

DISSERTATION

THE EFFECT OF IMPLICIT SELF-THEORIES OF INTELLIGENCE ON TASK
PERSISTENCE AND PERFORMANCE IN AN ADULT SAMPLE: TEST OF A
STRUCTURAL MODEL

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ABSTRACT

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Implicit self-theories have been studied extensively in children as part of a social cognitive approach to behavior and performance and have been found to increase persistence in the face of challenge or failure, leading to increased performance on difficult tasks. Recently there has been some support for the idea that implicit self-theories are relevant as well for performance of working adults. The purpose of the current study was to examine the effects of implicit self-theories in working adults by examining structural model with implicit self-theories predicting self-efficacy after task failure, which in turn predicts persistence on a difficult task, which further predicts overall performance on a set of difficult tasks. Structural equation modeling resulted in limited support for the proposed model; implicit self-theories predicted persistence, which in turn predicted performance, but the effect was not mediated through self-efficacy. Some evidence for a moderation effect of early failure was found for the effect of implicit self-theories on persistence. Implications and future directions are discussed.

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Introduction

In industrial and organizational (I/O) psychology, motivation is defined as the internal drive toward a particular direction of behavior, intensity of that behavior in achieving a goal, and persistence in that level of intensity until a goal is met (Kanfer, 1990). Motivation, along with declarative and procedural knowledge, is an antecedent to job performance (Motowidlo, 2003) and thus, it is reasonable that researchers and practitioners interested in enhancing job performance would attend to theories of motivation. One motivational construct that has received considerable attention is the social cognitive theory of goal orientation (GO).

Goal Orientation

GO is defined as “dispositions toward developing or demonstrating ability in achievement situations” (VanDeWalle, 1997, p. 996) and is often characterized as an individual’s predisposition to behave in particular ways in achievement settings (Dweck, 1986; Eison, 1981; Elliott & Dweck, 1988; Elliott & Harackiewicz, 1996; Nicholls, 1975). Two types of GO were originally defined: learning goal orientation (LGO) and performance goal orientation (PGO). LGO, alternatively referred to as mastery goal orientation, is an orientation toward learning and mastering skills and knowledge for the sake of mastery itself. Individuals with a LGO tend to set goals that are more challenging, regardless of how they conceive of their own abilities (Elliott & Dweck, 1988; Jagacinski, Kumar, & Kokkinou, 2008; Thomas, 1999). Further, individuals with a LGO also tend to react adaptively when facing failure by either persisting or by changing strategies until mastery is achieved (Dweck & Leggett, 1988; Friedel, 2006). PGO, on the other hand, is an orientation toward either demonstrating one’s competence or refraining from demonstrating a lack of competence to others. The primary goal for an

individual with a PGO is to seek positive judgments of ability and to avoid negative judgments from others (Elliott & Dweck, 1988). More recently, PGO has been separated into two dimensions, PGO-approach and PGO-avoid. PGO-approach is an orientation toward demonstrating competence to others, while PGO-avoid is a focus on avoiding demonstrating incompetence to others (Elliot, 1994; Elliot & Harackiewicz, 1996; VandeWalle, 1997). GO generally has been linked with job-relevant outcomes such as training outcomes (e.g. Brown, 2001; Kozlowski et al., 2001), goal setting (e.g. Phillips & Gully, 1997), and feedback seeking (e.g. VandeWalle & Cummings, 1997), among others. While GO has become relatively well studied in the extant literature, other aspects of the social cognitive motivational theories that encompass GO have received less attention.

Implicit Self-Theories

Another construct that is part of the same social cognitive motivational theory as GO is the construct of implicit self-theories (Dweck & Leggett, 1988). The term ‘implicit self-theories’ refers to naive beliefs held by individuals about the malleability of individual characteristics such as intelligence and personality (Dweck, 1999; Dweck & Leggett, 1988). It is important to point out that the terminology here is different than is often found in psychological science. The term ‘theory’ here is used to refer to the ways that individuals think about the traits of themselves and others, rather than the scientific term ‘theory,’ which refers to a scientific explanation for phenomenon. Implicit self-theories have been known by various names including Implicit Person Theory, Mindset, and Self Theories (Dweck, 1999; Dweck, Chiu, & Hong, 1995). For the purposes of maintaining consistency, I will refer to all of these terms using the designation ‘implicit self-theories.’

Within the spectrum of implicit self-theories, each individual is thought to hold either an entity theory or an incremental theory. An entity theorist holds the belief that individual characteristics are fixed and cannot be enhanced or improved. This belief does not include the assumption that abilities cannot decline (for example, intelligence declining with advanced age). An incremental theorist holds the belief that characteristics are malleable, under the control of the individual, and can be improved or changed given the appropriate amount of effort, opportunities, or instruction (Dweck, 2012).

Implicit self-theories have been characterized as being developed by individuals prior to GO; in fact, they may lead to GO. Incremental theorists are more likely to adopt a LGO because the underlying assumption of the incremental self-theory is that intelligence is enhanced as one persists in trying to learn. On the other hand, an entity theorist would be more likely to adopt a PGO because the underlying assumption of an entity self-theory is that the amount of ability one has is all there will ever be, and therefore it is of vital importance to demonstrate high ability (Dweck & Leggett, 1988). However, empirical evidence of the relationship between GO and implicit self-theories suggests that the relationship may be weaker than originally believed. For example, a meta-analysis of the nomological net of GO found that the relationship between GO and implicit self-theories of intelligence was weak, with corrected correlations ranging from -0.12 between incremental theory and LGO to 0.09 between entity theory and PGO (Payne, Youngcourt, & Baubien, 2007). These corrected correlations translate to a small amount of variance in GO explained by implicit self-theories (between .8% and 1.4%) The implication of this result is that GO and implicit self-theories are, in fact, separate constructs – a conclusion supported by other research as well (e.g. Wilson & Kraiger, 2012).

There are some similarities and some differences in the theoretical development of GO and implicit self-theories. The construct of GO originated in the educational psychology literature and as such, the focus of the construct is primarily on the self in achievement or learning situations (Eison, 1981). In particular, early GO research was focused on children. Similarly, implicit self-theories were also studied originally with children in educational settings. On the other hand, implicit self-theories predict a broader range of outcomes; not only success and behaviors in learning situations (e.g. Blackwell, 2002; Blackwell, Trzesniewski & Dweck, 2007; Martocchio, 1994; Robins & Pals, 2002), but also responses to failure and challenge (e.g. Beer, 2002, Diener & Dweck, 1996; Dweck, 1999; Dweck & Leggett, 1988), attributions of the behavior of others (e.g. Butler, 2000; Dweck et al., 1995), acknowledgement of change in another's behavior and performance (e.g. Heslin, Latham, & VanDeWalle, 2005; Tam, Pak, Hui, Kwan, & Goh, 2010), and developmental behaviors, such as coaching and providing feedback, directed at others (e.g. Heslin, VanDeWalle, & Latham, 2006). All of these outcomes are relevant in a work setting and therefore, the construct of implicit self-theories is rife with possibilities for the I/O psychologist.

Behavioral, cognitive, and affective consequences of implicit self-theories. Implicit self-theories influence the way we react when we face challenge or failure. For example, early research on implicit self-theories focused on children's academic behaviors and found that children who held entity theories were more likely to withdraw from the task (fail to persist in the task), engage in negative self-talk, or make excuses for their poor performance when faced with challenge or failure, compared to children who held incremental theories (e.g. Blackwell,

2002; Blackwell et al., 2007; Butler, 2000; Erdley & Dweck, 1993)¹. Children who held incremental theories were likely to demonstrate more adaptive emotional, cognitive, and behavioral reactions to challenge or failure compared with children who held entity theories. For example, incremental theorists tended to engage in adaptive responding, such as optimism, increased effort, and a focus on the growth opportunity of the situation, upon facing challenge or failure. Alternatively, entity theorists were more likely to engage in maladaptive behaviors, such as attribution of the failure to internal characteristics (“I’m too stupid to do this”), negative affect, and withdrawal from the task upon facing challenge or failure (Diener & Dweck, 1978; Dweck & Leggett, 1988). Thus, entity theorists are less likely to persist in a task after having experienced failure or challenge.

This relationship between the type of implicit self-theory and the level of persistence, as well as strategies used after failure, seems to transcend beyond childhood. Studies conducted by Blackwell and colleagues (Blackwell, 2002; Blackwell et. al., 2007) found that children transitioning from elementary school to middle school math courses were more resistant to a commonly-occurring decline in math performance if the children held incremental theories even controlling for previous math grades and proficiency. This was true whether the children had a natural baseline incremental theory or if they were exposed to an intervention designed to illicit a more incremental perspective of intelligence, suggesting that there is likely a causal relationship, with implicit self-theories influencing behavior. Blackwell (2002) found that positive strategies,

¹ For the purposes of the current study, challenge and failure are conceptualized as the same construct. Challenge means a task that is very difficult for an individual, and failure simply means that the task was so difficult for the individual that the individual was not able to successfully or correctly complete the task. Also, persistence and withdraw are used for the purposes of the current study to be opposite ends of the same spectrum. If one fails to persist, then one has withdrawn. If one fails to withdraw, then one has persisted.

operationalized as endorsement of items suggesting increased effort in the future (e.g. “I will study harder for this topic in the future”), mediated the relationship between implicit self-theory and achievement in middle school math. Similar outcomes have been found in challenging college courses as well (Good, Rattan, & Dweck, 2008 as cited in Dweck, 2012; Grant & Dweck, 2003; Robins & Pals, 2002), suggesting that the differences in adopting positive strategies (in particular, persistence) between incremental and entity theorists continues throughout childhood and into early adulthood.

In addition to the adaptive behavioral response of persistence, there is also evidence for more adaptive affective or cognitive responses from incremental theorists than from entity theorists upon exposure to failure or challenge. Undergraduate students who reported an incremental theory of intelligence (measured before any intervention) reported greater levels of perceived self-efficacy after the first block of challenging tasks as compared with entity theorists even though the task performance of the two groups was similar (Taberero & Wood, 1999). Self-efficacy is a cognitive response, and a greater self-efficacy is more adaptive than lower self-efficacy. In the same vein, Martocchio (1994) reported that induced self-theories of intelligence were effective in buffering the negative effects of challenge on self-efficacy and anxiety. In his study, employees involved in a computer training program were randomly assigned to one of two groups. One group received an intervention designed to present computer ability as an acquirable skill. The other group received an intervention that presented computer ability as fixed. The acquirable-skill group reported a reduction in computer anxiety between pre-training measures and post-training measures, whereas the fixed ability group showed no change in anxiety. Additionally, the acquirable-skill group experienced increased computer efficacy (task

specific self-efficacy) from pre- to post-training, whereas the fixed ability group demonstrated a reduction in computer efficacy from pre- to post-training.

A study designed to investigate the relationship between implicit self-theories and behavior concluded that shy participants with incremental theories were less likely to avoid social situations, more likely to view social situations as learning experiences, and less likely to suffer negative outcomes as a result of their shyness as compared to shy participants holding entity theories (Beer, 2002). Findings were based on both self-report and informant report data, and held true for both hypothetical situations and real social situations. Beer discovered that shy incremental theorists engaged in more adaptive behavioral and cognitive responses to challenge than shy entity theorists. Thus, incremental theorists demonstrate not only adaptive behavioral responses to challenge, but also adaptive cognitive and affective responses to challenge. It is reasonable to expect these cognitive and affective responses to have an impact on the behavioral response of persistence such that the adaptive cognitive (maintained or increased self-efficacy, framing situation as a challenge rather than a treat) and affective responses (maintained or reduced anxiety level) facilitate persistence, while maladaptive cognitive (reduced self-efficacy) and affective responses (increased anxiety) impede persistence.

Consequences of implicit self-theories in judgments of others. Implicit self-theories influence the way we react when we, ourselves, face challenge and failure, but the story doesn't end there. Implicit self-theories also influence the way we judge and react to others. Entity theorists should be less likely to notice changes in behavior over time, or to take changes in behavior into consideration in judging others, because their underlying assumptions about characteristics dictates that traits are stable and behavior is the result of traits (Butler, 2000). As a result, the information to which entity theorists attend, as well as the information which they

remember would likely be information consistent with stability of traits rather than development or malleability, referred to as confirmation bias (for a review of confirmation bias, see Nickerson, 1998). Entity theorists can often believe that ability doesn't change, and as such, can find it difficult to believe that someone can perform very badly on several tasks, then suddenly perform well on a similar task. Although, objectively there are many reasons why a high ability individual might perform poorly on a task, empirical evidence indicates that entity theorists do not seem as likely as incremental theorists to take this into consideration when judging others (Butler, 2000; Tam, Pak, Hui, Kwan, & Goh, 2010). The apparent inconsistency would likely be resolved by ignoring any change in behavior or performance as contrary to the initial belief. Incremental theorists, with their belief that abilities and characteristics do change with effort, would see no contradiction in a person's change in performance over time, and therefore the change would more likely be attended to and recalled. Butler (2000) found empirical support for this assertion. In a study using junior high school students and teachers she found that entity theorists were more likely to focus on first impressions, or the initial information provided about another, in making judgments, compared with incremental theorists who were more likely to rely on the most recent behavioral information in making judgments of others. Similarly, Tam et al. (2010) found that college students who held incremental theories were more perceptive to changes in the behavior of a professor, and evaluated the professor more accurately based on behavioral changes as compared to students who held entity theories. The researchers created a scenario in which a professor appeared to be absent-minded at the beginning of the semester. The professor would make comments that he had forgotten some important document, or left exams behind. After the first half of the semester, students were asked to rate the professor on several dimensions, including absent-mindedness. Entity and incremental theorists rated the

professor as equally absent-minded at that time. For the second half of the semester, the professor stopped engaging in the apparently absent-minded behavior, and when the semester was over, students were asked again to rate the professor on the same dimensions. Students who reported an entity theory rated the professor as more absent-minded during the second half of the semester compared with incremental theorists. Apparently, the entity theorists failed to notice that the professor's behavior had changed, while the incremental theorists did notice, and changed their rating of the professor to be in line with the new behavior. This finding is important because it emphasizes the differences between the two types of theorists, not only in their reactions to their own performance, but in their reactions to the behavior and performance of others. Similarly, Heslin and VanDeWalle (2008) applied the implicit self-theories literature to adults in a working environment. They found that supervisors who held incremental theories were more likely to notice changes in performance in employees rather than relying on their first impressions of the employee's performance. In another study, Heslin et al. (2006) found that supervisors who held incremental self-theories were more likely to engage in coaching behaviors with their employees than supervisors who held entity theories. This is to be expected because entity theorists do not believe that ability can be increased, in addition they tend to rely on first impressions to determine the level of ability an individual possesses. Taken together, there would be no reason to coach an employee who performs badly because the poor performance would likely be considered a result of low ability, and therefore unchangeable. Heslin et al. also found that an intervention designed to influence a more incremental theory in managers led to an increase in coaching behaviors by participants who had previously held entity theories. This finding implies that, although individuals display a default implicit theory, this default is subject to change through training or other environmental factors (e.g., Blackwell, 2002). This in turn

suggests that organizations could design interventions focused on implicit self-theories that would change the cognitive, affective, and behavioral reactions of their employees to be more desirable, whether those reactions are focused on the self or on others.

Current Study Model

To this point I have reviewed the relevant research demonstrating the consequences of holding different implicit self-theories (either entity or incremental). The current study will specifically examine how implicit self-theory is related to task performance. Specifically, I will examine the effects of implicit self-theory on performance of a challenging task. The current study will test a moderated and mediated model (see Figure 1 on page 22) with implicit self-theories predicting overall performance on a set of challenging tasks, through the effects of self-efficacy and persistence on task performance. The effect of implicit self-theories is expected to be significant only when a participant has encountered challenge or failure. In the following sections I describe each relationship that is contained in the model.

