert, Gariglietti & Bajaj, 1997). Gifted high school students may be less likely to believe in simple knowledge and quick learning (Schommer & Dunnell, 1994). Students who performed well on tests about statistics and mathematical text comprehension were also less likely to possess naïve epistemic beliefs such as belief in simple knowledge (Schommer, et al, 1992).

Although speculated upon, there has not been much research on the influence of epistemic beliefs on achievement goals until recently (Ravindran, et al., 2005). Researchers, however, are becoming more interested in this relationship, as well as the joint input of epistemic beliefs and achievement goals on academic cognition (DeBacker & Crowson, 2006; Harlow, unpublished manuscript) and performance (Bråten & Strømsø, 2004). Naïve epistemic beliefs have been positively linked directly and indirectly to shallow processing, negatively related to mastery goals (DeBacker &

Crowson, 2006), and positively correlated with performance goals (DeBacker & Crowson, in review; Ravindran, et al., 2005). For example, Bråten & Strømsø (2004) measured how much epistemic beliefs and theories of intelligence influence achievement goals in Norwegian student teachers. Naïve beliefs such as the belief that students learn quickly or not at all were associated with performance-avoidance goals over time. Students believing that they cannot understand a concept quickly may also think they will never understand it and may be inclined to avoid demonstrating this perceived incompetence to others. Beliefs in certain, given and stable knowledge were also negatively correlated with mastery goal orientation suggesting that students may not be willing to put forth meaningful effort required to increase one's competence.

Measuring epistemic beliefs. In past studies researchers have used various measures of personal epistemology such as Schommer's (1990) Epistemological Questionnaire or the Epistemological Beliefs Inventory (Schraw, Bendixen, & Dunkle, 2002). However, there have been concerns about the conceptual and psychometric underpinnings of these measures (Clareabout, Elen, Luyten, & Bamps, 2001; DeBacker, et al., 2006; Hofer & Pintrich, 1997). Many researchers have reported concerns about whether some of the subscales involving beliefs about learning are representative of beliefs about epistemology (Hofer & Pintrich, 1997). As a result, many researchers have agreed that measures focusing on the nature and structure of knowledge should be considered epistemic beliefs and items representing thoughts on learning (i.e. rate and ability) should be considered beliefs about learning (DeBacker, Crowson, Beesley, Thoma, Hestevold, & Li, in review; Hofer, 2001; Hofer & Pintrich, 1997; Schommer-

Aikins, 2004; Schraw, 2001). Reliability estimates for past epistemic belief scales have been lower than desired as well (DeBacker, et al., in review; Schommer, 1993).

Given these concerns, for the current study I will use the Beliefs About School Learning Questionnaire (BASLQ) which was designed to measure beliefs about knowledge acquired within academic settings (Mansell et al., in preparation). The BASLQ addresses epistemic beliefs and epistemic purposes for engaging in school. Epistemic beliefs include items addressing whether students believe knowledge to be *constructed* by the student or if it is believed to be a *commodity* attained from external sources. Items addressing epistemic purposes for acquiring knowledge include assessing whether or not students perceive knowledge gained in academic settings to be used as a source of personal *empowerment* (used to empower and increase personal control) or as *subjugation* in which academic knowledge is considered an attempt by authority to control personal opinions and thoughts. For purposes of the current study I used items that address epistemic beliefs (knowledge viewed as constructed or as a commodity) as representative of epistemic beliefs about school learning.

Achievement Goals

Achievement goals are goals that represent what motivates a student for engaging in a task (Dweck, 1986; Maehr, 1989). Past findings on achievement goals and their relation to learning have allowed researchers more insight on motivational factors that influence achievement (Elliot, 1999; Nicholls, 1984). Two categories of achievement goals were first defined by researchers as either being mastery (also known as task or learning goals) or performance (also known as ego-oriented) goals (Dweck, 1986; Elliot,

1999). Although different researchers have labeled these goals differently, their conceptualizations are very similar.

When a student adopts a mastery goal or is learning oriented, he or she is concerned with understanding a task or improving one's competence (Ames, 1992; Dweck, 1986; Elliot, 1999).

Performance goals are goals in which the learner is focused on demonstrating personal competence and external task evaluations (Elliot, 1999; Dweck, 1986; Pintrich, 2000). Given that perception of success is dependent upon external evaluation, a student's perceived self-worth and competence may be overly reliant on performance outcomes thus resulting in maladaptive study behaviors especially if performance is low (Ames, 1992; Dweck, 1986). Therefore, if a student encounters difficulty he or she may become worried about demonstrating poor ability to others and thus prefer easy tasks rather than challenging ones (Dweck, 1986; Meece, Blumenfeld, & Hoyle, 1988).

Elliot (1999) proposed that individuals who are performance oriented may differ in reasons why they are concerned with performance evaluation. He suggested that some individuals may be motivated to avoid demonstrating lack of competence if perceived ability is low. As a result performance goals were separated into two types of goals (performance-approach and performance-avoidance) that differed according to motive and valence (Elliot, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996).

Performance-approach goals represent an individual's need to demonstrate ability. A positive valence is associated with a performance-approach goal if an individual has a need to achieve and high competence. An individual may experience increased satisfaction once confirmation of good performance is obtained. A negative valence may

be associated with a performance-approach goal as well. If an individual has high competence and a need to avoid failure he or she may experience relief rather than satisfaction if performance evaluation is high. However, a negative affect may result such as increased anxiety and worry if evaluation is low.

Performance-avoidance goals may be adopted if an individual wishes to conceal lack of ability from others. A negative valence is also associated with this goal because of the underlying need to avoid failure leading an individual to avoid task participation and other maladaptive learning behaviors. (Elliot, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996).

