5-2010

CONSTRUCTING A CREATIVE SELF-EFFICACY INVENTORY: A MIXED METHODS INQUIRY

Daniel H. Abbott
University of Nebraska - Lincoln, danhabbott@gmail.com

CONSTRUCTING A CREATIVE SELF-EFFICACY INVENTORY: A MIXED METHODS INQUIRY

by

Daniel H. Abbott

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Philosophy

Major: Psychological Studies in Education

Under the Supervision of Professor Roger H. Bruning

and Professor James A. Bovaird

Lincoln, Nebraska

May, 2010

CONSTRUCTING A CREATIVE SELF-EFFICACY INVENTORY: A MIXED METHODS INQUIRY

Daniel H. Abbott, Ph.D.

University of Nebraska, 2010

Advisers: Roger H. Bruning and James A. Bovaird

A quantitative and qualitative mixed methods study was conducted to examine the latent structure of creative self-efficacy. The CTSE II and CPSE II instruments were developed to measure two dimensions of creative self efficacy, creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE), respectively. Following this, a two-phase inquiry was conducted. In the first and primary phase, factor analysis was used to test the ability of a specific measurement model to accurately capture the four hypothesized factors of CTSE (fluency, flexibility, elaboration, and originality) and the three hypothesized factors of CPSE (domain, field, and personality). In the second, explanatory phase, interviews were conducted to understand how four sets of individuals–individuals high in CTSE, individuals low in CTSE, individuals high in CPSE, and individuals low in CPSE–experience creativity and creative self-efficacy. This study revealed that: (1) the proposed measurement model of creative self-efficacy provides adequate psychometric evidence, (2) CTSE and CPSE related to openness to experience and to an older measure of creative self-efficacy, (3) the proposed measurement model is more parsimonious than any of the rival models tested, and (4) unique themes emerged from qualitative interviews that provide depth and context for understanding the latent structure of creative self-efficacy. Avenues for developing an

improved creative self-efficacy inventory in the context of these findings are discussed at the conclusion of this dissertation.

DEDICATION

To my family, in this world and in the next.

ACKNOWLEDGMENTS

I thank God and the family that He has given me. I am especially thankful for and to John Abbott, Caryl Abbott, Xiaofei Abbott, and Archie Hebbert. My brothers and my sister mean more to me than I can say. My cousins and other relatives, both in America and in China, give joy and meaning to my life. They are so wonderful.

I want to thank all those who prepared me for writing this document. I thank my supervisory committee, for teaching me, encouraging me, and (most incredibly of all) putting up with me. Dr. Roger Bruning, Dr. James Bovaird, Dr. Christy Horn, Dr. David Moshman, and Dr. John Hibbing guided me in adding everything worthwhile in this document. Every fault is my own. I also thank all others who opened doors for me in the hallway of life, including Gary Stensaas, Steve Boint, Jim Maloney, Aaron Thoreson, Brendan Grant, and Mark Safranski.

I want to thank my fellow graduate students at the University of Nebraska—Lincoln. You inspired me and motivated me. You made me laugh. You made studying at this institution so much fun. You helped me understand when I was confused, and encouraged me when I was weary.

Thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Guilford's (1950) APA Presidential address signaled the dawn of modern research into creativity. Guilford began his speech by noting that the field of creativity had been neglected, and that creativity was “an area in which psychologists, whether they be angels or not, have feared to tread” (p. 444). Guilford's criticism of the "[appalling] neglect of this subject by psychologists" (p. 445) was answered by volumes of research by generations of psychologists. Edited handbooks, chapters, and journals have been written since Guilford's speech. As Brown (1989) summarized on the fortieth anniversary of Guildford's address, the speech “is generally viewed as the foundation of much contemporary research on creativity” (p. 13).

Inspiring Motivation for Creative Expression

Modern research into motivation for creative expression also likely began with Guilford's speech. Guilford asserted that the expression of creativity depends not just on an internal trait but also on motivation. Since then, psychologists have tried to understand motivation for creative expression from a variety of perspectives. Among these have been investment theory (Sternberg, 2006b), motivated focus (De Dreu &Nijstad, 2007), self-determination (Deci & Ryan, 2008), reinforcement (Eisenberger & Cameron, 2003), and romantic/mating motivation (Griskevicius, Cialdini, & Kenrick, 2006), as well as locus of control (Pannells & Caxton, 2008), and general self-efficacy (Prabhu, Sutton, & Sauser, 2008). Recently, many researchers have begun to investigate creative self-efficacy, or an

individual's perception of his or her own ability to be express creativity. I am one of those researchers (Abbott, 2009a, 2009b, 2009c, 2010a).

Creativity refers to a stable trait that enables the production of novel, original, and appropriate solutions, is separate from intelligence, and is distributed throughout the population (Brown, 1989; Guilford, 1950). Creativity is expressed through the state-like constructs of creative performance (e.g., Csikszentimalyi, 1996) and creative thinking (e.g., Torrance, 2008). Self-efficacy, in contrast, refers to a person's state-like belief in his or her own ability to actually perform specific tasks to achieve some objective given whatever obstacles may exist (Bandura, 2007). Creative self-efficacy, therefore, refers to an individual's state-like belief in his or her own ability to perform the specific tasks required to produce novel, original, or appropriate solutions.