Implicit theory predicts persistence. The first relationship in the proposed conceptual model is the relationship between implicit self-theory and persistence. Recall that several studies have reported a relationship between implicit self-theories and adaptive behavior in the face of challenge. In addition to the empirical evidence already discussed, Briones, Tabernero, and Arenas (2007), for example, studied shy participants and found that those with an entity theory regarding social skill were more prone to helpless or self-defeating behavior such as withdrawal from social situations, as compared to those participants holding incremental theories. The incremental theorists were more likely to persist with effort in social situations, even in the face of negative social consequences. Similarly, Burnette (2010) discovered that dieters with an incremental theory of body weight were more likely to engage in adaptive dieting behavior, such

as increased dieting effort, dieting persistence, and identification of failure cues, after weight loss setbacks than those holding entity theories of body weight. Other researchers have focused their attention on implicit theories of intelligence, and found similar results. As previously described, Blackwell (2002) conducted a longitudinal study of students entering junior high school and found that students who reported an incremental theory had higher math grades after two years than those who reported an entity theory. Junior high students who held incremental theories of intelligence had more positive beliefs about effort (that effort is useful and necessary for accomplishment) and were more likely to report mastery goal orientations as opposed to performance goal orientations compared with entity theorists. These motivational factors were related to more positive and adaptive study strategies such as persistence with effort, which were, in turn, related to higher math grades. Specifically, students who reported entity implicit theories of intelligence were more likely to withdraw from math work or to avoid math upon facing challenge or failure, while those who reported incremental theories were more likely to report intentions to persist and to increase effort. A common theme across these studies is a difference in the behavioral response, specifically persistence, between entity and incremental theorists.

The relationship between implicit self-theories and persistence appears to be a causal one, with implicit self-theory driving the behavioral reaction to challenge. For example, Blackwell et al. (2007) implemented an intervention designed to create a more incremental implicit self-theory in one group of junior high school students as those students entered 7th grade. A control group did not receive the intervention. In subsequent measures, the researchers found that the members of the intervention group did, in fact, report more incremental implicit self-theories than the control group. They also found that those students in the intervention condition tended to have an upward trajectory of math scores across junior high school, similar to the upward

trajectory that is demonstrated by students who naturally hold incremental theories of intelligence. The control group demonstrated a downward trajectory of math grades across junior high school, similar to the downward trajectory that is experienced by the average junior high student. In the same study, Blackwell found that implicit self-theories predicted goal orientation, which in turn predicted strategies such as persistence or withdrawal. Strategies, in turn, predicted trajectory of math scores. Specifically, those participants who were induced to have a more incremental implicit self-theory tended to adopt a LGO, which in turn predicted positive strategies such as persistence, which in turn predicted an upward trajectory of math scores. For those participants who were not part of the intervention group, and therefore held a more entity implicit self-theory, the tendency was to adopt a PGO, which in turn led to fewer positive strategies (i.e. withdrawal), and that, in turn, predicted a downward trajectory of math scores. Thus, the intervention did not only increase incremental self-theory in the intervention group, it also predicted the same outcomes as if students naturally held an incremental theory. This finding suggests that there is a causal relationship between implicit self-theories and behavior that is either more or less adaptive in challenging situations.

The empirical evidence for a relationship between implicit self-theories and persistence reviewed above is based primarily on research conducted with children and college students. To date there has been little research on implicit theories conducted with adult participants, and in particular there has been little research on the link between implicit self-theories and persistence using working adults. One might argue that this relationship may not be as strong, or may not exist at all, in adults as a result of cognitive development or other factors of adult working life (e.g. financial responsibilities, expectations of coworkers and leaders) overriding the effects of implicit self-theories in adults. However, as has been discussed previously, Heslin and

colleagues (Heslin et al., 2005; Heslin & VandeWalle, 2008; Heslin et al., 2006) have studied implicit self-theory in working adults and found that the construct predicts important outcomes of interest. Their findings would suggest that implicit self-theories are not only relevant for children, but are also relevant for adults. In addition, there is at least one other social cognitive theory of motivation, GO, that was originally focused on children and later became very important in research on motivation for working adults. Based on the prior evidence linking self-theories to persistence in children, and other studies generalizing social cognitive theory effects from children to adults, I predict that implicit self-theories will be related to persistence in working adults. In the current study, I operationalize persistence in three ways: a) number of task items attempted; b) time spent trying to solve a task item; and c) time spent on a tutorial presented after failure. Thus, it is predicted that:

H₁: Implicit self-theories will affect persistence on challenging tasks.

H_{1a}: Incremental theorists will be more likely to persist (spend more time) in solving difficult problems or in solving problems after an incorrect response has been given than will entity theorists.

H_{1b}: Incremental theorists will be more likely to persist in a training activity presented after an incorrect answer than will entity theorists.

Self-efficacy mediates the relationship between implicit self-theory and persistence.

Self-efficacy predicts persistence. Bandura (1977) proposed the concept of self-efficacy as a motivating driver of behavior. The assumption was that expectations for successful completion of behavior would influence individuals to engage, and to persist, in the behavior. Absent self-efficacious expectations, motivation would be low regardless of the desirability of the outcome or the expectation that the outcome would follow the successful completion of the

behavior. Since then, self-efficacy has been the subject of extensive research (Vancouver & Day, 2005) in various areas of psychology including educational psychology (see Schunk, 1991 and Pajares, 2003 for reviews), health psychology (Strecher, DeVillis, Becker, & Rosenstock, 1986), career psychology (Lent, Brown, & Hackett, 1994) and I/O psychology (Stajkovic & Luthans, 1998). The general consensus from all of this research is that self-efficacy beliefs enhance performance by increasing motivation.

Although a large number of empirical studies focused attention on the link between self-efficacy and future performance, some studies also focused on the link between past performance and self-efficacy. Bandura's (1977) original conceptualization of self-efficacy indicated that the origins of self-efficacy were tied to, among other things, previous achievement. Sitzmann and Yeo (2013) meta-analyzed self-efficacy research and found that the within-person relationship between self-efficacy and future performance was weak at best, and possibly non-existent. However, they also found that the relationship between previous performance and self-efficacy was positive and strong (corrected correlation: $\rho = .40$, $k = 36$, $N = 30,733$). The conclusion drawn by Sitzmann and Yeo is that, contrary to popular belief, success or failure during previous performance causes increased or decreased self-efficacy respectively, but that the level of one's self-efficacy does not cause success or failure on future performance.

Although Sitzmann and Yeo's meta-analysis suggests that the relationship between self-efficacy and future performance may be spurious, and the real predictor of future performance is past performance, these researchers did not examine the relationship between self-efficacy and persistence. Low task specific self-efficacy may result in anxiety about the task, which in-turn may result in task withdrawal (Bandura, 1997). Thus, self-efficacy should improve persistence on a difficult task, which in turn should improve overall performance on the task. Social

cognitive career theory has been established and supported based upon the assumption that self-efficacy, along with perceptions of outcomes, drives interest of, and motivation for, academic and career choice and performance through the effect of self-efficacy on motivating factors such as persistence and behavioral choice (the decision to persist in a task) (Lent et al., 1994). This stands to reason as a belief that one cannot do a task should lead to a belief that continuously trying to do the task is time and effort wasted, regardless of the desirability of the result of good performance.

In support of this assertion, Multon, Brown, and Lent (1991) conducted a meta-analysis of the relationship between self-efficacy perceptions and academic persistence. They found that the unbiased effect size of the relationship between self-efficacy (included studies used either natural baseline self-efficacy or manipulated self-efficacy) was $r=0.34$. This relationship was significant, with a 95% CI of $r=0.28$ to $r=0.39$. Persistence was operationalized in the meta-analyzed studies as either time spent on the performance measure, number of items attempted or completed on the performance measure, or number of academic terms completed (Multon et al., 1991). The strongest relationships between self-efficacy and persistence were found in studies in which persistence was operationalized as number of items attempted or completed.

Given the effect of implicit self-theories on self-efficacy, it is possible that the effect of implicit self-theories on persistence may not be entirely direct, but instead mediated by the self-efficacy. Thus, it is predicted:

H₂: Self-efficacy will affect persistence on a difficult task.

H_{2a}: Participants with higher self-efficacy will attempt more items from a difficult set of items than participants with lower self-efficacy.

H_{2b}: Participants with higher self-efficacy will spend more time trying to solve a

difficult item than participants with lower self-efficacy.

H_{2c}: Participants with higher self-efficacy will spend more time viewing a training module that is presented after an incorrect answer is given (after task failure) than participants with lower self-efficacy.

Implicit self-theory predicts self-efficacy, but only in the face of challenge or failure.

Entity implicit self-theories lead to different cognitive and affective reactions to failure than do incremental implicit self-theories. Self-efficacy is an important cognitive reaction to past performance. Entity theorists, with their belief that ability is not developable, would be more likely to suffer a reduction in self-efficacy upon facing failure or challenge compared to incremental theorists. Recall that entity theorists are more prone to internal attributions of performance as being indicative of ability (Butler, 2000; Heslin & VanDeWalle, 2008; Tam et al., 2010). As a result, when an entity theorist fails on a task, the cognitive reaction should be to assign fault for that failure to his or her own lack of ability. This assumption is likely to lead to a reduction in the level of self-efficacy the individual would feel regarding future attempts at similar tasks. Incremental theorists, on the other hand, believe that ability can be developed, and tend to be more likely to notice improvements in performance. Thus, upon facing failure an incremental theorist should be less prone to judge his or her own level of ability, and therefore more likely to maintain a constant level of self-efficacy. Hong et al. (1995) found empirical support for this assertion in a study of the reactions to performance setbacks in students with incremental versus entity theories of intelligence. In the Hong et al. study, half of the participants were given a difficult test and then were provided with negative feedback about their performance on the test. The other half of subjects were not given a test, nor were they given any negative feedback. Subsequently, both groups were given an a timed decision task in which

they were asked to make decisions about whether or not an adjective could be used to describe a person. Some of the adjectives were ability salient, such as 'smart' or 'stupid.' Entity and incremental theorists had similar levels of self-efficacy at the beginning of the study. However, when ability was made salient (failure occurred or negative feedback was received) entity theorists took longer to respond to ability adjectives in implicit reaction time trials than incremental theorists did. There was no difference in response latency between incremental and entity theorists on non-ability salient adjectives or in the control group that did not receive negative feedback. The conclusion presented by the researchers was that entity theorists suffered a reduction in confidence in their ability after negative feedback was received while incremental theorists did not. This reduction in confidence led to negative emotional responses, which inhibited their quick response on the decision task. It is my belief that similar effects would occur for self-efficacy. That is after failure has occurred, or upon experiencing challenge, participants holding an entity theory will suffer a reduction in self-efficacy, while participants who hold an incremental theory will not.

While Hong et al. (1995) used an implicit measure to determine the effect of failure on cognitive and affective reactions of entity versus incremental theorists, Taberero and Wood (1999) used a more direct measure and reported a similar finding – implicit self-theories did not predict perceived self-efficacy measured prior to blocks of challenging tasks, however participants holding an incremental theory reported stronger perceived self-efficacy compared to entity theorists after the first block of a challenging task. In the Taberero and Wood study, entity theorists demonstrated a reduction in self-efficacy after a challenging task, that is, incremental theorists were buffered from the negative effects of failure or challenge on self-efficacy whereas entity theorists were not.

Similarly, Martocchio (1994) found support for the buffering effect of an incremental theory on self-efficacy, even when the incremental theory is artificially induced. In a study in which employees were assigned to a real-world computer training program, Martocchio randomly assigned participants to receive either an intervention designed to increase incremental beliefs or an intervention designed to increase entity beliefs. Participants in the incremental condition reported an increase in task specific self-efficacy after training, while participants in the entity condition reported decreased task specific self-efficacy after training. Martocchio's hypotheses are centered on the idea that when one perceives a training task (a task that represents challenge because it is new to the participant and poses a threat of failure) as an opportunity to increase ability, then one's self-efficacy can be maintained even in the face of failure. Further, incremental theorists are the ones who are most likely to see training tasks as opportunities rather than threats because they conceive of ability as malleable. Therefore, since incremental theorists believe that they can increase their ability, opportunities to do so do not seem threatening, however this is not true for entity theorists. For entity theorists, novel or challenging tasks represent threats to their perceived ability, and since they believe that ability cannot be increased, their self-efficacy is likely to be reduced upon their encounter with challenging tasks. The conclusion is that individuals who hold an entity theory are more likely to suffer reductions of self-efficacy in the face of challenge or failure than individuals who hold an incremental theory. Stated another way, entity theorists tend to suffer from decreased self-efficacy perceptions in the face of failure, while incremental theorists tend to either maintain their initial level of self-efficacy or report increases in self-efficacy after facing failure or challenge.

H₃: Task failure moderates the relationship between implicit self-theory and self-efficacy such that differences between incremental and entity theorists in self-

efficacy will be present only after task failure has occurred, but not when task failure has not occurred.

The path from implicit self-theory to persistence is moderated by task challenge and mediated by self-efficacy. As previously stated, implicit self-theory predicts self-efficacy, but only when participants encounter task challenge or task failure. Additionally, self-efficacy predicts persistence on challenging tasks. Thus, a likely explanation for the relationship between implicit self-theory and persistence is that implicit self-theory affects level of persistence through its effect on self-efficacy, which is only seen in the case of challenging tasks. Individuals who hold more of an incremental implicit self-theory of intelligence are less likely to react to failure with reduced self-efficacy as compared with individuals who hold a more entity implicit self-theory of intelligence. As a result of the maintenance of self-efficacy after task failure, individuals with more of an incremental implicit self-theory are likely to persist in a challenging task because their confidence in their ability to succeed is greater. On the other hand, individuals who hold more of an entity implicit self-theory, upon encountering task failure, are more likely to experience a reduction in self-efficacy for the task. This, in turn, reduces their likelihood of persistence in the task as there is little to support a belief that they can succeed. Thus:

H4: Self-efficacy will partially mediate the relationship between implicit self-theory and persistence.

As a result of the moderating effect of task failure in the relationship between implicit self-theories and self-efficacy, and the mediating effect of self-efficacy in the relationship between implicit self-theory and persistence, it follows that the direct effect of implicit self-theories on persistence will be moderated by task failure as well. That is, implicit self-theories will only affect persistence on a difficult task if task failure has occurred. When individuals are

succeeding at a task, then implicit self-theory is not relevant for self-efficacy or persistence.

Thus:

H₅: Task failure will moderate the relationship between implicit self-theories and persistence such that the relationship between implicit self-theories and persistence will be null unless task failure has occurred.

Implicit self-theory and task performance

Persistence Predicts Performance. If one withdraws from a task before the task is complete, one cannot succeed in the task, therefore persisting with effort in a challenging task should be related to final performance on said task. In the current study, several blocks of challenging tasks will be presented to the participants. It is hypothesized that entity theorists will be more likely to withdraw after failure compared with incremental theorists. If this hypothesis holds true, then one would expect a reduced overall task score (a score combining all blocks of tasks) for entity theorists than for incremental theorists if failure is experienced early in the task.

Limited empirical support for this assumption has been found. Blackwell (2002) included persistence as a positive strategy in a study with middle school children transitioning from elementary school math to middle school math. Children holding entity theories reported fewer positive strategies (operationalized as self-report behavioral intentions, such as, “I will work harder on this participant in the future”) compared with incremental theorists. These positive strategies were found to be mediators in the relationship between implicit self-theories and overall math performance over an academic year. Further, persistence is one such positive strategy for task performance. Thus:

H₆: Participants who persist on the task will achieve higher scores on the task than participants who withdraw from (or fail to persist on) the task.

H_{6a}: Participants who answer all of the items in the task will achieve higher scores than participants who fail to answer all of them items in the task.

H_{6b}: Participants who spend more time answering items in the task will achieve higher scores than participants who spend less time answering the items.

H_{6c}: Participants who spend more time viewing a tutorial that is presented after a failed item will achieve higher scores than participants who spend less time viewing the tutorial.

Persistence as a Mediator. Based upon the arguments and evidence presented above, I anticipate that individuals who report more of an incremental theory will be more likely to persist on the tasks after facing challenge or failure compared with individuals who report more of an entity theory. I anticipate this difference in level of persistence to lead to increased overall performance on a score combining all tasks together.

H₇: Persistence will mediate the relationship between implicit self-theory and overall task performance.