Influence on achievement-related variables. Past research has found students who were mastery oriented were more inclined to pursue challenges (Elliott & Dweck, 1988), seek help when needed (Elliot, 1999), persist in spite of obstacles (Elliott & Dweck, 1988; Miller, Greene, Montalvo, Ravindran, & Nicholls, 1996), possess a positive affect toward the learning situation (Meece, et al., 1988), have high self-efficacy (Wolters, 2004), and use deep cognitive strategies for learning (Meece et. al, 1988; Nolan, 1988; Pintrich & DeGroot, 1990).

Past research has also indicated that performance-avoidance goals have been linked to test anxiety, low efficacy, low intrinsic motivation, and shallow study strategies (Elliot, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Middleton & Midgley, 1997). Although behaviors such as use of shallow learning strategies (Greene & Miller, 1996; DeBacker & Crowson, 2006; Nolen, 1988; Ravindran et al., 2005), lack of effort (Elliott & Dweck, 1988), challenge avoidance (Dweck & Leggett, 1988), low intrinsic motivation (Meece, et al., 1988), and low performance (Graham & Golan, 1991)

have also been linked to performance-approach goals, research findings on the effectiveness of performance-approach goals have been ambiguous (Elliot, 1999; Pintrich, 2000; Wolters, 2004). For example, in some studies performance-approach goals have been associated with high performance, self-efficacy, deep processing, and adaptive study behaviors (Harlow, unpublished manuscript; Harackiewicz, Barron, & Elliot, 1998; Pintrich, 2000; Wolters, 2004). For the purposes of this study I will use the Approaches to Learning Survey (ATL) which measures three separate components of achievement goals (mastery, performance-approach, and performance-avoidance).

Cognitive Engagement

Past researchers have generally conceptualized cognitive engagement as a student's choice of tasks, applied effort, persistence, self-regulation and processing strategies used in order to learn (Wolters, 2004; Ravindran et al., 2005). The level of engagement a learner applies to a task has been described as deep or shallow (surface) processing (Craik & Lockhart, 1972; Entwistle & Ramsden, 1983; Nolan, 1988). Deep processing refers to the understanding or processing of information at a level which enables the learner to establish meaningful connections between old information and new knowledge (Graham & Golan, 1991; Pintrich, Roeser, & De Groot, 1994). A learner engaged in deep processing uses elaborative cognitive strategies such as summarizing, focusing on relevant and meaningful information, connecting new information to prior knowledge, and monitoring learning behavior (Graham & Golan, 1991; Nolan, 1988; Pintrich & Garcia, 1991). The use of deep learning strategies has been linked to higher performance (Pintrich & DeGroot, 1990; Zimmerman & Martinez-Pons, 1990), mastery and intrinsically oriented goals (Nolan, 1988; Greene & Miller, 1996; Pintrich & Garcia,

1991), greater effort and persistence (Wolters, 2004), performance-approach goals (Elliot, 1999), interest level (Pintrich, et al., 1994), greater perceived instrumentality (Miller, DeBacker, & Greene, 1999; Miller, et al., 1996) and high self-efficacy (Pintrich & Schunk, 1996; Wolters & Pintrich, 1998).

Shallow processing refers to a surface level of cognitive engagement in which students are more inclined to use rehearsal strategies to learn material (Nolan, 1988; Pintrich & Garcia, 1991). A learner who simply underlines text without reflecting upon material, re-reads class notes, or uses rote memorization techniques such as mnemonic devices when studying may have a lesser degree of understanding and have difficulty recalling relevant information when necessary (Entwhistle & Ramsden, 1983; Weinstein & Mayer, 1986). Use of shallow learning strategies has been linked to performance goals (Nolen, 1988; Meece, et al., 1988; Greene & Miller, 1996; Ravindran, et al., 2005;) low achievement (Pintrich & DeGroot, 1990; Greene, et al., 2004) low self-efficacy and lack of effort (Ames, 1992; Bandura, 1997; Pintrich & DeGroot, 1990). For my study, level of cognitive engagement was measured by the Approaches to Learning survey (ALS) (DeBacker & Nelson, 1999; Greene & Miller, 1996).

Research Questions

The purpose of the current study was to investigate direct and indirect influences of epistemic beliefs (i.e., representing the belief in the constructed nature of knowledge) and need for closure (i.e., representing one's preference for certainty and preference for structure) on achievement goals, level of cognitive engagement, and academic performance. Research questions that guided the procedure of this study are listed below:

1. What are the relationships among need for closure, epistemic beliefs, achievement goals, cognitive engagement and performance when measured within a specific academic context?
2. Does the path model representing the hypothesized relationships among need for closure, epistemic beliefs, achievement goals, cognitive engagement, and achievement fit the data acquired? (See Figure 1)

Research Hypothesis

In the current study, I hypothesized that certain measures of epistemic beliefs and need for closure would directly and indirectly predict achievement goals (mastery, performance-approach, performance-avoidant), cognitive engagement (deep and shallow) and academic performance (see Figure 1). Specifically, based on past research results linking naïve epistemic beliefs to achievement goals (Bråten & Strømsø, 2004; DeBacker & Crowson, 2006; DeBacker & Crowson, in review; Harlow, unpublished manuscript), I hypothesized that the belief in constructed knowledge will be positively related to mastery goals. A student may willingly apply more effort toward learning and focus on learning content if he or she believes that knowledge is self-constructed. However, belief in constructed knowledge may be associated with performance-approach goals as well. A student who believes knowledge to be self-constructed may wish to demonstrate his or her perceived ability to “construct” knowledge. A belief that knowledge is acquired through external sources or authority (such as in the classroom) may also lead a student to demonstrate competence to specific authority in order to gain performance validation creating a negative association among belief in constructed knowledge and performance-approach goals. Due to the variety of plausible reasons explaining how belief in constructed knowledge may influence performance-approach goals, the path direction

was left unspecified in order to look for more empirical evidence to support the relationship.

In regard to need for closure, preference for structure should positively predict mastery goals and performance goals. A student who has a dispositional preference for an organized and orderly academic environment may demonstrate performance-oriented behaviors such as surface learning strategies or avoiding challenges; especially when the stability of the structure is not maintained. If, however, the environment suits the needs of the learner (i.e., it is highly structured) then there may be a shift in goal orientation leading the learner to become more focused on mastering content. Given the unclear relationship among preference for structure and achievement goals, continued testing is necessary to determine the how influential it is on other learning variables.

Preference for certainty should negatively predict mastery goals and positively predict performance goals. A high need for certainty can influence a student to demonstrate competence when self-efficacy is high (performance-approach) when relying on external sources to validate performance. A student may also have a desire to avoid demonstrating competence when self-efficacy is low or uncertain (performance-avoidance).

Finally, in line with past research, I hypothesized performance-avoidance goals should correlate negatively with deep engagement and relate positively with shallow engagement. Mastery and performance-approach goals should positively relate to both shallow and deep engagement. Deep cognitive engagement should negatively predict academic performance and shallow engagement should positively predict academic

performance as well (Greene & Miller, 1996; Pintrich & DeGroot, 1990; Pintrich & Garcia, 1991).

Method

Participants

Voluntary study participants included 178 undergraduate students enrolled in educational psychology courses at a major university in Midwest United States. Students varied in ethnicity and represented a variety of education majors. Racial/ethnic groups included in the sample were African American (2%), Asian American (3%), Hispanic/Latino (2%), Native American (5%), White (87%), and multiracial (1%). The majority of participants were female (76%). The age range for students was 19 to 61 years with the mean age being 22 years.

Measures

Participants completed three paper and pencil surveys: the Approaches to Learning Survey (ATL) representing cognitive engagement and achievement goals; the Opinions about Learning and Studying (OLS) representing components of need for closure; and the Beliefs about School Learning Questionnaire (BASLQ) representing components of epistemic cognition.

Approaches to Learning. The Approaches to Learning survey is a 41 item survey using a 6-point Likert scale (1 = strongly disagree to 6 = strongly agree) that measures achievement goals and level of cognitive engagement. The achievement goals represented are mastery (6 items), performance-approach (8 items), and performance-avoidance (3 items). Mastery items address the extent that students are oriented toward learning to improve competence (e.g. "I do my work in this class because I like learning

new things”). Performance approach and avoidance items refer to the extent that competence or lack of competence is desired to be recognized by others or hidden (e.g. “I do my work in this class because I can show other people I’m smart” or “I don’t do my work in this class so I can avoid looking stupid to others”). Measures of cognitive engagement assessed shallow (6 items) and deep processing (6 items). Shallow processing items represent a student’s tendency to use surface learning strategies when studying (e.g. “When studying, I write out lists of terms and definitions”). Deep processing items represent a student’s tendency to engage in meaningful and elaborative study strategies (e.g. “When studying, I analyze the concepts to see how they apply to me”). The validity and reliability of the ATL subscales have been established through use in previous studies (DeBacker & Crowson, 2006; DeBacker & Nelson, 1999; Greene & Miller, 1996; Miller et al., 1999).

Opinions about Learning and Studying. The Opinions about Learning and Studying is a 28 item survey using a 6-point Likert scale (1 = strongly disagree to 6 = strongly agree) designed to measure need for closure contextualized to a classroom setting. Need for closure components represented on the survey include preference for structure (18 items) and preference for certainty (10 items). Preference for structure addresses student needs for order in learning and a classroom environment (e.g. “I feel uncomfortable when my [name of class] teacher is not well-organized for class”). Preference for certainty addresses a student’s need to know what to expect within a classroom (e.g. “I dislike being asked to do [name of class] projects or class activities that have unpredictable outcomes”).

In establishing the validity of the OLS, DeBacker & Crowson (in review) reported internal consistency among the need for structure ($\alpha = .88$) and need for closure ($\alpha = .82$) and reported confirmatory factor analysis indicative of a good fit to the data. Test-retest reliability was established for the OLS within this same study. Construct and convergent validity was also established by predicted relationships between the OLS and measures of need for cognition, dogmatism, measures of epistemic beliefs as well.

Beliefs about School Learning. The Beliefs about School Learning Questionnaire is a 34 item survey using a 6-point Likert scale (1 = strongly disagree to 6 = strongly agree). The questionnaire was narrowed to 18 items for the purposes of this study in order to measure a student's belief in constructed knowledge (11 items) versus the belief that knowledge is a commodity (7 items). Constructed knowledge items represent a student's belief that knowledge is created by the learner (e.g. "The student has a lot to do with the meaning of what is learned"). Items assessing knowledge as a commodity represent a student's beliefs that knowledge is externally acquired through others (e.g. "I have little influence over the exact nature of the things that I learn in school"). Past studies using this measure have reported acceptable internal consistency (Mansell et. al., in preparation). Given that belief in constructed knowledge and belief in knowledge as a commodity seemed to represent opposite ends of the continuum, in the current study commodity items on the BASLQ were reverse-coded and combined with items on the constructed knowledge scale to form a single index of belief in the constructed nature of knowledge

Academic Performance. Academic performance was measured by using participants' end of the semester percentage grades assigned in an Educational

Psychology course. Grades were obtained from instructors with students' permission. In order to correct for a negative skew in the data, scores were reflected and a log transformation was applied to students' percentage grades. Data that are negatively skewed tend to yield attenuated correlations, often underestimating the population value. Therefore, to best determine the effects of other learning variables on performance, a log transformation was applied.