Because task failure moderates the model at an early stage, between implicit self-theories and self-efficacy, it follows that the relationship between implicit self-theories and any other variable in the model will be null unless task failure has occurred. When participants are succeeding on the task, implicit self-theories should not affect performance. Thus:

H₈: Task failure will moderate the direct effect of implicit self-theories on overall task performance such that differences in task performance between entity and incremental theorists will be present only after task failure has occurred.

Final Model

Several hypotheses have been asserted in the above sections. Each hypothesis is a part of an overall model which explains the process through which, and the boundary conditions under which implicit self-theories affect performance. For the sake of clarity, I will put these relationships together here in a discussion of the overall model to be tested. The overall hypothesis is that implicit self-theory predicts performance on a task. The task consists of a set of challenging items. However, the effect of implicit self-theory on performance is not direct. Instead, the effect of implicit self-theory on performance is through its effect on self-efficacy, which in turn affects persistence, which in turn finally predicts overall performance. In addition, the effects of implicit self-theories on self-efficacy, persistence, and performance are hypothesized to be relevant only in the case of a previous failure or challenge. A conceptual model is presented below in Figure 1.

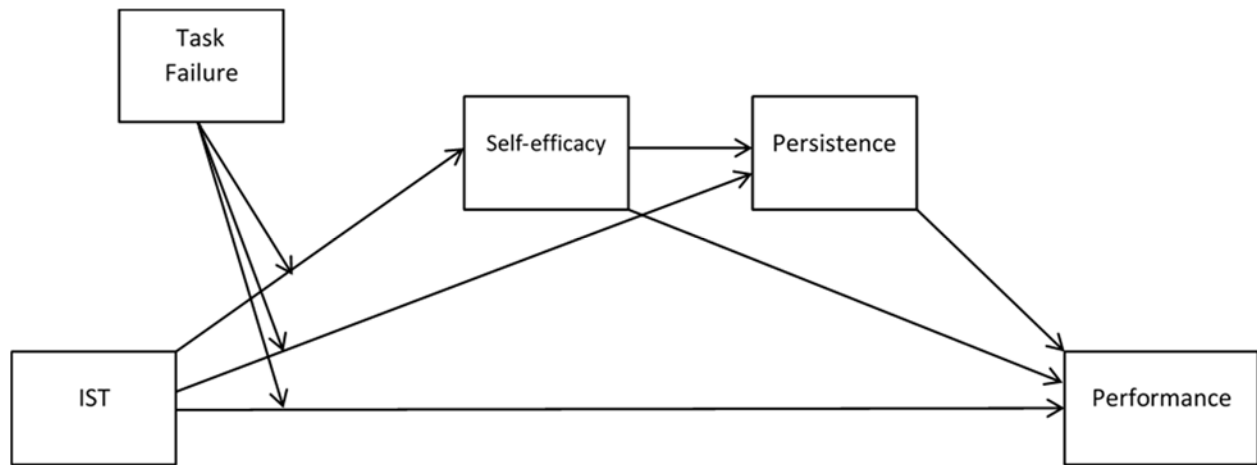


Figure 1: Proposed Conceptual Model

Methods

I conducted an online, self-report survey and task-based study designed to test the conceptual model presented on page 22. All data were collected online using the survey program Qualtrics.

Participant Recruitment

The population of interest for the current study was working adults in the United States. For purposes of this study, participants were included in the study if they were at least 21 years of age and employed for pay at least part-time (20 hours per week). The reason for this restriction was that significant psychological development is still occurring in many individuals until at least age 21 (Blakemore & Choudhury, 2006), and one purpose of this study is to examine whether findings of previous implicit self-theory research in children and college students are also relevant in an adult sample. In addition, as a result of the difficulty level of the proposed task (discussed below), it was necessary to focus on individuals who have achieved a relatively high level of education. The items used in the challenging task are designed as part of a standardized law school entrance exam, thus participants taking the test would normally have completed at least a bachelor's degree. Thus, participation in the current study was limited to individuals who have earned at least a bachelor's degree or equivalent. This will limit the generalizable population to only working adults who have achieved relatively more education than average, but it is necessary given the methods proposed. Participants were not included if they had attended law school or if they had previously taken the LSAT exam. The reason for this is that the task consisted of exam items from the LSAT exam and it was necessary to reduce confounds associated with participants having experience with the task items.

The participants were obtained using a Qualtrics Panel, which is a previously existing pool of participants who are rewarded for their participation in research studies with small amounts of money or entries into drawings for prizes. Participants who met the above stated criteria received an e-mail notification of the availability of the study containing a link to the online survey / task environment. A priori power analysis conducted using a Monte Carlo method, specifying the complex model under investigation, and using the data received during the pilot study indicated that a sample size of 150 participants would be sufficient to detect the effects of the complex model, but only if the effect sizes were slightly larger than that found in the pilot study and if the early failure group (discussed below) were twice the size of the early success group. There are three reasons why it is reasonable to expect that there would be at least a slightly larger effect of implicit self-theories in the main sample compared to the pilot sample. First, the distribution of implicit self-theory in the pilot sample demonstrated a ceiling effect with 90% of the participants self-reporting an incremental theory when the sample is divided into two groups (i.e. divided along the center of the scale) and only 10% self-reporting an entity theory. This ceiling effect may have attenuated the effect of implicit self-theories on other variables in the model. In fact, the main sample did demonstrate a more theoretically appropriate distribution of implicit self-theory (as discussed in the results section). Second, the pilot sample did not receive feedback about whether or not they had answered the task items correctly. Thus, success and failure were unknown to the participants who may have assumed that they had answered correctly. Third, for the main study sample, success and failure on a task item was not only identified through feedback, but was made salient through the use of relatively large font in the statement of success or failure in feedback.

To be conservative regarding issues of power, 200 participants were requested from Qualtrics. A participant was considered to have completed the study if the participant agreed to the informed consent information, completed the self-report surveys, responded to validation items correctly (e.g. “For validation purposes, please select ‘disagree’ here”), and completed the first of eight total task items to be administered. All participants who agreed to the informed consent and navigated through the entire task environment (whether or not they responded to items) received a debrief document explaining the purpose of the study again and asking for a secondary consent. If secondary consent was not obtained, then the participant was also excluded from analysis.

As a result of the recruitment efforts of the Qualtrics Panel, 662 individuals navigated to the survey / task environment. Of those, 206 completed the survey and tasks, and indicated secondary informed consent after reading the debriefing form. This represents a response rate of 31%.

Inclusion and exclusion of participants. Prescreened prospective participants who apparently met the inclusion criteria stated above received e-mail invitations to participate in the study. The e-mail included a link to the online survey and task. Upon navigating to the link, participants were asked to respond to a list of questions designed to ensure that they were suitable for the study. The screening questions can be found in Appendix A.

All participants who passed the screening questions were presented with the informed consent message which provided a general description of the reason for the study. This description indicated that the purpose for the study is to determine how personality is related to decision-making and problem solving. At this point, the exact purpose for the study was hidden from the participants in an attempt to reduce demand characteristics. The informed consent also

included a description of the requirements for completing the study, as described below, including a brief description of the types of items that were included in the task and the range of difficulty for those items. Participants were given the option to either accept or reject consent to participate in the study. If the participant did not consent to participate, the end survey message appeared. If the participant accepted the informed consent, this was taken as evidence that the participant had consented to participate in the study and the initial self-report surveys appeared.

Final Sample

The final sample included 206 adults from the United States. The mean age of participants was 44.0 years-of-age ($SD = 11.1$, with nine missing values). Age ranged from 21 to 66. The majority of participants reported being Caucasian (87%), with the rest reporting being either Asian (10%) or Black (3%). Six percent of respondents reported being of Hispanic descent, and 93% reported not being Hispanic, with three missing values. Females outnumbered males by a small margin, with 56% females and 44% males responding.

Of the individuals who were not included in the final sample, who either dropped out of the study or were excluded as a result of failing to meet inclusion criteria, only twenty-five provided demographic data. Of those 88% were Caucasian, and 12% were Black, 96% were not of Hispanic ancestry, while 4% were of Hispanic descent. 60% were male and 40% were female, and the mean age was 42.2 with a range of 26 to 58. As data are not available for the rest of the non-included participants it is unclear whether the groups differ significantly in any meaningful way.

Design

The current study was designed to test a complex moderation and serial mediation relationship between implicit self-theories and performance. The variables included in the model are as follows:

Independent variable. The independent variable is implicit self-theories, which were measured using a self-report survey. Details about the specific measure to be used can be found below in the measures section.

Dependent variable. The dependent variable in the current study was overall task performance. This variable was operationalized as the total score on the task items, which was measured by counting the number of task items (not including the first) that were answered correctly. In structural equation models, task items are binary (either correct or incorrect responses). Details about the task can be found below.

Moderating variable. There was one moderator variable in the model: task failure. Task failure was measured with the first task item (details about the task can be found below). If a participant answered the first task item correctly then that participant was considered to be in the “early success” group. If a participant answered the first task item incorrectly then that participant was considered to be in the “early failure” group.

Mediating variables. There were two serial mediating variables in the tested model. That is to say, there were two variables that are proposed to mediate the relationship between the independent variable and the dependent variable. These mediators are proposed to act in serial, one after the other, rather than in parallel. The first mediator variable in the model was self-efficacy, which was measured using a self-report survey. This variable was measured before the first task item and again after each individual item during the task. Self-efficacy measured

before the first task item constitutes a baseline self-efficacy. Self-efficacy as measured after each task item was combined into an average score across the three items. The indicators used in the measurement model were the averages from self-efficacy after each task item.

The second mediator variable is persistence. Persistence had been intended to be operationalized in three ways: a) Number of task items attempted, b) time spent trying to solve an item, and c) time spent on the tutorial presented after having provided an incorrect answer to an item. After data collection, it became clear that all 206 participants who were included in analyses completed all of the task items. Thus, the first operationalization, number of task items attempted, was not viable for use in analysis as it had no variance across participants. Therefore, analyses only included the operationalization of persistence as either tutorial time or as time spent answering each item.

Distractor variables. Several variables were measured for no reason other than to distract participants from the specific personality characteristics that are under investigation in the current study. Participants were told that the research sought to examine links between personality and problem solving, however participants were not explicitly told which aspects of personality were specifically under investigation. It was certainly clear to participants that self-efficacy is a salient variable for the study since they were asked about that variable several times during the task. However, it was important that implicit self-theories be less obvious to participants as the variable of interest because participants may have been able to guess what behavior was expected given their answers to those self-report items. In order to avoid demand characteristics that may result from a participant's ability to guess the hypotheses, several measures of personality characteristics were included in the self-report survey, but were not

analyzed as part of the current study. The distractor variables are described below in the measures section.

Measures

The following self-report measures were used in the current study. As noted above, some of the measures were intended to directly measure variables that are part of the model (e.g. implicit self-theory and self-efficacy) while some measures were used to distract participants from the true purpose of the study until the task has been completed. Specific items by scale are in Appendix A.

Implicit self-theory. To measure implicit self-theory, I used six items including the three-item domain specific implicit person theory of intelligence measure as presented by Dweck et al. (1995). The three-item measure presents items that are consistent with entity theory statements and included a six-point Likert-type scale, with *1=Strongly Disagree* and *6=Strongly Agree*. In addition, three items written using an incremental perspective (Wilson & Kraiger, 2012) were included using the same Likert-type scale as the entity perspective items. The entity perspective items were reverse scored, thus higher scores on the scale are indicative of a more incremental theory of intelligence.

Task-specific self-efficacy. Task-specific self-efficacy was measured using three items revised from the generalized self-efficacy scale (see description in the distractors section below). The items were revised to refer to the task involved in the current study, solving logic puzzles. Prior to answering the self-efficacy items participants saw an explanation of what the task would be and what skills would be involved. Thus, participants should have had enough information about the task to make a guess about how confident they felt in their ability to complete the task. A sample item is, “I am confident that I can perform effectively on a logic puzzle task.” The

scale was a 5-point Likert-type scale with 1 = *Strongly Disagree* and 5 = *Strongly Agree*. High scores indicate greater task-specific self-efficacy. Task-specific self-efficacy was measured before and after the first task item and after each subsequent task item. Each self-efficacy score was computed as the average of the three item measure at each time. Each score was then used as an indicator for the overall self-efficacy construct.

Persistence. Persistence was measured in two ways: Amount of time spent viewing task items, and amount of time spent viewing tutorials upon submitting an incorrect response to a task item.

Time on task. The amount of time, in seconds, that the participant viewed the task item was measured automatically by the survey software program. The timing clock began as soon as the task item appeared to the participant, and ended when the participant clicked the 'next' button to submit the response. Time was recorded for all task items, and persistence was measured as the average time that a participant spent viewing all task items following the first item.

Time on tutorial. The amount of time, in seconds, that the participant viewed the tutorial that was presented upon submission of an incorrect response for each item was measured automatically by the survey software program. The timing clock began as soon as the tutorial appeared to the participant, and ended when the participant clicked the 'next' button to continue with the next task. Time was recorded for all tutorials, and persistence was measured as the average time that a participant spent viewing any tutorials that were presented following the first task item.

Performance. Performance was measured as a sum of the items answered correctly after the first task item. Each item answered correctly was coded as 1, while items answered

incorrectly were coded as 0, thus the indicators for the latent variable of performance were binary, while the actual measure of performance was continuous. There were a total of eight task items presented.

Demographics. Demographic information about the participants was collected after the task had been completed. The measures included age, race ethnicity, and sex. These items were presented after the task in an attempt to reduce the effects of stereotype threat as recommended by Danaher and Crandall (2008).

Distraction measures. In an attempt to reduce the likelihood that participants would guess the hypotheses, and consequently behave in accordance with their perception of the hypotheses, I included several measures of personality. Thus, I included the following measures to distract participants from the variables of interest.

Generalized self-efficacy. To measure generalized self-efficacy, I used the Chen, Gully, and Eden (2001) general self-efficacy scale. Chen et al. reported that their scale is unidimensional with acceptable internal consistency ($\alpha = .85$) and scores demonstrate test-retest reliability ($r = .86$), as well as convergent validity compared with previously existing tests of self-efficacy ($r = .35$ to $.43$ at two different administrations). The scale was measured using a 5-point Likert-type scale with $1 = Strongly Disagree$ and $5 = Strongly Agree$. Higher combined scale scores (an average of the eight items in the scale) indicate greater self-efficacy.

Goal orientation. Goal orientation was measured using the VanDeWalle (1997) scale for work domain goal orientation. The scale includes 13 items in three sub-scales; learning, avoid, and prove, measured using a six-point Likert-type scale ($1 = Strongly Agree$, $6 = Strongly Disagree$). VanDeWalle reported the internal consistency using Cronbach's alpha for each subscale as follows: Learning, $\alpha = .89$, prove $\alpha = .85$, and avoid $\alpha = .88$.

Cognitive Reflection. Cognitive reflection was measured using the seven-item cognitive reflection test (CRT7) (Frederick, 2005; Toplak, West, & Stanovich, 2014). The CRT7 is a short measure that correlates moderately well with traditional measures of intelligence such as the Wechsler Abbreviated Scale of Intelligence composite ($r = 0.50$). Internal consistency of the CRT7 was reported by Toplak et al. (α Cronbach= 0.67). Each item in the CRT7 has one specific correct answer and the score on the scale would be equal to the number of correct answers given.

Five factor personality model. The five factors of personality were measured using the Big Five Inventory 10 (BFI-10) (Rammstedt & John, 2007). The BFI-10 is a short version of the BFI-44 (John, Donahue & Kentle, 1991) that is designed to allow personality to be measured within one minute. Rammstedt and John reported that the BFI-10 had an average correlation with the BFI-44 scale of $r = 0.83$. The measure consists of five scales, each containing two items. The five scales measure extraversion, neuroticism, conscientiousness, agreeableness, and openness. Items are measured on a five-point Likert-type scale with 1 = *Strongly Disagree* and 5 = *Strongly Agree*.