Procedure

Student participation in the study was proposed as a voluntary event in which students have the opportunity to earn extra credit in their educational psychology course for their contribution. Informed consent was acquired and students were given a brief description of the study and assurance of confidentiality. A survey packet was given to be completed at home and returned the following class session. The order of the instruments was similar for all students with Approaches to Learning and Opinions about Learning and Studying being followed by Beliefs about School Learning.

Results

Reliability Coefficients and Descriptive Statistics

The means, standard deviations, and Cronbach's alpha reliability coefficients for each subscale can be found in Table 1. Student scores obtained from the sample were above the scale midpoint for belief in constructed knowledge ($M = 4.31$; $SD = .59$), preference for structure ($M = 4.01$; $SD = .79$), mastery goals ($M = 4.54$; $SD = .94$), shallow engagement ($M = 3.47$; $SD = 1.08$), and deep engagement ($M = 4.19$; $SD = .82$). Student scores reflecting preference for certainty ($M = 2.98$; $SD = .75$), performance-approach goals ($M = 2.52$; $SD = .98$), and performance-avoidance goals ($M = 1.40$, $SD =$

.61) were below scale midpoints. The mean and standard deviation for course grade were .89 and .30, respectively, after a log transformation was conducted to normalize grade distribution. Reliability analyses indicated that all scales had reasonable internal consistency with values ranging from .69 to .91.

Correlations

Pearson product moment correlations were calculated among all variables selected for inclusion in the path model (belief in constructed knowledge, preference for certainty, and preference for structure, mastery, performance-approach, and performance-avoidance goals, shallow and deep engagement, and performance) (see Table 2).

A significant positive correlation was found between belief in constructed knowledge and mastery goals ($r = .29$) and deep engagement ($r = .24$). Belief in constructed knowledge was also negatively significantly related to preference for certainty ($r = -.33$) and performance-avoidance goals ($r = -.15$) but was not significantly related to performance-approach goals.

Preference for structure was significantly and positively correlated with preference for certainty ($r = .49$), performance-approach goals ($r = .26$), and shallow engagement ($r = .34$) but was not significantly related to performance-avoidance goals. Preference for certainty correlated significantly and negatively with mastery goals ($r = -.32$), deep engagement ($r = -.25$), and performance ($r = -.23$). A significant and positive correlation was found between preference for certainty and performance-approach goals ($r = .39$), performance-avoidance goals ($r = .28$) and shallow engagement ($r = .22$) also.

Mastery goals were significantly and positively correlated with shallow engagement ($r = .24$) and deep engagement ($r = .59$). A significant positive relationship

was found between mastery goals and performance ($r = .21$) as well. Performance-approach goals were only found to be significantly and positively correlated with performance-avoidance goals ($r = .35$). There was no significant relationship found with performance-avoidance goals and either level of cognitive engagement.

A significant positive relationship emerged between shallow and deep engagement ($r = .21$). Shallow engagement was also found to be significantly and negatively related to performance ($r = -.16$). A significant positive relationship also appeared between deep engagement and performance ($r = .16$).

Path Analysis

A path analysis was conducted using AMOS 6.0 to determine how well the proposed conceptual model (see figure 1) fit the data. Fit indices utilized to assess the fit of the model were χ^2/df ratio, Root-mean-square error of approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI). The χ^2/df ratio was originally designed to reduce sample size effects on model fit with preferred values ranging from 1.0 to 5.0. However, Kline (2005) claims that guidelines to determine best fit using the χ^2/df ratio value are debatable given its sensitivity to sample size. The RMSEA attempts to correct for model complexity with preferred values $\leq .05$ being an optimal fit, values between .05 and .08 indicating acceptable fit, and values $\geq .10$ indicating a poor fit. The CFI and the TLI compare the hypothesized model with that of a baseline or null model. Preferred values over .90 are indicative of a reasonably good fit (Kline, 2005; Schumacker & Lomax, 2004).

Test results for my conceptual model include $\chi^2/df = 3.49$, CFI = .85, TLI = .60, and RMSEA = .119. These results suggested that the model would benefit from

modification in order to better represent the data (see figure 2). Therefore, model modifications involved deleting non-significant paths and adding two additional paths from preference to certainty to (a) shallow engagement and (b) performance. Given past research supporting a connection between preference for certainty and shallow processing (Harlow, unpublished manuscript) it is empirically plausible to hypothesize a direct influence of preference for certainty on shallow engagement. Adding the path from preference for certainty to performance was based on the observed zero-order correlation between these two variables.

Weak, non-significant paths that were deleted from the original model include 1) constructed knowledge to preference for structure, 2) constructed knowledge to performance-approach goals, 3) preference for structure to performance-approach goals, 4) preference for structure to performance-avoidance goals, 5) performance-approach goals to deep engagement, 6) performance-approach goals to shallow engagement, 7) performance-avoidance goals to deep engagement, and 8) performance-avoidance goals to shallow engagement. These changes improved the overall fit of the model indicating an acceptable fit to the data [$\chi^2/df = 1.95$, CFI = .92, TLI = .85, RMSEA = .073]. Due to the results of model modification, all paths in the re-specified model were statistically significant (see figure 3).

In using Kline's (2005) criteria suggestions for interpreting the magnitude of standardized coefficients in path models, the direct effects for the final model indicated a small positive effect of belief in constructed knowledge on mastery goals ($\beta = .18$). Preference for structure moderately and positively predicted mastery goals only ($\beta = .33$). However, preference for certainty was found to have a moderate to large and negative

influence on mastery goals ($\beta = -.41$). Preference for certainty was also found to have a moderate and positive direct influence on performance-approach ($\beta = .39$), performance-avoidance goals ($\beta = .27$), and shallow cognitive engagement ($\beta = .33$) and a small negative influence on performance ($\beta = -.15$). A strong positive predictive relationship emerged between mastery goals and deep engagement ($\beta = .59$) and a moderate positive direct influence appeared between mastery goals and shallow engagement ($\beta = .35$). A small direct positive influence was found between deep engagement and performance ($\beta = .151$) and a small negative effect was found between shallow engagement and performance ($\beta = -.155$).

A suppressor effect or an effect that occurs when the relationship between a predictor variable and a criterion variable changes upon controlling for the influence of another predictor (Kline, 2005) was found after re-specifying the path model. The direct effect of mastery goals on shallow learning ($\beta = .25$) increased ($\beta = .33$) after the addition of a direct path from preference to certainty to shallow learning was included in the model. Preference for certainty also appeared to suppress the effect of preference for structure on mastery goals. The association between preference for structure and mastery goals was small and non-significant ($r = .113$) until controlling for need for certainty influences. This, in turn, created a medium significant influence of preference for structure on mastery goals ($\beta = .33$).

Indirect and Total Effects in Revised Model

Indirect and total effects of epistemic factors (belief in constructed knowledge and need for closure) on deep and shallow cognitive engagement and performance were examined. Standardized effects are provided in Table 3. The indirect effect of constructed

knowledge beliefs on deep engagement was .105 and shallow processing was .062. Belief in constructed knowledge also had little to no indirect effect (.006) on performance. The indirect effect of preference for structure on deep engagement was .197 and shallow engagement was .116. Preference for structure also had an indirect influence of .012 on performance. The indirect effects of preference for certainty on shallow engagement, deep engagement, and performance, were -.144, -.245, and -.066 respectively. The total effect of preference for certainty on shallow engagement was .184 and the total effect on performance was -.221. Indirect and total effects range from small (values of .10 or less) to moderate (values around .30) according to Kline's (2005) effect size interpretations.

Discussion

The purpose of this study was to test the relationships among student epistemic beliefs (represented by the belief that knowledge is constructed by the learner), epistemic motives (represented by need for closure facets-preference for structure and preference for certainty), achievement goals (mastery, performance-approach, and performance-avoidance), level of cognitive engagement (deep and shallow) and performance. Classroom-specific measures were utilized for epistemic beliefs and motives directly predicting type of achievement goal adopted and indirectly predicting influence on cognitive engagement and performance.

Consistent with past research that linked naïve epistemic beliefs to achievement goals (Bråten & Strømsø, 2004; DeBacker & Crowson, 2006), and research concerning the influences of belief in constructed knowledge (DeBacker & Crowson, in review; Harlow, unpublished manuscript), path analysis results and zero-order correlations indicated that students who believe knowledge to be personally constructed may be

inclined to adopt mastery goals and may also use both shallow and deep learning strategies. This suggests that students may apply more effort in mastering material if they feel they are responsible for the amount of knowledge acquired. However, belief in constructed knowledge was not found to predict a student's tendency to adopt either type of performance-goals suggesting that whether one believes knowledge to be constructed may not influence one to demonstrate or avoid demonstrating competence despite a priori predictions. On the other hand, zero-order correlations suggest as belief in constructed knowledge increases, the tendency for students to adopt performance-avoidance goals may decrease.

Consistent with findings in social psychological research, (Dijksterhuis, Van Knippenberg, Kruglanski, & Schaper, 1996; Kruglanski & Webster, 1996; Kruglanski, Webster, & Klem, 1993; Mayseless & Kruglanski, 1987), recent research linking need for closure to learning variables (DeBacker & Crowson, 2006; DeBacker & Crowson, in review; Harlow, unpublished manuscript), and my hypothesis, I found that a high preference for structure in regard to the classroom environment was related to student mastery goals. Those having a high preference for structure may also use deep and shallow learning strategies. Although, no other predictive relationships appeared in regard to preference for structure as expected, zero-order correlations indicate that students preferring a structured academic environment may also adopt performance-approach goals and use shallow learning strategies as well.

As predicted, test results of my conceptual model also demonstrated that students needing things to be certain and clear may be less inclined to adopt mastery goals and more inclined to adopt performance goals. A mastery-oriented student is found to be

focused on understanding content or improving competence (Elliot, 1999; Dweck, 1986), often leading to encounters with complex and ambiguous information which may deter a student with high certainty needs away from mastering content. Adopting performance goals appears to be more characteristic of a learner with a high need for certainty, suggesting that learners most likely are concerned with meeting an external *certain* standard or avoiding demonstrating ability if *uncertain* about efficacy. Zero-order correlations suggest that students with a high need for certainty may also use shallow learning strategies, receive lower grades, and use meaningful strategies as well.

Despite previous research suggesting associations among performance goals and both deep and shallow strategy use (Ames & Archer, 1988; DeBacker & Crowson, 2006; Greene & Miller, 1996; Meece et al., 1988; Miller et al., 1996; Nolen, 1988), these anticipated relationships were not supported in the current study. However, consistent with past research (Greene & Miller, 1996; Harlow, unpublished manuscript; Ravindran, et al., 2005; Pintrich, 2000; Wolters, 2004), path model results indicated that mastery-oriented students are inclined to utilize both shallow and meaningful learning strategies within a learning environment. Given that shallow learning strategies are sometimes required of students (i.e. memorizing material for test purposes), it seems plausible that mastery-oriented students would use both types of strategies in learning environments.