Task

The task that was used is designed to have several important features. First, the task consists of individual parts (items) that participants can work on independently from other items. Time spent on each item was recorded as a measure of persistence. Second, each item has an objectively correct answer, and all other answers (to that item) are objectively incorrect. Items were ‘scored’ by the computer program used to collect the data. It was important that automatic scoring be possible so that feedback could be provided immediately to participants; if the item was answered correctly then the participant saw a screen that said “Congratulations, that is the correct answer!” in green font a bit larger than standard. Then the task-specific self-efficacy

items were presented, followed by the next task item. If the item is answered incorrectly, then a tutorial block appeared with the message, “I’m sorry, your answer for this question was not correct” in red font a bit larger than standard. Below this message there was a tutorial walking the participant through correctly answering the preceding question. The third important feature of the task was that there were objectively easier and more difficult items associated with the overall task. It is important that respondents had the opportunity to answer at least some of the items correctly, and that all participants encountered high difficulty items. The percentage of participants who answered each item correctly was 33% for item 1, 44% for item 2, 53% for item 3, 43% for item 4, 40% for item 5, and 24% for item 6. Finally, the task needed to be one that did not require extensive training or prior experience to complete.

In an attempt to meet all of these criteria, the current study included eight Law School Admission Test (LSAT) items (six of which were included in the final analysis) that have been retired and are currently published in an LSAT preparation book. LSAT items are professionally developed, with scores that tend to be valid and reliable. In addition, there are objectively easier and more difficult items and the correct answers were readily available to the research team in preparing the task, but not readily available to an individual who did not happen to have access to the same LSAT preparation books. This reduced the possibility that participants were simply searching for the answers online rather than working out the solutions on their own.

The current study focused specifically on ordering logic puzzles, which means that given a scenario and some constraints the participant was expected to decide which order of objects ‘could be’ or ‘must be’ correct from several options. Each item consisted of a scenario, conditions, and a question to be answered. The scenario sets the stage for the question, for example, “An exam administrator has to sit Sally, John, Jose, and Maria along one side of a long

table. There are four spaces, labeled #1, #2, #3, and #4. Sally will not sit next to Maria and prefers to be no more than 1 space from John.” Sometimes the constraints implied exact relationships between objects (e.g. Sally must sit in space #3), and sometimes the constraints only provided relative relationships between objects (e.g. Maria must be in a lower numbered seat than Jose). The first item presented was a relatively difficult item, such that approximately one-third of the participants answered it correctly. The first item represented exposure to challenge or failure, and participants were grouped based upon their correctly or incorrectly responding to that item (see below). Seven more items were presented; these items varied from relatively easy to relatively difficult items, based on a psychometric analysis (discussed under ‘Pilot Test’). An example task item can be found in Appendix B and an example tutorial can be found in Appendix C.

Pilot Test

An initial pilot test on all measures was conducted in order to determine several characteristics of the measures and the task to be used. The pilot test provided data regarding the amount of time that should be reasonably expected for a participant to respond to the survey and each task item. In addition, the pilot test provided psychometric data on task items which were used to select which item was presented as the first item, as well as to determine which items would be included in the main study task. Finally, the pilot test was used to ensure that the online data collection tool works appropriately. The sample for the pilot test included 150 introductory psychology students who participated in exchange for course credit. The pilot test was presented in the same format as the main study, described below, and the procedures were the same with three exceptions. First, the pilot study participants were not given any screening questions, but instead were immediately shown the informed consent page. Following informed

consent, the pilot study participants were automatically directed to the self-report survey, and then to the task items, just as occurred in the main study. Additionally, the pilot study participants saw twelve total task items. Each task item included a scenario, a list of constraints, and a question about the scenario and constraints. The purpose of this was to allow for specific items to be selected for use in the main study based on psychometric characteristics. An additional difference in the pilot study was that the participants did not receive feedback after answering the task items. Instead, once participants responded to the task item, they were asked to complete the three task-specific self-efficacy items and then were immediately presented with the next task item. Finally, the pilot study results were used in a Monte Carlo technique in the statistical program Mplus, to determine the number of participants required for the main study.

Procedures

Self-report surveys and background information. After completing the screening questions and informed consent, participants were asked to answer questions from the implicit self-theory, generalized self-efficacy, task-specific self-efficacy, goal orientation, and personality measures. All participants were presented with these items in the same order. Next, participants were provided with the CRT items.

Task failure measure. Upon completion of the background measures, participants were presented with one item from the LSAT to answer. This item was selected based on difficulty as identified in the pilot test. Specifically, the first item was relatively difficult so that it could be expected that about one-third of the participants would be successful in answering the item correctly. The first item included a scenario, constraints, and one question to be answered using the provided information. A sample task item can be seen in Appendix B. This first item was used to separate participants into groups on the early success / early failure variable. Those

participants who answered correctly (33% of participants) experienced early success, while those participants who answered the item incorrectly (67%) experienced early failure. After answering the first item, participants were told whether or not they answered correctly. In the case that the participant answered correctly, the three-item self-efficacy scale items were presented, followed by the next task item. In the case that the participant answered incorrectly, the participant was presented with a short tutorial explaining a technique for arriving at the correct answer. The amount of time that the participant spent viewing the tutorial was collected. After the tutorial, the three-item self-efficacy scale items was presented, followed by the next task item.

Task performance measure. After the initial LSAT item was answered, participants were presented with seven more LSAT items. The items were presented to participants one at a time, and any time a participant answered an item incorrectly, the participant was presented with a tutorial specific to that item. The amount of time participants spent answering items was recorded, as was the amount of time participants spend on tutorials presented upon incorrect responses.

Demographics. After all task items were completed, participants were presented with demographic items.

Analytic Plan

The analytic strategy proceeded in three steps. In Step 1, descriptive statistics and zero order correlations for the observed variables were examined, with visual techniques used to explore the data in terms of normality and outlying scores. In Step 2, independent single factor confirmation factor analysis (CFA) models for the four latent constructs (IST, self-efficacy, persistence, and performance) were fitted, followed by fitting a full measurement model with all four latent factors and their respective indicators included. All variables were scaled with a

mean of zero and a standard deviation of one. CFA models were evaluated using the chi-square statistic (χ^2) in which smaller values indicate a better model fit, and a non-significant value is preferred. Chi-square is sensitive to sample size, however, and with a large sample even very small inconsistencies in the model can lead to a significant chi-square result. Thus, it is recommended that more than one fit index be reported. So, in addition to the chi-square statistic, model fit will also be evaluated through the use of the root mean squared error of approximation (RMSEA), the comparative fit index (CFI) and the Tucker-Lewis Index (TLI). According to Hu and Bentler (1999), RMSEA values of .06 or less are preferred, and the smaller the value the better the model fit. CFI and TLI values of at least .95 are preferred and the larger values are better.

In Step 3, the full measurement model from Step 2 was specified within a causal structure to test the theoretical model (presented below in Figure 2) within the structural equation modeling (SEM) framework. First, a constrained model was fitted without concern for the moderating variable (i.e., all paths were constrained to equality across early success and early failure groups). Next, a partially constrained model was fitted where the implicit self-theory paths were allowed to vary across the early success and early failure groups (presented in Figure 3 below) while all other paths were constrained to equality. A likelihood ratio test was used to evaluate whether the unconstrained model fit the data significantly better than the more parsimonious constrained model. I also compared model fit using the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) (Akaike, 1973; Schwarz, 1978). Both AIC and BIC are comparative indices where smaller values are preferable.

All CFA and SEM models were fitted in Mplus 7.3 using robust maximum likelihood (MLR) estimation and the latent factors were scaled by fixing the factor variance to 1 (Muthen &

Muthen, 2012). The observed binary performance items were modeled using the logit link function. For all CFA models and SEMs that include the binary performance items, standard fit indices such as RMSEA, TLI, and CFI are unavailable using robust maximum likelihood estimation.

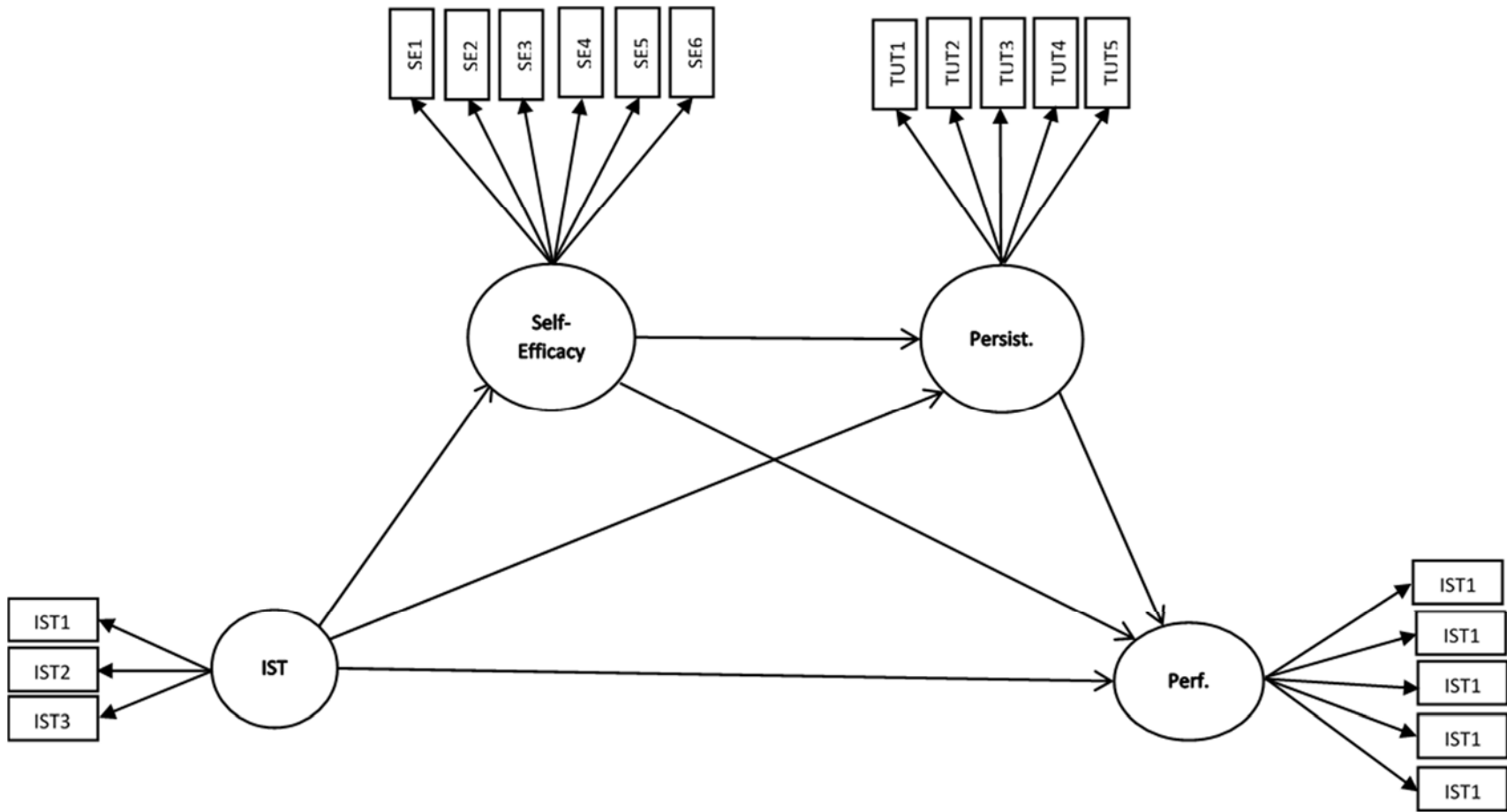


Figure 2: Tested Theoretical Model – No Moderation

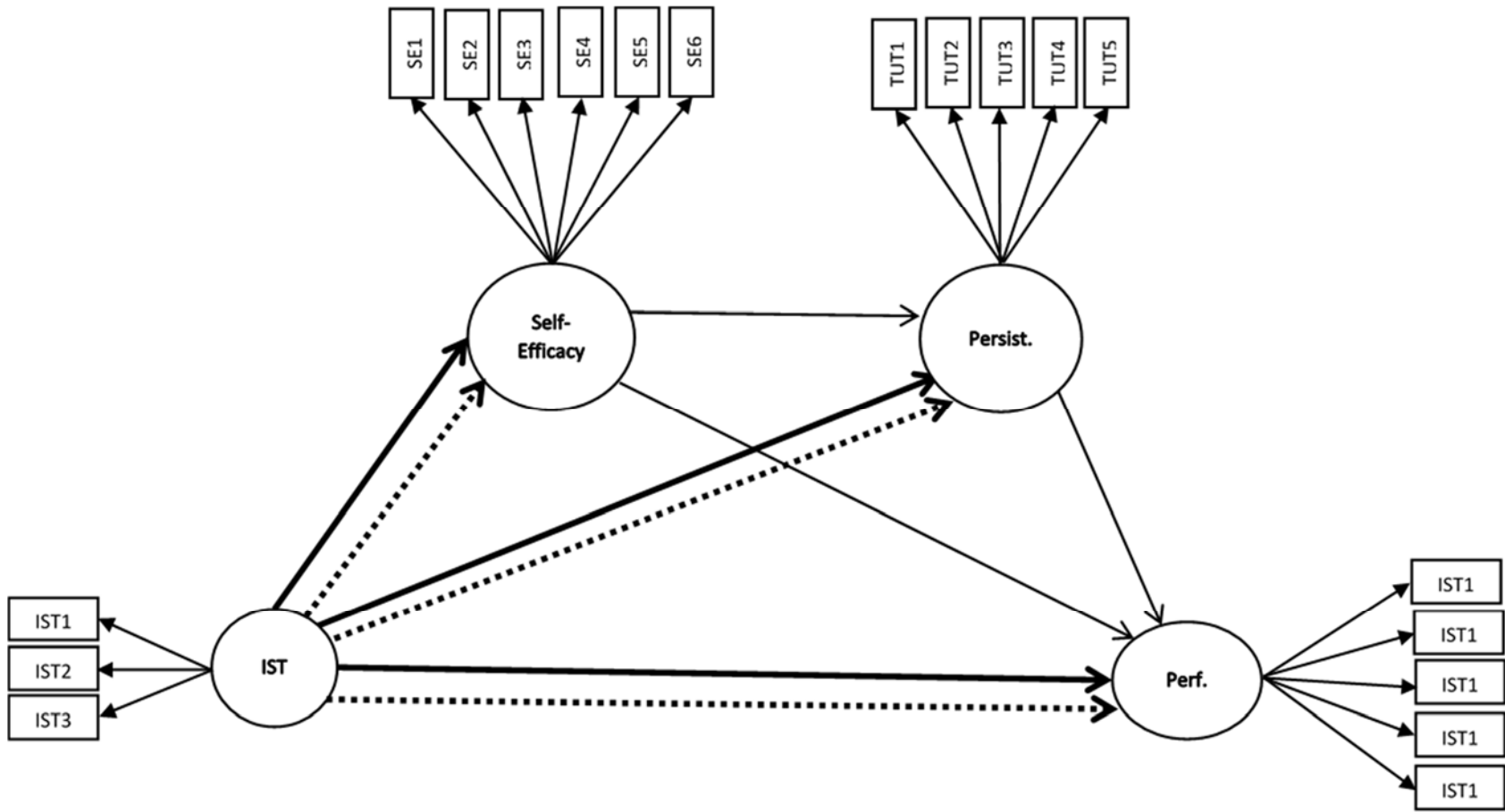


Figure 3: Tested Theoretical Model – Moderation in IST Paths²

² Solid bold arrows indicate early failure group, dotted arrows indicate early success group.

Results

Descriptive Statistics, Correlations and Measurement by Scale

Table 1 summarizes the intercorrelations among the variables in the model, as well as the means and standard deviations for those variables in raw form (all data included and no transformation of variables). Independent single factor CFAs were fitted for each of the latent variables in the model. Individual CFA models for all latent variables tested are presented in the corresponding sections.

The simple and raw correlations among the variables included in the model reveal some relationships, and some surprising lack of relationships.

Table 1

Summary of raw intercorrelations, Means, and Standard Deviations for Scores on implicit self-theory (IST), Persistence Measured by Time on Task, Persistence Measured by Time on Tutorial, Performance and Early Success.