My path model results also supported the expected predictive relationship between deep engagement and performance and the influence of shallow engagement on performance as found in past research (Greene, et al., 2004; Pintrich & DeGroot, 1990). Negative zero-order correlations among shallow engagement and performance and positive correlations were found between deep engagement and performance as well.

Important indirect and direct predictive relationships also appeared in the data after the conceptual model was re-specified. Belief in constructed knowledge and having high structure needs may indirectly lead students to better grades through mastery goals. Shallow engagement and performance were found to be positively and directly influenced by a student's certainty needs also. As this finding appeared, a notable increase in the direct influence of mastery goals on shallow engagement also appeared when controlling for the direct effect of preference for certainty on shallow engagement. A positive relationship also appeared between preference for structure and mastery goals when controlling for the influences of preference for certainty. These findings suggest that preference for certainty may be suppressing the direct effect of preference for structure on mastery goals as well as the direct effect of mastery goals on shallow engagement. Further research is needed in order to determine the reason for these findings.

Findings of the re-specified model highlight the importance of considering certainty needs in learners and the strong connection these needs have with other learning variables. Preference for certainty was significantly associated with all learning variables in the model suggesting that the influence of certainty needs in learning should not be ignored when determining what may motivate a student to adopt effective study behaviors.

Limitations

There are several limitations in the current study worth noting. Participants were largely female and undergraduate students which limits the generalizability of the results to the general U.S. population or to males and younger students. Research results may not

be consistent in samples differing from the one examined as a result. Student participants were enrolled in different Educational Psychology course sections under different instructors. Different instructional styles and methods may have possibly introduced error or systematic variance unaccounted for in the performance measure.

Implications for Future Research and Instruction

Results of the current study have several implications for theory and practice. This study expands upon previous research connecting epistemic beliefs, achievement goals, and need for closure. Considering possible negative and positive predictors of achievement-related behavior is important in learning environments so that instructional methods may be designed to enhance rather than limit learning. Given the results of the current study, instructors should be aware of how belief in constructed knowledge influences mastery learning. Providing opportunities for students to observe how knowledge is acquired through a variety of personal experiences and individual and collective thoughts may lead students to believe that knowledge is personally constructed rather than handed down through external sources.

The current study also provides further support for the effects of need for closure on learning behavior. Providing a structured environment may be important for instructors to consider if students are to adopt mastery goals and meaningful learning behaviors. The impact of certainty needs on learning is a critical finding in the current study given its significant association with all variables tested. Determining effective ways to curtail excessive certainty needs is important in leading students toward mastery learning and away from performance-focused learning and use of shallow strategies.

Despite significant findings in the current study, further research is needed to fully understand the effects of belief in constructed knowledge and need for closure facets on learning. Future research should determine if need for closure influences are apparent in young learners. Future research should also assess how instructor's need for closure and epistemic beliefs influence instructional behaviors as well as student need for closure and epistemic beliefs. Manipulation studies should be conducted similar to that in social psychological research (Kruglanski & Freund, 1983; Kruglanski, Webster, & Klem, 1993) to determine if need for closure can be manipulated in classroom situations. Specific interventions on classroom need for closure should also be designed so that instructors are provided with specific tools and steps that help in limiting its negative effects as well.

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Table 1

Descriptive Statistics

Variable	Description	Mean	SD	Cronbach's α
1. Construct	Belief in constructed knowledge	4.31	.59	.84
2. Prefstruct	Preference for structure	4.01	.79	.88
3. Prefcert	Preference for certainty	2.98	.75	.83
4. Mastery	Mastery goals	4.54	.94	.91
5. Perfappr	Performance-approach goals	2.52	.98	.85
6. Perfavoid	Performance-avoidance goals	1.40	.61	.69
7. Shallow	Shallow cognitive engagement	3.47	1.08	.73
8. Deep	Deep cognitive engagement	4.19	.82	.78
9. Perform	Course grade	.89	.30	

Table 2

Pearson product-moment correlations among belief in constructed knowledge, preference for structure, preference for certainty, achievement goals, cognitive engagement, and performance (n = 178).

Variable	1	2	3	4	5	6	7	8	9
1. Construct	-	-.091	-.332**	.288**	-.076	-.150*	-.045	.244**	-.131
2. Prefstruct		-	.490**	.113	.261**	.119	.337**	.110	-.015
3. Prefcert			-	-.316**	.392**	.276**	.223**	-.250**	-.230**
4. Mastery				-	.001	-.119	.240**	.588**	.211**
5. Perfappr					-	.349**	.134	-.061	.027
6. Perfavoid						-	.087	-.049	-.043
7. Shallow							-	.214**	-.160*
8. Deep								-	.158*
9. Perform									-

Note. ** $p < .01$, * $p < .05$

Table 3

Standardized indirect and total effects of epistemic variables onto deep and shallow engagement and performance.

Proposed causal variable	Shallow	Deep	Performance
Construct	.119 (.119)	.105 (.105)	.027 (.027)
Prefstruct	.116 (.116)	.197 (.197)	.051 (.051)
Prefcert	.184 (-.144)	-.245 (-.245)	-.064 (-.243)

Note: Values in parentheses reflect the total effect of the proposed causal variable.