Measure	1	2	3	4	5	6	<i>M</i>	<i>SD</i>
1. IST	--	.002	.058	-.046	-.072	.015	3.64	1.34
2. Self-Efficacy	.002	--	.006	.047	.348**	.237**	3.67	0.87
3. Persist_Item	.058	.006	--	.077	-.001	.020	144.09	309.87
4. Persist_Tutorial	-.046	.047	.077	--	.215**	.122	58.24	205.93
5. Performance	-.072	.348**	-.001	.215**	--	.336**	2.06	1.41
6. Early Success	.015	.237**	.020	.122	.336**	--	34% succeeded ¹	

¹ Success was a dichotomous measure

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

All of the bivariate correlations between implicit self-theory and other variables in the model are small and statistically insignificant (r ranges from $-.07$ to $.06$). Similarly, persistence

measured as time on task was not related to any other variable in the model (r ranges from .00 to .08). Self-efficacy, on the other hand is significantly predicted by early success ($r=.24, p < .01$) and significantly predicts subsequent performance ($r=.35, p < .01$). However, the relationships between self-efficacy and persistence are small and non-significant (time on task $r=.01$, time on tutorial $r=.05$) as is the relationship between self-efficacy and implicit self-theory ($r=.00$). Persistence on tutorials was not predicted by early success ($r=.12, ns$) but predicted subsequent performance ($r=.22, p < .01$). Early success significantly predicted subsequent performance ($r=.34, p < .01$) as is to be expected.

Table 2 summarizes the intercorrelations of the variables in the model after outliers have been removed and time data has been log transformed (to be discussed further in the sections addressing persistence measures below).

Table 2

Summary of intercorrelations, Means, and Standard Deviations for Scores on implicit self-theory (IST), Persistence Measured by Time on Task, Persistence Measured by Time on Tutorial, Performance and Early Success with time outliers removed and time variables log transformed.

Measure	1	2	3	4	5	6	<i>M</i>	<i>SD</i>
1. IST	--	.002	.094	.123	-.072	.015	3.64	1.34
2. Self-Efficacy	.002	--	.096	-.065	.348**	.237**	3.67	0.87
3. Persist_Item	.094	.096	--	.537**	.468**	.257**	4.28	0.87
4. Persist_Tutorial	.123	-.065	.537**	--	.395**	.007	2.8	0.96
5. Performance	-.072	.348**	.468**	.395**	--	.336**	2.06	1.41
6. Early Success	.015	.237**	.257**	.007	.336**	--	34% succeeded ¹	

¹ Success was a dichotomous measure

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Implicit self-theory. Cronbach’s alpha for the scale score was acceptable ($\alpha = 0.86$), however deletion of one of the incremental items (“Even if it takes me longer to learn something,

as long as I put in the effort I can learn anything”) improved the alpha to 0.89. Deletion of this item was further supported by a principal components analysis with varimax rotation. The same item loaded onto the learning goal orientation scale rather than the implicit self-theory scale. Thus the item was removed from further analysis.

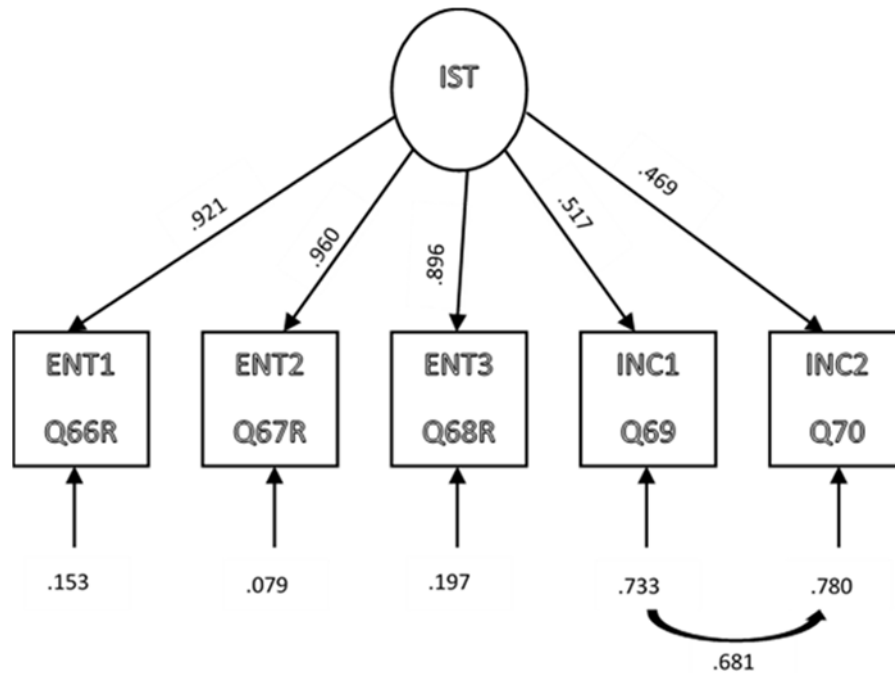


Figure 4: CFA measurement model for implicit self-theory using three entity items and two incremental items³

A preliminary CFA model including the remaining five candidate implicit self-theory items indicated that the three entity perspective items were more closely related to the latent construct of implicit self-theory than the two incremental perspective items (i.e., there were higher factor loadings for entity items than incremental items), see Figure 4. Also, this model only fit well if the residuals for the incremental items were correlated, which is not ideal. As a result, only the three entity items were used in further analysis, Figure 5 presents the path diagram with resulting factor loadings. This decision is consistent with the extant literature in

³ $\chi^2 = 4.16, p > .05, RMSEA = .01, CFI = 1.00, TLI = .99$

which implicit self-theory is generally measured using only entity perspective items. (e.g., Aronson, Fried, & Good, 2002; Butler, 2000; Dweck et al., 1995; Hong, Chiu, & Dweck, 1995; Robins & Pals, 2002) With removal of the incremental perspective items, the entity items were still reverse coded so that higher scores on the implicit self-theory scale indicate a more incremental theory. The internal consistency for the three-item measure is more robust than for the five-item measure ($\alpha=.95$). This 3-item CFA Model was just-identified so model fit indices were not relevant.

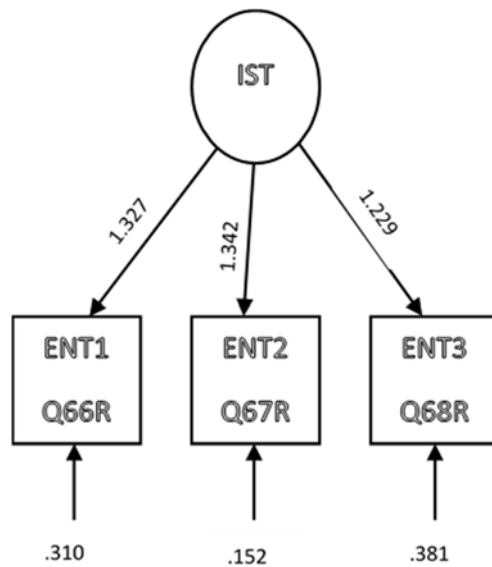


Figure 5: CFA measurement model for implicit self-theory using only three entity items⁴

The average score on the implicit self-theory scale was 3.6 ($SD=1.3$) on a six-point scale. The range included the entire scale, from 1 to 6. In previous research the distribution of implicit self-theory has been called into question (Wilson & Kraiger, 2012), thus I examined the distribution of implicit self-theory in the current data. Dividing the participants into groups based on scores on the lower half of the scale versus the upper half of the scale (i.e. 3.5), approximately half (48%) of respondents reported a more entity perspective and the other half

⁴ Model is just-specified with three indicators, thus fit indices are not relevant.

(52%) reported a more incremental perspective. I also divided participants into three groups, consistent with a more extreme groups design. The first group, clearly entity theorists, were defined as having a mean score of less than 3.0 on the implicit self-theory scale and represented 30% of the sample. Clearly incremental theorists, defined as having a mean score on the implicit self-theory scale greater than 4.0, represented 35% of the sample. Participants with a mixed theory, defined as scoring between 3.0 and 4.0 on the implicit self-theory scale, comprised 35% of the sample.

Task Specific Self-Efficacy. The three-item task-specific self-efficacy scale score measured prior to the first task item demonstrated adequate internal consistency ($\alpha=0.90$). The pre-task measure of task-specific self-efficacy was not used in any further analysis. The internal consistency of subsequent scale scores of task-specific self-efficacy demonstrated a slight upward trend over time, but differences were small (range $\alpha=.93$ to $\alpha=.96$). In the analysis, self-efficacy scores from each task were used as indicators for the overall construct of self-efficacy.

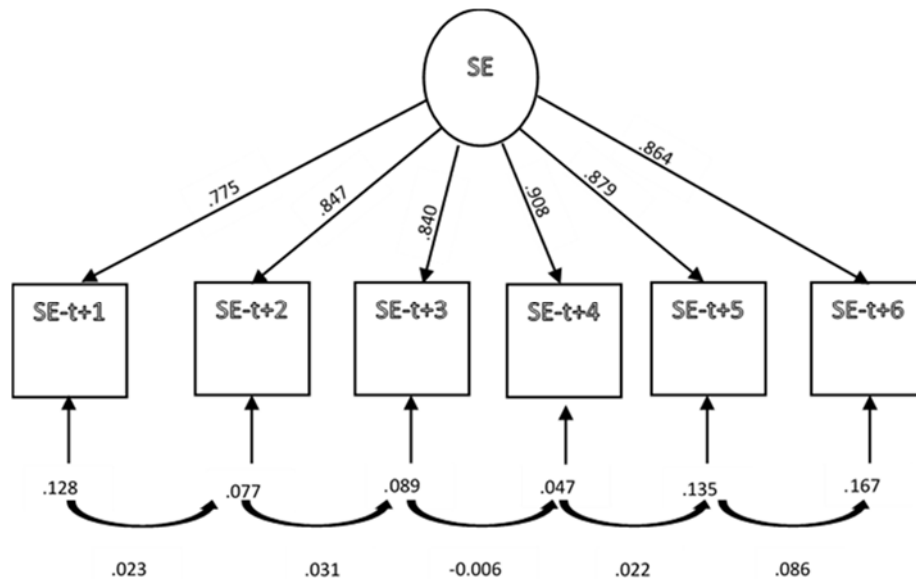


Figure 6: CFA measurement model for task-specific self-efficacy⁵

⁵ $\chi^2 = 4.82, p > .05, RMSEA = .03, CFI = 1.00, TLI = .99$

The CFA model for self-efficacy had good model fit when time adjacent residuals were correlated (time 1 with time 2, time 2 with time 3 etc). Factor loadings for all indicators were large, indicating that each indicator was strongly associated with the latent self-efficacy variable. A diagram of the CFA model including parameter estimates can be found in Figure 6. The mean score on the task-specific self-efficacy scale across all tasks was 3.0 ($N=206$, $SD=0.6$) on a five-point scale (range: 1.1 to 4.0).

The mean pre-task task-specific self-efficacy was 3.8 ($N=206$, $SD=.77$). A paired-sample t -test indicated that the reduction in self-efficacy from before the first task item to after the first task item was statistically significant ($t=24.18$, $df=205$, $p<.001$). I separated the sample into extreme groups on the implicit self-theory score (as described in the implicit self-theory section above) and found that the t -test results were similarly significant for all implicit self-theory groups (t ranged from 13.21 to 14.5, and all were significant at the .001 level).

Persistence measured as time on task items. The amount of time participants spent, on average, on the second through sixth task items was measured in seconds and computed in a scale score. The CFA model for persistence measured as time on task fit the data well when time adjacent residuals were correlated. Factor loadings for all indicators were large indicating that each indicator was strongly associated with the persistence latent construct. A diagram of the time on task CFA model with parameter estimates can be found in Figure 7.

The mean time spent on task items was 144 seconds ($SD=310$). The average time spent on each task ranged from 4 seconds to 4,410 seconds. There was a strong positive skew (skewness = 12.85) in the time spent on task. Visual examination of the frequencies indicated a few outliers. Outliers were removed if they were at least three standard deviations above the mean (i.e. a cutoff of 720 seconds) for each item time. This removal of outliers resulted in

removal only of components of the overall time score, and no participants' time data was completely removed. Additionally, scores were log transformed for further analysis to correct for non-normality. After transformation, the mean on persistence measured by time on task was 4.46 ($SD=.80$) and the positive skew was removed (skewness = -0.64).

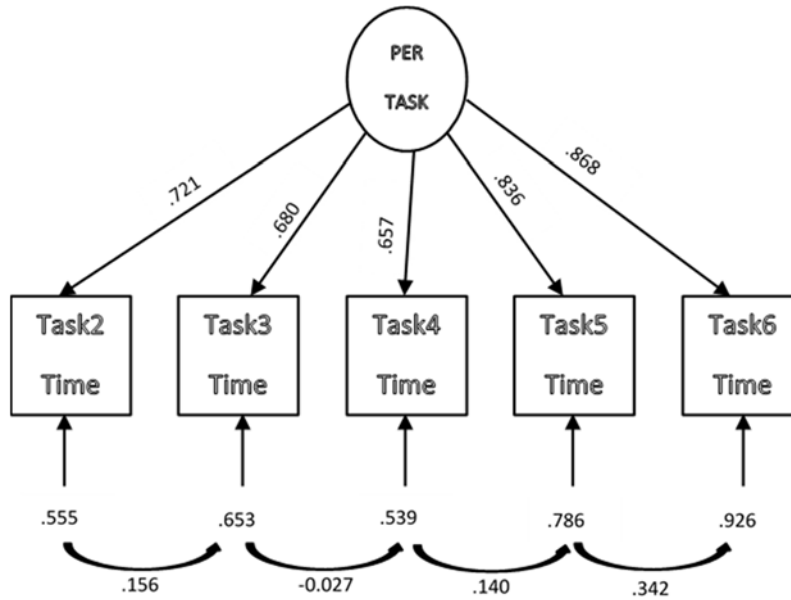


Figure 7: CFA measurement model for persistence measured as time on task⁶

Persistence measured as time on tutorials after task failure. The amount of time participants spent viewing tutorials after providing an incorrect response was measured in seconds and computed in a scale score as an average across all tutorials presented. Tutorials were only encountered by participants if they answered at least one item incorrectly. Of the 206 participants in the sample, 5 answered all items correctly and therefore had no data for this measure of persistence. The confirmatory factor analysis model for persistence measured as time on tutorial showed adequate model fit. The large factor loadings indicated that each item was

⁶ $\chi^2 = .10, p > .05, RMSEA = .00, CFI = 1.00, TLI = 1.04$

strongly associated with the latent persistence construct. A diagram of the CFA model with parameter estimates can be found in Figure 8.

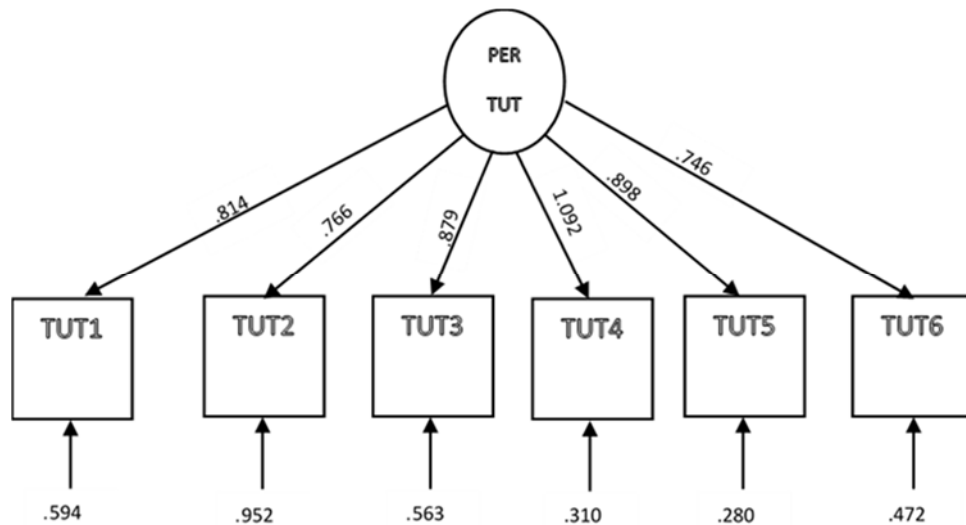


Figure 8: CFA measurement model for persistence measured as time on tutorial⁷

The mean time spent viewing tutorials was 47 seconds ($N=193$, $SD=200$). The average time viewing each tutorial ranged from 2 seconds to 2,507 seconds. There was a strong positive skew (skewness = 10.69) in time spent on tutorials. Visual examination of frequencies indicated some outliers, which were removed per tutorial if the outlying score was at least three standard deviations above the mean (i.e. a cutoff of 720 seconds). This removal of outlying times on tutorials resulted only in the removal of components of the scale score as no participants' scores were completely removed as a result of removal of outlier scores. In addition, the tutorial times were log transformed to correct for non-normality. After transformation, the mean on persistence measured by time on tutorial was 2.75 ($N=193$, $SD=.96$) and the strong positive skew was reduced (skewness = 0.54).

Task Performance subsequent to the first task item. Performance was measured as the count of items answered correctly after the first item. Although eight total items were presented,

⁷ $\chi^2 = 15.70$, $p > .05$, $RMSEA = .06$, $CFI = .97$, $TLI = .95$

the seventh item contained formatting errors during early data collection. I was alerted to the error after several participants had completed the survey, and the error was repaired. However, the formatting error would have made it difficult for any participants to have answered the item correctly and may have negatively impacted the participants' desire to continue responding in a conscientious way. In addition, the mean task-specific self-efficacy score declined significantly immediately following the seventh task item (from a mean of 3.6 (across the 3-item measure) on the sixth task item to 2.4 on the seventh task item). Although the self-efficacy report returned to normal after the eighth task item, I chose to remove both the seventh and eighth items to avoid any error associated with the formatting problem. Thus, included in the analysis are the first item, the measure of early success or early failure, and items two through six. Five participants answered all six items correctly and therefore did not encounter any tutorials.

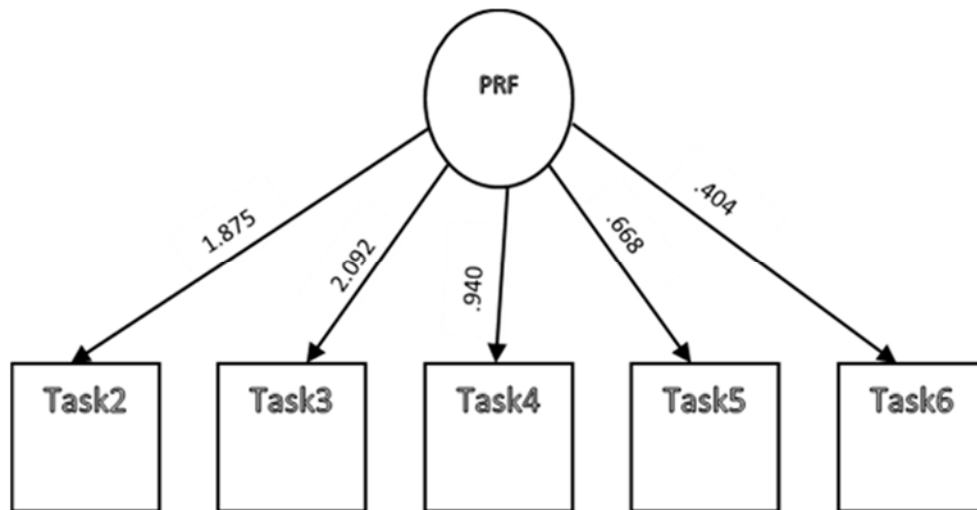


Figure 9: CFA measurement model for performance⁸

The CFA model for performance fit the data well. Task items appearing earlier in time have the strongest factor loadings, with each subsequent item's factor loading reduced compared to the one before. All factor loadings indicated that each item was associated with the latent

⁸ $\chi^2 = 15.03$ ($df = 21$, $p = .82$), $AIC = 1312.49$, $BIC = 1345.77$

performance construct, however. A diagram of the measurement model with parameter estimates can be found in Figure 9.

Examination of the frequency of scores indicated that most participants answered one to three items correctly. The mean number of items answered correctly after the first task item was 2.1 ($SD=1.4$). Scores on performance ranged from 0 to 5.

Early Success / early failure. Early success / early failure was a binary measure of the score achieved on the first task item. Frequency analysis indicated that 33% of the respondents answered the first item correctly and were considered to have had early success, while 67% of the respondents answered the first item incorrectly and were considered to have experienced early failure. This success rate aligns with the pilot test success rate which prompted me to select this item as the measure of early success / early failure, thus ensuring that the failure group would contain approximately two-thirds of the sample.

Structural Equation Models⁹

Full Measurement Model. Before testing the proposed structural model, the individual measurement models were combined into a four factor measurement model using tutorial time persistence with latent variables uncorrelated ($AIC = 6425$, $BIC = 6628$) and then again with the latent factors correlated ($AIC = 6364$, $BIC = 6587$). The model with the factors correlated fit significantly better than the uncorrelated model according to a likelihood ratio test ($\chi^2(6) = 55.81$, $p < .0001$). The full measurement model with the latent factors correlated is equivalent to the structural model estimating regression coefficients across the predicted paths (MacCallum,

⁹ No significant implicit self-theory paths were detected when persistence was measured as time on task, thus the results discussed will consider only the time on tutorial measure of persistence.

Wegener, Uchino, & Fabrigar, 1993), thus the structural model tested next will also fit the data significantly better than the uncorrelated measurement model.

Constrained SEM Model (implicit self-theory paths constrained to equality across early success / early failure groups). The proposed model was first tested without consideration for the moderation variable by fully constraining all paths to equality across groups (e.g. unique implicit self-theory effects in the early success and early failure groups were ignored). The final structural model is depicted in Figure 10 at the end of this chapter. In the fully constrained model using tutorial time persistence, implicit self-theory significantly predicted the mediator of persistence (parameter estimate = .17, $p < .05$), which in turn significantly predicted performance (parameter estimate = .99, $p < .01$). However, the effect of implicit self-theory on self-efficacy was not statistically significant (parameter estimate = -.01, $p > .05$). Additionally, the effect of self-efficacy on persistence was not statistically significant (parameter estimate = -.04, $p > .05$). The direct effect of implicit self-theory on performance was non-significant and negative (parameter estimate = -.30, $p > .05$). The effect of self-efficacy on performance was significant and relatively strong (parameter estimate = .82, $p < .01$). Because the models tested include binary performance indicators with maximum likelihood estimation, fit indices are limited compared to the continuous indicator case; $\chi^2(48) = 71.29$ $p = .02$, $AIC = 6364$, $BIC = 6587$. The fact that chi-squared was not highly significant (chi-squared is often an overly sensitive measure of model fit) along with the good model fit from the single factor models provides some support for acceptable model fit. As further support for model fit, the model was run an additional time using WLSMV estimation to obtain traditionally reported fit indices. Those fit indices were acceptable ($\chi^2(159) = 179.59$ $p > .05$, $RMSEA = 0.025$, $CFI = 0.973$, $TLI = 0.968$). Unfortunately,

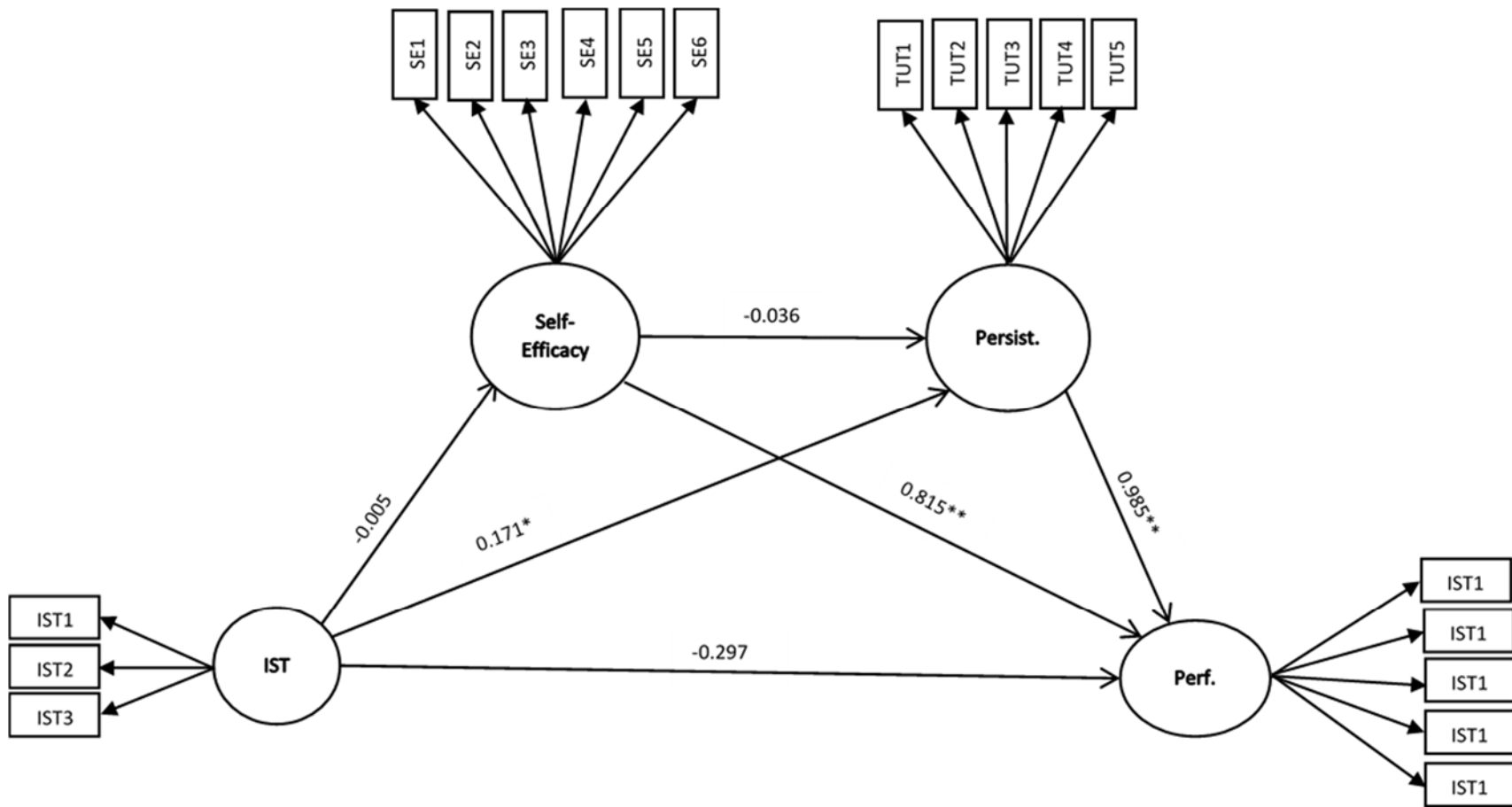
running the analysis using the WLSMV estimation technique resulted in a model that failed to resolve into an appropriate model solution (i.e. negative residual variance).

Partially constrained SEM Model (implicit self-theory paths differ across early success and early failure groups). In order to test moderation, the analysis was run again as a multiple group analysis with the implicit self-theory paths varying across the early success versus early failure groups. In the multiple group analysis measurement parameters were constrained to equality across groups, as were the non-implicit self-theory structural paths. A likelihood ratio test comparing this unconstrained model to the more parsimonious constrained model (implicit self-theory paths were equal across groups) was non-significant, suggesting that the more parsimonious constrained model was preferred, $\chi^2(3) = 3.89, p = .27^{10}$. However, the unconstrained model was still investigated for exploratory purposes. Fit indices for the partially constrained model were similar to those reported in the fully constrained model; $\chi^2(48) = 70.54, p = .02, AIC = 6366, BIC = 6599$.

In the early failure group, the effect of implicit self-theory on persistence is slightly stronger than it was in the fully constrained model, and is significant (parameter estimate = .24, $p < .01$). In contrast, the early success group shows no significant effect of implicit self-theory on persistence (parameter estimate = -.01, $p > .05$). The effect size associated with that path in the early success group is attenuated significantly (and in the opposite direction) compared to the effect size associated with that path in the early failure group. As in the constrained model, self-efficacy does not predict persistence in either group (parameter estimate = -.03, $p > .05$), but does predict performance in both groups (parameter estimate = .81, $p < .01$), and persistence predicts performance in both groups (parameter estimate = .96, $p < .01$). The direct effect of

¹⁰ This finding is consistent the AIC and BIC fit indices as smaller numbers indicate more optimal fit. The fully constrained model had smaller AIC and BIC indices, although the differences were quite small.

implicit self-theory on performance is non-significant in both groups (early failure group: parameter estimate = $-.19, p > .05$; early success group: parameter estimate = $-.54, p > .05$). The partially constrained model is depicted in Figure 11.

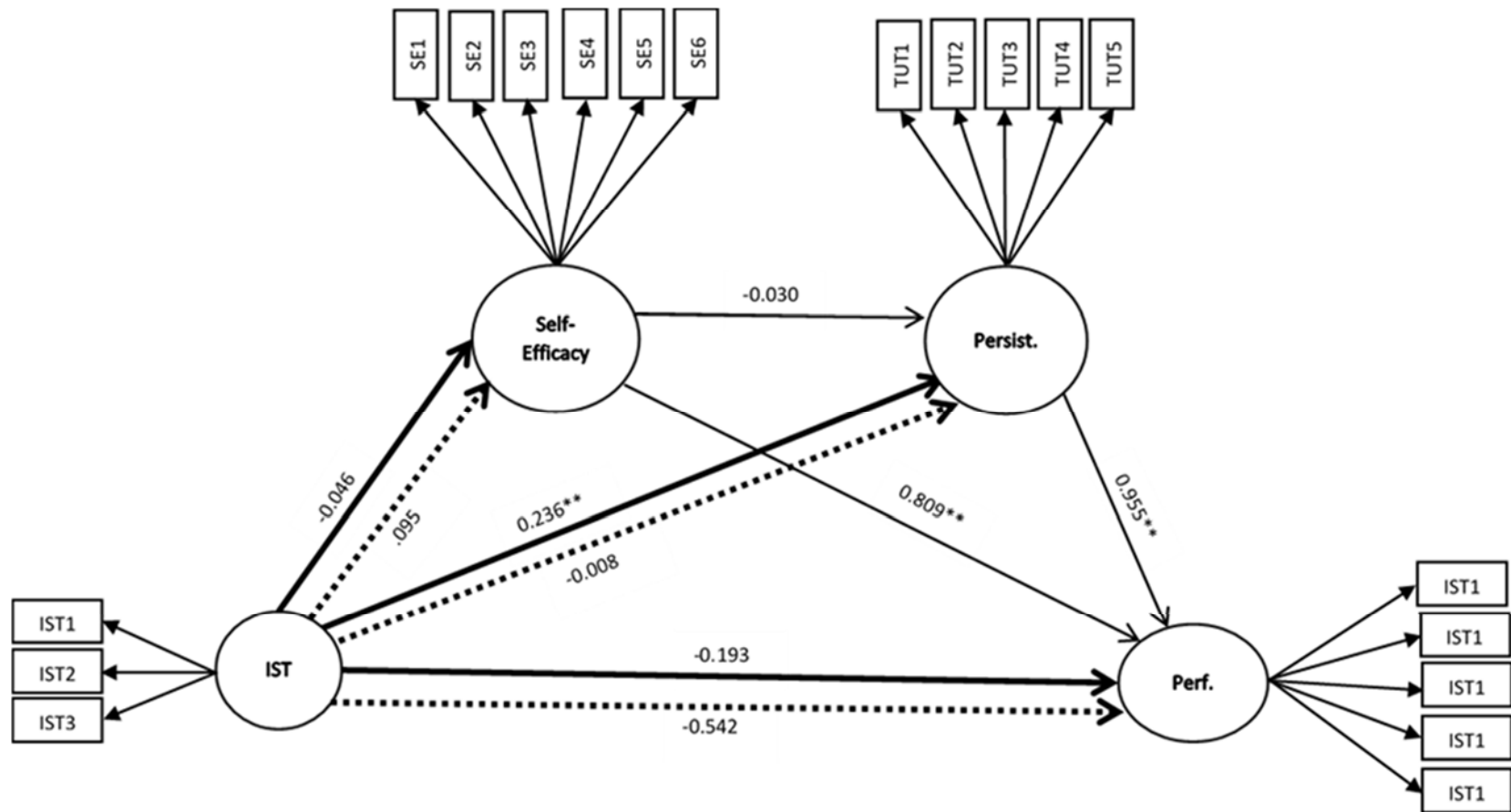


** Estimate is significant at the 0.01 level

* Estimate is significant at the 0.05 level

Figure 10: Structural Model, fully constrained (no moderation)¹¹

¹¹ $\chi^2(48) = 71.29$ $p = .02$, $AIC = 6364$, $BIC = 6587$



** Estimate is significant at the 0.01 level

* Estimate is significant at the 0.05 level

Figure 11: Structural model, multiple groups analysis.¹²

¹² Bold arrows indicate paths free to vary across groups. Solid bold arrows indicate the path for the early failure group. Dotted bold arrows indicate the path for the early success group.