Figure 1

Conceptual Path Model

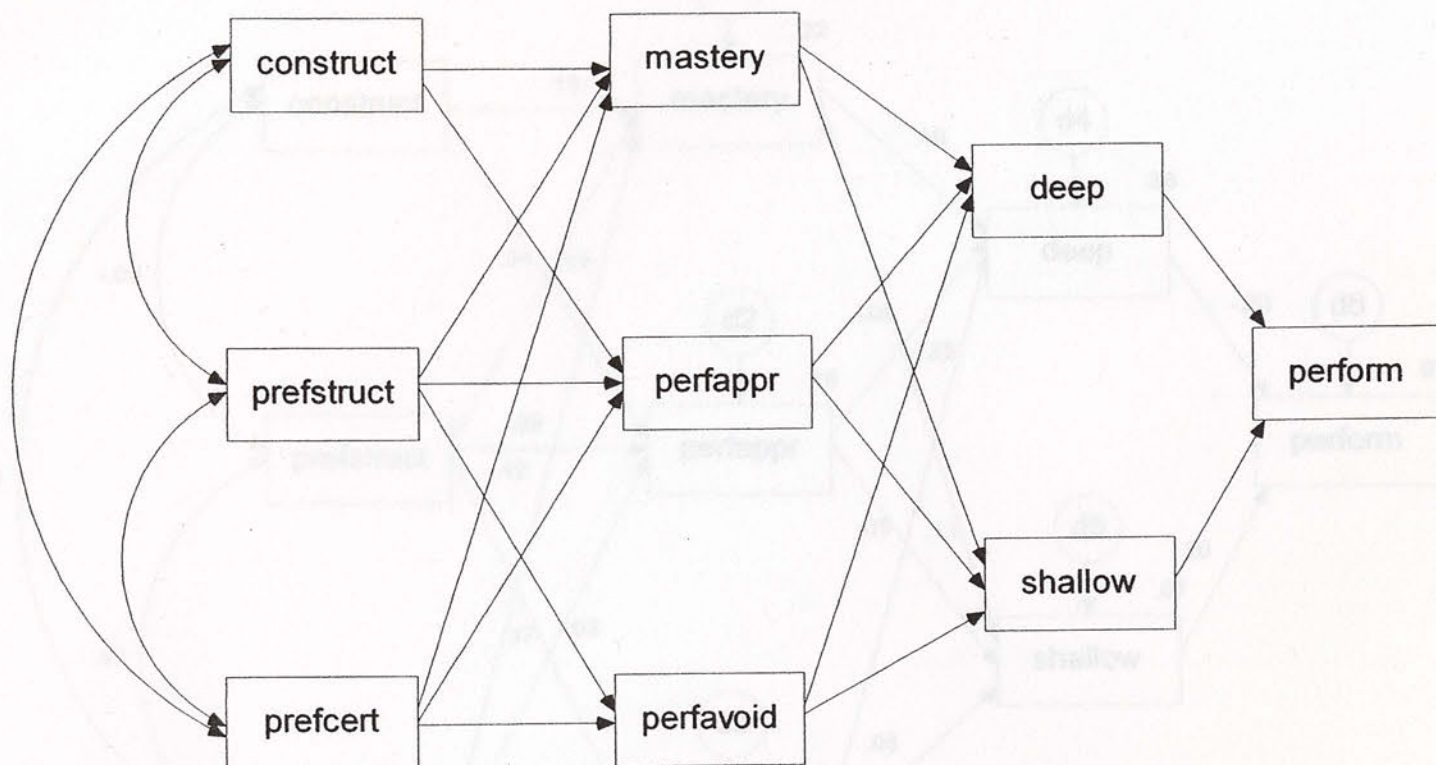


Figure 2

Standardized Regression Coefficients for test of conceptual model (model 1)