$\chi^2(48) = 70.54$ $p = .02$, $AIC = 6366$, $BIC = 6599$

Discussion

The purpose of the current study was to investigate a theoretical model of implicit self-theory predicting performance, with a serial mediation through self-efficacy and persistence, and moderated by early failure / early success. The model was based on extant literature which relied mostly on samples consisting of children and college students and theoretical assertions about implicit self-theories (Blackwell, 2002; Blackwell et al, 2007; Dweck et al., 1995; Dweck, 1999) and self-efficacy (Bandura, 1997; Bandura, 2012). The specific goals of the study were twofold. First, to test the disparate assertions of implicit self-theory literature in a unified model. Theoretical assertions of implicit self-theory literature indicate that implicit self-theory should have an effect on performance as a result of the different cognitive and behavioral responses to failure exhibited by incremental versus entity theorists (e.g. Beer, 2002, Blackwell, 2002; Dweck, 1999; 2012; Grant & Dweck, 2003; Robins & Pals, 2002; Taberero & Wood, 1999). Previous research with adult samples has provided support for aspects of this model. For example, support has been found for an effect of implicit self-theory on cognitive and behavioral responses to challenge without an examination of the resulting effect on performance (Martocchio, 1994) and the effect of implicit self-theory on behavioral responses to the environment and resulting performance, without an examination of cognitive responses or an examination of the effect of challenge or failure (Burnette, 2010; Heslin et al. 2004; 2005; Heslin & VandeWalle, 2008; Heslin et al. 2006), however an examination of the full spectrum of assertions with adult samples is lacking. The second purpose of the current study was to determine whether findings from children and college students supporting the full spectrum of assertions from implicit self-theory literature (e.g. Blackwell, 2002) would translate to an adult sample.

The model was tested using a sample of 206 working adults who took part in an online self-report survey and online test-like task that included a series of very challenging logic puzzles from the Law School Admission Test.

Supported Theoretical Pathways

Findings from the current study suggested that incremental theorists tended to show greater tutorial time persistence; increased persistence, in turn, predicted better performance. This finding is consistent with the extant literature in children and college students. Blackwell (2002) found that middle school students with an incremental theory were more likely to use positive strategies in response to failure, including reporting an intention to try harder next time. Similarly, Beer (2002) found that shy children with incremental theories were more likely to approach others in a social situation (which is challenging for a shy person) than shy children with entity theories. This result held true whether the incremental theory was a natural baseline for the student, or was experimentally manipulated (Blackwell et al., 2007). This finding is also consistent with theoretical assertions of implicit self-theories. Dweck and Leggett (1988) proposed a theoretical framework that included incremental theorists displaying mastery oriented responses such as seeking more challenge and high levels of persistence regardless of their beliefs about their current level of ability. In contrast, entity theorists were proposed to avoid challenge and to lack persistence, particularly when faced with evidence of low ability.

Differences in adaptive behavior as a function of implicit self-theory has previously been found in working adult samples as well. Heslin et al. (2006) found that managers with an incremental theory were more prone to provide coaching to employees compared with managers who held entity theories. While that finding did not specifically address persistence, as has been

done in the current study, it can be interpreted as an approach behavior rather than an avoidance behavior, which is similar to persistence versus withdrawal.

These results collectively are promising for implicit self-theory as a useful construct for working adults as it has been found to be for children. If working adults with incremental theories are more likely to persist on a difficult task compared to entity theorists, then organizations selecting employees for particularly difficult jobs may find implicit self-theories a useful predictive construct. Moreover, given evidence that implicit self-theories can be successfully manipulated (Aronson et al., 2002; Blackwell et al., 2007) organizations could develop interventions targeted at increasing the incremental theories of employees who are engaged in very difficult tasks.

Partially Supported Theoretical Pathways

There was some evidence for the moderating effect of early failure on the relationship between implicit self-theory and persistence. Although the constrained non-moderated SEM showed that increased implicit self-theory predicted increased persistence, the exploratory multiple group analysis suggested that the effect of implicit self-theory on persistence was only significantly different from zero for the early failure group and not the early success group. However, these results should be interpreted with caution because, even though these patterns of effects differed compared to zero, the implicit self-theory effects for the two groups did not significantly differ from each other. This finding is partially supportive of theoretical assumptions about implicit self-theory (Dweck & Leggett, 1988) and trait activation theory (Tett & Gutterman, 2000), failure may act as a trait activator for implicit self-theory such that in the absence of failure, implicit self-theory may not be relevant for persistence or performance; but once failure occurs, that is when the consequences of one's implicit self-theory become

meaningful. Unfortunately, the current study cannot strongly support this assertion as a result of the lack of statistically significant differences between the groups, regardless of the apparently different patterns of results between the groups.

There are a number of reasons why the moderating effect of early failure on the relationship between implicit self-theory and persistence was not fully supported in the current study, contrary to previous findings (e.g., Blackwell, 2002; Blackwell et al., 2007). First, it is possible that failure is not as meaningful for adults as it is for children. Early findings focusing on challenge, difficulty, and failure mostly focused on samples consisting of children and college students (e.g. Hong et al., 1995). Another, and possibly more likely, explanation is that the current study failed to produce enough statistical power to find a moderating effect that does exist. The current study had a limited sample size compared with the complexity of the model tested. Additionally, by design there was a larger sample in the early failure group compared to the early success group. The early failure group consisted of about two-thirds of the overall sample, while the early success group consisted of only one-third of the sample. This decision was made to provide the best possible opportunity to find the result expected in the early failure group by maximizing the number of participants in that group, but had the unintended consequence of reducing statistical power to find differences between the two groups.

Consistent with implicit self-theory literature was the non-significant direct path from implicit self-theory to performance. Previous literature would suggest that the direct path from implicit self-theory to performance should be essentially null as the effect of implicit self-theory on performance should be fully mediated through other motivational constructs (Blackwell, 2002; Dweck & Leggett, 1988). This assertion was supported in the current study with the statistically non-significant result.

Unsupported Theoretical Pathways

There was surprising lack of support for several hypothesized paths in the current study. First, self-efficacy was found, in the current data, to be unrelated to implicit self-theories under any conditions. Second, self-efficacy was found to be unrelated to persistence under any conditions. These findings are surprising as both theories about implicit self-theory and about self-efficacy are contradicted by the result; both theories suggest that self-efficacy should affect persistence, at least under some circumstances. The link between implicit self-theory and self-efficacy has been supported in previous findings from implicit self-theory literature (e.g. Blackwell, 2002; Blackwell et al., 2007; Robins & Pals, 2002), however, the current study's results are inconsistent with the previous findings. There are some artifacts of the current study that may have led to the finding. First, persistence was measured as time spent on tutorials after having provided an incorrect response. Self-efficacy may not have had an effect on amount of time spent, but perhaps another measure of persistence would have been more sensitive to the relationship between self-efficacy and persistence. Additionally, there was a floor effect in performance that may have translated into lower self-efficacy scores than would represent the normal responses for the participants in this study. The tasks included in this study were very challenging and likely had a negative effect on self-efficacy scores, as is evidenced by the consistent downward trend in self-efficacy from one trial to the next.

Social cognitive career theory is also relevant for the null effect of self-efficacy on persistence. The theory asserts that self-efficacy is a precursor of interest in a task, which is in turn a precursor of the decision to engage in the behavior required for the task. However, social cognitive career theory also includes expectations about the outcome associated with good performance on the task such that if one believes that the outcome of doing well will not be

valuable, then the choice to engage in the effort required to do the task will be undermined. This could be true regardless of efficacy beliefs (Lent et al., 1994). In the current study there was no extrinsic reward associated with performing well on the task, thus the motivational drive to persist in the tutorial may have been undermined.

Contrary to assertions of implicit self-theory theory, there was no self-efficacy buffering effect for incremental theorists compared to entity theorists when facing a challenging task (e.g. Martocchio, 1994; Taberero & Wood, 1999). Again, the task involved in the current study may have been so difficult that virtually all participants, regardless of personality traits and other motivational factors, experienced reductions in self-efficacy simply because the tasks were too difficult.

Strengths and Limitations

One limitation of this research was the use of a very difficult task. The task used in this research was much more difficult than tasks normally associated with implicit self-theory literature. It may be that the task was too difficult for participants and created a situation in which all participants began to feel hopeless, regardless of implicit self-theory. The universal decline in self-efficacy from pre-task measures to post-task measures supports this possibility. Thus, the task chosen for the current research may have been more difficult or challenging than anticipated and may have had unintended consequences in self-efficacy for the participants.

The measure of persistence that was used for analysis may have been problematic because the measure only included the amount of time that a screen was open for a participant. Not included in this measure were some variables that may have made a difference in performance without having an effect on time (e.g. striving, concentration, dedication to task, reading speed, etc.). Relatedly, there is more data on this variable available for participants who

performed more poorly overall as those participants would have encountered more tutorials compared to participants who performed well. That is, participants who answered most items correctly encountered fewer tutorials and therefore did not supply as much data to this construct. This is a confound inherent in the means chosen to measure persistence in this study.

Additionally, the sample size for this project was relatively small for the complex model tested. In a complex SEM analysis a general rule of thumb is to have between 5 and 10 cases per parameter estimated, with the larger sample size being more important for non-normal variables (Bentler & Chou, 1987). The constrained SEM model in the current research estimated 67 parameters and therefore would have called for at least 335 participants rather than the 206 that were included. There were also quite small intercorrelations which exacerbated the statistical power issue. However, even with a relatively small sample, some support was found for the theory. That being said, a larger sample would have been optimal. In the current study it was necessary to balance the quantity of participants with the quality of the sample. A Monte Carlo analysis on the pilot data indicated that 150 participants would be adequate to examine the relationships hypothesized as long as the effect sizes were slightly larger than what was found in the pilot study, and if the early failure group comprised about two-thirds of the sample. A sample size of 200 was requested, in an attempt to ameliorate the power problem, and it was reasonably likely that the effect sizes relevant to implicit self-theory would be adequate to find an effect using a sample of that size. In order to increase the number of participants, it would have been necessary to include a lower quality sample (e.g. introductory psychology students) which would have undermined part of the purpose for the current study.

Another limitation of the current study is that it was not conducted using a longitudinal method. Previous research that has been conducted linking implicit self-theory to self-efficacy

has been longitudinal, including time spans of at least a few weeks (e.g. Blackwell, 2002; Martocchio, 1994; Robins & Pals, 2002). It is possible that effects of implicit self-theory on self-efficacy take time to develop, and an hour long task session is simply not enough time.

Finally, the current study did not include any extrinsic incentive to perform well. Working adults generally have some extrinsic incentive to perform well at work, and as a result the task included in the current study was somewhat unlike work in that way. The decision to avoid any extrinsic incentive was deliberate, as that question is outside the scope of the current research purpose and would likely have created variance noise making it difficult to examine the specific relationships hypothesized. Future research should examine the extent to which extrinsic incentives play a role in the effects of implicit self-theory on persistence and performance.

Along with limitations, the current study was strong in some areas as well. First, unlike previous studies of implicit self-theory, the current study included a highly select group of participants, all of whom completed all task items and passed various validation measures. Although it still possible that some participants responded randomly, that issue is attenuated by the rigorous methods of selection. The high quality of the sample is evidenced in the distribution of implicit self-theory that was found in the main study sample, which closely matched the theoretically proposed even split of the population between entity and incremental theory.

Second, the current study focused on working adults from a variety of settings, rather than employees in a particular organization, college students in a particular program, or children. This may translate to greater representativeness of the findings to the general population of working adults.

Finally, the current study used direct measures of persistence and performance. Previous studies have relied on self-report intentions of persistence (e.g. Blackwell, 2002), self-report of performance (Aronson et al., 2002) and antecedents of performance (e.g. Martocchio, 1994). The risk with self-reports of intention is that behavioral intention, while a good predictor of behavior, is not a perfect predictor of behavior (Ajzen, 1985). Similarly, antecedents of performance are predictive of performance, but are not the same thing. As with any self-report measure, caution is required as participants may not know what they are asked to report, or may not be willing to divulge the information.

Future Directions

One area for future research focus is the development or discovery of a task that is sufficiently difficult to activate the effects of implicit self-theory, but not so difficult as to create a floor effect. Additionally, the surprising lack of mediation of the relationship between implicit self-theory and persistence through self-efficacy should be examined. If self-efficacy is not the driver of persistence for incremental theorists, what is? Theoretically, incremental theories themselves should not directly affect persistence, rather persistence should be the by-product of a consequence of implicit self-theory. An examination of the mediators in this relationship would explain more clearly why incremental theorists persist while entity theorists do not. One avenue to explore might be affective responses to failure. Perhaps incremental theorists demonstrate more positive affective responding, and this explains their likelihood to persist. In a similar vein, future research should seek to replicate the findings of the current study using a larger sample to ensure that non-significant findings were not solely attributable to a lack of statistical power.

Conclusion

The current study contributes to the current understanding of implicit self-theories in two ways. First, disparate findings from extant implicit self-theory literature are combined into a unified model so that an examination of the inter-relationships among the consequences of implicit self-theory can be examined within the context of a full model. Examination of the full model led to some support for previous theoretical assumptions, but has also led to interesting questions to be answered in future research. Second, unlike previous research in implicit self-theory, the mediated link between implicit self-theory and performance was examined in a working adult sample rather than children and college students. The results of this study provide some support for an assertion that implicit self-theory is relevant for adult performance as well as performance in childhood and adolescence. The implication of this result is that organizations should consider implicit self-theory in selection, training, and performance management.

References

- 10 actual, official LSAT pretests (vol. V). (2014). Newtown, PA: Law School Admission Council.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11- 39). Heidelberg, Germany: Springer.
- Akaike H. (1973). Information theory and an extension of the maximum likelihood principle. In B.N. Petrov & F. Csaki (Eds), *Second International Symposium on Information Theory* (pp. 267-281). Budapest: Akademiai Kiado.
- Aronson, J., Fried, C.B., Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology*, 38, 113-125.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman
- Bandura, A. (2012). On the functional properties of perceived self-efficacy revisited. *Journal of Management*, 28, 9-44.
- Beer, J. S. (2002). Implicit self-theories of shyness. *Journal of Personality and Social Psychology*, 83, 1009-1024.
- Bentler, P. M. and Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods and Research*, 16, 78-117.
- Blackwell, L.S. (2002). *Psychological mediators of student achievement during the transition to junior high school: The role of implicit theories*. Unpublished Dissertation, Columbia University.