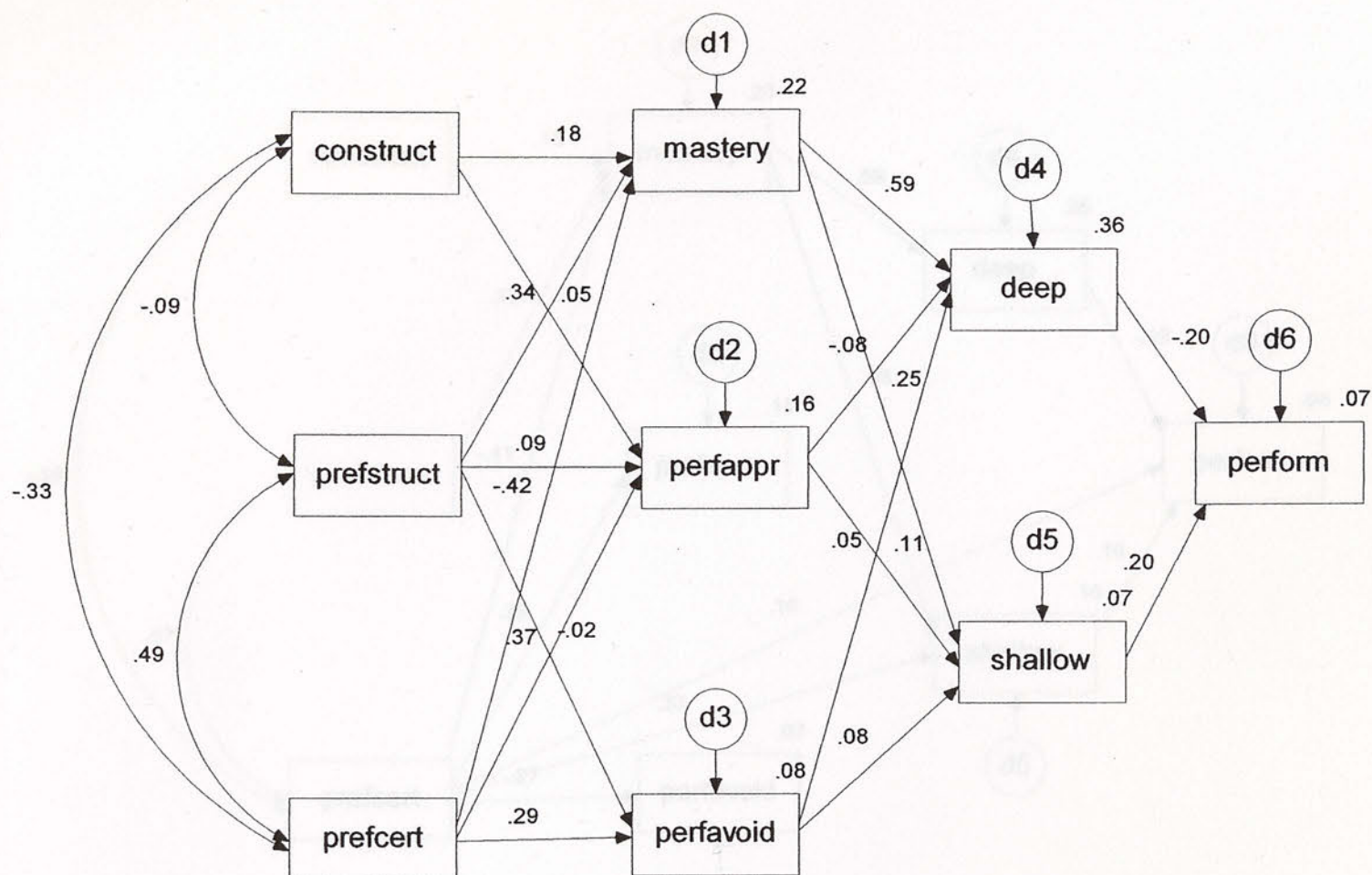
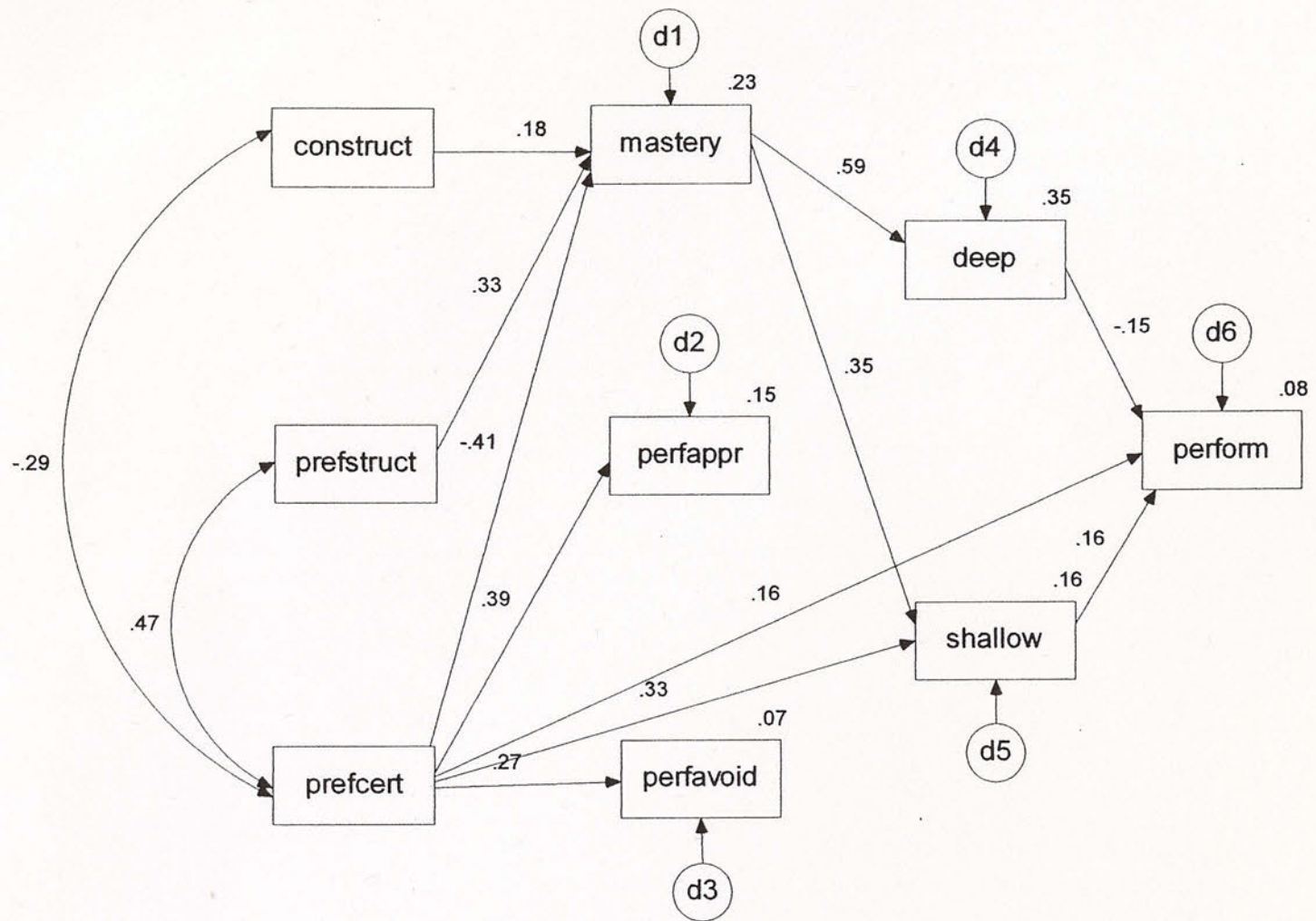


Figure 3

Standardized Regression Coefficients for test of re-specified model (model 2)



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