- Blackwell, L.S., Trzesniewski, K.H., & Dweck, C.S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development, 78*, 246-263.
- Blakemore, S., & Choudhury, S. (2006). Development of the adolescent brain: implications for executive function and social cognition. *Journal of Child Psychology and Psychiatry, 47*, 296-312.
- Briones, E., Taberero, C., & Arenas, A. (2007). Effects of disposition and self-regulation on self-defeating behavior. *Journal of Social Psychology, 147*, 657-679.
- Brown, K. G. (2001). Using computers to deliver training: Which employees learn and why? *Personnel Psychology, 54*, 271-296.
- Burnette, J. L. (2010). Implicit theories of body weight: Entity beliefs can weigh you down. *Personality and Social Psychology Bulletin, 36*, 410-422.
- Butler, R. (2000). Making judgments about ability: The role of implicit theories of ability in moderating inferences from temporal and social comparison information. *Journal of Personality and Social Psychology, 78*, 965-978.
- Chen, G., Gully, S. M., & Eden, D. (2001). Validation of a new general self-efficacy scale. *Organizational Research Methods, 4*, 62-83.
- Danaher, K. & Crandall, C. S. (2008). Stereotype threat in applied settings re-examined. *Journal of Applied Social Psychology, 38*, 1639-1655.
- Diener, C. L., & Dweck, C. S. (1978). An analysis of learned helplessness: Continuous changes in performance, strategy and achievement cognitions following failure. *Journal of Personality and Social Psychology, 36*, 451-462.

- Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development*. Philadelphia, PA: Psychology Press.
- Dweck, C. S. (2012). Implicit theories. In P. Van Lange, A. Kruglanski, & E. T Higgins (Eds.), *Handbook of Theories of Social Psychology* (Vol. 2, pp. 43-61). London: Sage.
- Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgments and reactions: a world from two perspectives. *Psychological Inquiry*, 6, 267-285.
- Dweck, C. S. & Grant, H. (2008). Self-theories, goals, and meaning. In J.Y. Shah & W.L. Gardner (Eds.), *Handbook of Motivation Science*, (pp. 405-416). New York: Guilford Press.
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, 95, 256-273
- Eison, J. A. (1981). A new instrument for assessing students' orientations towards grades and learning. *Psychological Reports*, 48, 919-924.
- Elliot, A. J. (1994). *Approach and avoidance achievement goals: An intrinsic motivation analysis*. Unpublished Doctoral Dissertation, University of Wisconsin-Madison.
- Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology*, 70, 461-475.
- Elliott, E. S., & Dweck, C. S. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology*, 54, 5-12.
- Erdley, C.A., & Dweck, C.S. (1993). Children's implicit personality theories as predictors of their social judgments. *Child Development*, 64, 863-878.

- Frederick, S. (2005). Cognitive Reflection and Decision Making. *The Journal of Economic Perspectives*, 19(4), 25-42.
- Friedel, J. M. (2006). *Children's efficacy beliefs and coping strategies in mathematics across the transition to middle school: The roles of perceived parent and teacher achievement goal emphasis* (Unpublished doctoral dissertation). University of Michigan, Ann Arbor.
- Good, C., Rattan, A., & Dweck, C. S. (2008). *Development of the sense of belonging to math survey for adults: A longitudinal study of women in calculus*. Unpublished manuscript.
- Grant, H. & Dweck, C.S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology*, 85, 541-553.
- Heslin, P.A., Latham, G.P, & VandeWalle, D. (April, 2004). *Implicit person theory effects on employee coaching*. Poster session presented at the annual meeting of the Society for Industrial / Organizational Psychology, Chicago, IL.
- Heslin, P.A., Latham, G.P, & VandeWalle, D. (2005). The effects of implicit person theory on performance appraisals. *Journal of Applied Psychology*, 90, 842-856.
- Heslin, P. A. & VandeWalle, D. (2008). Managers' implicit assumptions about personnel. *Current Directions in Psychological Science*, 17, 219-223.
- Heslin, P. A., VandeWalle, D., & Latham, G. P. (2006). Keen to help? Managers' implicit person theories and their subsequent employee coaching. *Personnel Psychology*, 59, 871-902.
- Hong, Y., Chiu, C., & Dweck, C. S. (1995). Implicit theories of intelligence: Reconsidering the role of confidence in achievement motivation. In M. H. Kernis (Ed.), *Efficacy, Agency, and Self-Esteem* (pp. 197-216). New York: Plenum Press.
- Hong, Y., Chiu, C., Dweck, C., & Sacks, R. (1997). Implicit theories and evaluative processes in person cognition. *Journal of Experimental Social Psychology*, 33, 296-323.

- Jagacinski, C. M., Kumar, S., & Kokkinou, I (2008). Challenge seeking: The relationship of achievement goals to choice of task difficulty level in ego-involving and neutral conditions. *Motivation and Emotion, 32*, 310-322.
- John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory Versions 4a and 54*. Berkley, CA: University of California, Berkley, Institute of Personality and Social Research.
- Kanfer, R. (1990). Motivation theory and industrial / organizational psychology. In M. D. Dunnette & L. Hough (Eds.) *Handbook of industrial and organizational psychology: Vol. 1. Theory in industrial and organizational psychology* (pp. 75-170). Palo Alto, CA: Consulting Psychology Press.
- Kozlowski, S. W., Gully, S. M., Brown, K. G., Salas, E., Smith, E. M., & Nason, E. R. (2001). Effects of training goals and goal orientation traits on multidimensional training outcomes and performance adaptability. *Organizational Behavior & Human Decision Processes, 85*, 1-31.
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45*, 79-122.
- MacCallum, R. C., Wegener, D. T., Uchino, B. N., & Fabrigar, L. R. (1993). The problem of equivalent models in applications of covariance structure analysis. *Psychological Bulletin, 114*, 185-199.
- Martocchio, J. J. (1994). Effects of conceptions of ability on anxiety, self-efficacy, and learning in training. *Journal of Applied Psychology, 79*, 819-825.

- Motowidlo, S. J. (2003) Job performance. In W. Borman, D. Ilgen, & R. Klimoski (Eds.), *Handbook of Psychology, Vol. 12: Industrial and organizational psychology* (pp. 39-54). Hoboken, NJ: Wiley & Sons.
- Multon, K. D., Brown, S. D., & Lent, R W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38*, 30-38.
- Muthén, L.K., & Muthén, B.O. (1998-2012). *Mplus user's guide. Seventh edition*. Los Angeles, CA: Muthén & Muthén.
- Nicholls, J. G. (1975). Causal attributions and other achievement-related cognitions: Effects of task outcome, attainment value, and sex. *Journal of Personality and Social Psychology, 31*, 379-389.
- Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology, 2*, 175-220.
- Pajares, F. (2003). Self-efficacy beliefs, motivation, and achievement in writing: A review of the literature. *Reading and Writing Quarterly, 19*, 139-158.
- Payne, S. C., Youngcourt, S. S., & Beaubien, J. M. (2007). A meta-analytic examination of the goal orientation nomological net. *Journal of Applied Psychology, 92*, 128–150.
- Phillips, J. M., & Gully, S. M. (1997). Role of goal orientation, ability, need for achievement, and locus of control in the self-efficacy and goal-setting process. *Journal of Applied Psychology, 82*, 792– 802.
- Rammstedt, B. & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*, 203-212.

- Robins, R. W., & Pals, J. L. (2002). Implicit self-theories in the academic domain: Implications for goal orientation, attributions, affect, and self-esteem change. *Self and Identity, 1*, 313-336.
- Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*, 207-231.
- Schwarz G. (1978). Estimating the dimension of a model. *Annals of Statistics, 6*, 461-464.
- Sitzmann, T., & Yeo, G. (2013). A meta-analytic investigation of the within-person self-efficacy domain: Is self-efficacy a product of past performance or a driver of future performance? *Personnel Psychology, 66*, 531-568.
- Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. *Psychological Bulletin, 124*, 240-261.
- Strecher, V. J., DeVillis, B. M., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education Quarterly, 13*, 73-91.
- Taberner, C. & Wood, R. E. (1999). Implicit theories versus the social construal of ability in self-regulation and performance on a complex task. *Organizational Behavior and Human Decision Processes, 78*, 104-127.
- Tam, K., Pak, S. T., Hui, C. H., Kwan, S., & Goh, M. K. H. (2010). Implicit person theories and change in teacher evaluation: A longitudinal field study. *Journal of Applied Social Psychology, 40*, 273-286.
- Tett, R. P., & Gutterman, H. A. (2000). Situation trait relevance, trait expression, and cross-situational consistency: Testing a principle of trait activation. *Journal of Research in Personality, 34*, 397-423.

- Thomas, D. A. (1999). *Adult achievement goal orientations and perceived ability: Impact on task choice, persistence and strategy use* (Unpublished doctoral dissertation). University of Southern California, Los Angeles.
- Toplak, M. E., West, R. F., & Stanovich, K. E. (2014). Assessing miserly information processing: An expansion of the Cognitive Reflection Test. *Thinking & Reasoning*, 20, 147-168.
- Vancouver, J. B., & Day, D. V. (2005). Industrial and organisation research on self-regulation: From constructs to applications. *Applied Psychology: An International Review*, 54, 155-185.
- VanDeWalle, D. (1997). Development and validation of a work domain goal orientation instrument. *Educational and Psychological Measurement*, 57, 995-1015.
- VandeWalle, D., & Cummings, L. L. (1997). A test of the influence of goal orientation on the feedback-seeking process. *Journal of Applied Psychology*, 82, 390- 400.
- Wilson, C.L, & Kraiger, K. (2012, August). *Implicit person theory: An empirical test of assumptions*. Poster presented at the annual convention of the American Psychological Association, Orlando, FL.

Appendix A – Scale Items

Screening items

- Are you at least 21 years-of-age? Yes = continue to next question; No = end survey message.
- Have you obtained at least a bachelor's degree or equivalent education? Yes = continue to next question; No = end survey message.
- Do you work for pay at least 20 hours per week on average? Yes = continue to next question; No = end survey message.
- Have you ever attended law school? Yes = end survey message; No = continue to next question.
- Have you ever taken the Law School Admission Test (LSAT)? Yes = end survey message; No = continue to informed consent screen.

Implicit self-theory

- You have a certain amount of intelligence and you really can't do much to change it. (entity)
- Your intelligence is something about you that you can't change very much. (entity)
- You can learn new things but you can't really change your basic intelligence. (entity)
- With effort anyone can improve in intelligence. (incremental)
- As we learn new things, or intelligence tends to increase. (incremental)
- Even if it takes me longer to learn something, as long as I put in the effort I can learn anything. (incremental)

Generalized self-efficacy

- I will be able to achieve most of the goals that I have set for myself.
- When facing difficult tasks, I am certain that I will accomplish them.
- In general, I think that I can obtain outcomes that are important to me.
- I believe I can succeed at most any endeavor to which I set my mind.
- I will be able to successfully overcome many challenges.
- I am confident that I can perform effectively on many different tasks.
- Compared to other people, I can do most tasks very well.
- Even when things are tough, I can perform quite well.

Task specific self-efficacy

- I am confident that I can perform effectively on a logic puzzle task.
- I believe I can succeed at a logic puzzle task if I set my mind to it.
- Even if a logic puzzle is tough, I can answer it correctly.

Demographics

- What is your age in years
 - Under 21 (Pilot study only)
 - 21-30
 - 31-40
 - 41-50
 - 51-60
 - Over 60
- With which race do you most identify?
 - American Indian or Alaska Native
 - Asian
 - Black or African American
 - Native Hawaiian or Other Pacific Islander
 - White
- Do you consider your ethnicity to be Hispanic or Latino?
 - Yes
 - No
- With which sex do you most identify?
 - Male
 - Female
 - Other

Goal Orientation

Learning subscale

- I am willing to select a challenging work assignment that I can learn a lot from.
- I often look for opportunities to develop new skills and knowledge.
- I enjoy challenging and difficult tasks at work where I'll learn new skills.
- For me, development of my work ability is important enough to take risks.
- I prefer to work in situations that require a high level of ability and talent.

Prove subscale

- I'm concerned with showing that I can perform better than my coworkers.
- I try to figure out what it takes to prove my ability to others at work.
- I enjoy it when others at work are aware of how well I am doing.
- I prefer to work on projects where I can prove my ability to others.

Avoid subscale

- I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others.
- Avoiding a show of low ability is more important to me than learning a new skill.
- I'm concerned about taking on a task at work if my performance would reveal that I had low ability.
- I prefer to avoid situations at work where I might perform poorly.

Cognitive Reflection Test

- A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?
 - The ball costs 5 cents. If the ball costs 5 cents, the bat costs \$1.05. $\$1.05 + \$0.05 = \$1.10$
- If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
 - Five minutes. Each machine can make a widget in 5 minutes. The number of machines is irrelevant in this context.
- In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?
 - 47 days. If the patch doubles in size every day, and it covered the entire pond on the 48th day, then it would be half that size on the 47th day.
- If John can drink one barrel of water in 6 days, and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together?
 - 4 days (together they drink $\frac{3}{12}$ or $\frac{1}{4}$ per day)
- Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class?
 - 29 students (the intuitive answer is 30, but the 15th highest, would be the 16th lowest if there were 30 students)
- A man buys a pig for \$60, sells it for \$70, buys it back for \$80, and sells it finally for \$90. How much has he made? _____ dollars

- correct answer \$20 (intuitive answer is \$10, but he doesn't ever lose \$10, he gains \$10 twice)
- Simon decided to invest \$8,000 in the stock market one day early in 2008. Six months after he invested, on July 17th, the stocks he had purchased were down 50%. Fortunately for Simon, from July 17th to October 17th, the stocks he had purchased went up 75%. At this point, Simon:
 - a. has broken even in the stock market
 - b. is ahead of where he began
 - c. has lost money in the stock market (correct answer – he gained 75% of only half the original money)

Personality

I see myself as someone who ...

- ...is reserved.
- ...is generally trusting.
- ...tends to be lazy.
- ...is relaxed, handles stress well.
- ...has few artistic interests.
- ...is outgoing, sociable.
- ...tends to find fault with others.
- ...does a thorough job.
- ...gets nervous easily.
- ...has an active imagination.

Appendix B – Sample Task Item

Five employees: Andy, Kim, Rick, Joyce, and Max are scheduled for performance assessment during a five day period beginning Monday and ending Friday. Each employee is scheduled for only one day and no two employees are scheduled on the same day. The following constraints apply

1. Andy is scheduled on either Monday or Friday
2. Kim is scheduled before Max
3. Rick is scheduled at least two days apart from Joyce
4. Max is scheduled before Joyce

If Andy is scheduled for Friday, which of the following could be true?

- a) Rick is scheduled for Thursday
- b) Max is scheduled for Wednesday
- c) Kim is scheduled for Monday
- d) Rick is scheduled for Tuesday

Appendix C – Sample training/tutorial

I'm sorry, your answer for this question was not correct.

Let's review how one might go about solving this question to arrive at the correct answer.

Here is the question information again:

Question text appears here

Let's begin by diagramming our constraints:

Togowa > Young

Souza > Xu

Togowa > Young > Robertson

(Robertson)	(Robertson)	(Robertson)	(Robertson)	X	X
1	2	3	4	5	6

When starting this problem it is important to note the phrase “**could be true**”. This means that the answer is one of several possible arrangements in which Togowa is assigned a higher-numbered parking space than Souza. It also means that all of the other options **must be false**. We know that Robertson cannot be placed in a parking space higher than #4. We also know that Young and Togowa must be placed in parking spaces lower than Robertson.

Souza > Togowa > Young > Robertson

In this problem Souza must also be assigned a parking space numbered lower than Robertson. Therefore, a total of three people must be assigned a parking space numbered lower than Robertson so Robertson must be in space #4. Now we can fill in spaces #1 through #3 with Souza, Togowa, and Young. This means that the only possible way to satisfy these criteria AND have Souza in a parking space lower than Togowa, as defined in the question, is to place Souza in #1. The next step is to diagram what we know has to be true, as follows:

Souza	Togowa	Young	Robertson	Xu OR Vaughn	Xu or Vaughn
1	2	3	4	5	6

This leaves parking spaces #5 and #6 for either Xu or Vaughn. Remember that the original question only asks us which **could be true**. We know that #5 and #6 can be occupied by either Vaughn or Xu.

After completing this diagram we can go through the answer options and see that the only option that is not ruled out in our diagram is **B. Vaughn is assigned parking space #5.**