This dissertation examines creative self-efficacy in two dimensions apparent in the literature, using methods and constructs derived from my earlier research (Abbott, 2009a, 2009b). One stream of research has focused on Creative Thinking Self-Efficacy (CTSE), or self-efficacy for idea generating tasks (Abbott, 2010a; Gist, 1989; Locke, Frederick, Lee, & Bobko, 1984). These studies used Bandura's recommendations for creating self-efficacy inventories, but have been limited in the extent they measured self-efficacy for the expression of creativity in authentic environments. A second stream of research has focused on Creative Performance Self-Efficacy (CPSE), or self-efficacy for creativity in the workplace or the classroom (e.g., Schack, 1989; Tierney & Farmer, 2002, 2004). This latter group of studies emphasized self-efficacy for creative performance in authentic environments, but strayed farther from Bandura's recommendations for

generating measures of self-efficacy. In general, these quantitative inquiries into creative self-efficacy have produced standardized instruments which perform reliably in certain populations. Researchers in these streams have not used the voices of the participants or incorporated multiple dimensions or measures of creative self-efficacy to form a better understanding of the phenomenon.

A third stream of research has focused on open-ended inquiries. This has lead to creative self-efficacy being studied with qualitative and non-traditional methods. Laws (2003) conducted a qualitative investigation of creative self-efficacy. She triangulated the results of interviews with research scientists in order to inquire into how adults in an organizational setting experienced creative self-efficacy. Her qualitative methodology allowed her to frame participants' perspectives to build understanding, though this limited her ability to generalize to an overall population. Lemons (2006, 2009) used a multimethod approach, with one quantitative item in an otherwise qualitative inventory. While Lemons obviously did not address scale construction and reliability in her single-item inventory, her work was the first on creative self-efficacy to seriously consider how qualitative and quantitative approaches might be combined to study creative self-efficacy.

A fourth stream of research into creative self-efficacy has examined the possibility of multiple dimensions of creative self-efficacy. Riley (1999) began this stream by differentiating between the cognitive and behavioral aspects of creative expression (Riley, 1999). Beghetto's (2009) research has bridged the gap between CTSE and CPSE research through the use of a domain-specific creative self-efficacy inventory, while Tan, Ho, Ho, and Ow (2008) independently extended Beghetto's (2006) instrument to study two

hypothesized dimensions of creative self-efficacy, cognitive style and working style. I recently conducted a qualitative case study of three bloggers to analyze how they experienced creativity, CTSE, and CPSE (Abbott, 2009a). This research was conducted simultaneously with my development of the CTSE I and CPSE I inventories for measuring CTSE and CPSE, respectively (Abbott, 2009b). More recently, I have studied the possibility of multiple latent classes of individuals, with respect to their responses to items on the CTSE I, CPSE I, CTSE II, and CPSE II inventories (Abbott, 2009c).

The Need for a Study

It is important that we study creativity. Creativity, more than ever, is the competitive advantage of the human brain. The rise of computers and the Internet mean that many forms of work are gone, and others are being destroyed. Humans no longer have a monopoly on logical thinking in domains such as science, technology, engineering, and mathematics. Many tasks in these fields that were once vital to success can be performed more quickly and less expensively by computers. This automation is even more challenging in the context of continuing trends toward assessment and accountability, especially in education. Presciently, Guilford (1950) wrote, "We are told that [computers] can be made to take over much of [our] thinking and that the routine thinking of many industries will eventually be done without the employment of human brains" (p. 446). Individuals without creativity will be left behind in a world in which non-creative thought can be automated, but creative solutions to problems are at a premium.

For these reasons, there arguably is a need to help people express creativity. Guilford (1950) described abilities, motivation, and temperament as influencing creative expression. My earlier qualitative inquiry into creative self-efficacy (Abbott, 2009a) revealed that some participants felt helpless to increase their creative thinking. They also believed that creative performance is difficult and arduous. Further, the voices of the participants revealed that, from their perspective, creative expression depended on being able to think and perform creatively. Given that an important reason for understanding creativity is to help individuals think and perform creatively, a theoretical conception of creative self-efficacy that reflects lived experience should allow any experimental programs designed to improve creative self-efficacy to be more meaningful to the researcher and to the participant.

To help people better express creativity, a need exists for an instrument that does not oversimplify creative self-efficacy. Prior literature implies that at least two dimensions of creative self-efficacy exist: creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE). However, except for research into multiple dimensions of creative self-efficacy (Abbott, 2009a, 2009b, 2009c; Beghetto, 2009; Riley, 1999; Tan et al., 2008), most research has treated creative self-efficacy as having only one dimension. Further, different researchers have operationalized creative self-efficacy in different ways rarely in accordance with Bandura's (2006) suggestions. Without a consistent framework for making sense of the dimensions and factors of creative self-efficacy, it is unlikely that measures of creative self-efficacy will become as reliable or as useful as measures of creative thinking (e.g., Torrance, 2004).

To aid in interpretability, a study ideally should combine the generalizability of quantitative methods with the meaning provided by qualitative methods. While Lemons (2006, 2009) used both quantitative and qualitative methods in her work, and I have used both approaches separately (e.g., Abbott, 2009a, 2009b), no mixed methods approach has yet emerged to clarify how findings in quantitative research into creative self-efficacy might be understood through the use of qualitative methods. A need exists for an inquiry into the dimensions of creative self-efficacy that emphasizes quantitative methods while also providing the additional meaning that can emerge from a structured, follow-up qualitative study.

The Proposed Study

This study sought to capture and understand the latent structure of creative self-efficacy. This was done in part to overcome the traditional separation of the CTSE, CPSE, open-ended research into creative self-efficacy, and research into multiple dimensions of creative self-efficacy streams. The purpose of this study was served by developing a measurement, referred to as the *Revised model*, for the CTSE II and CPSE II inventories of creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE). Then, as a follow-up, the voices of participants in four groups–Low CTSE, High CTSE, Low CPSE, and High CPSE–were used to illuminate how such an instrument may provide context for the latent structure of creative self-efficacy. This approach allowed the present inquiry to utilize the affordances of the four existing streams of research into creative self-efficacy. Further, this mixed-methods study of CTSE and CPSE avoided the measurement problems that can come from attempting to

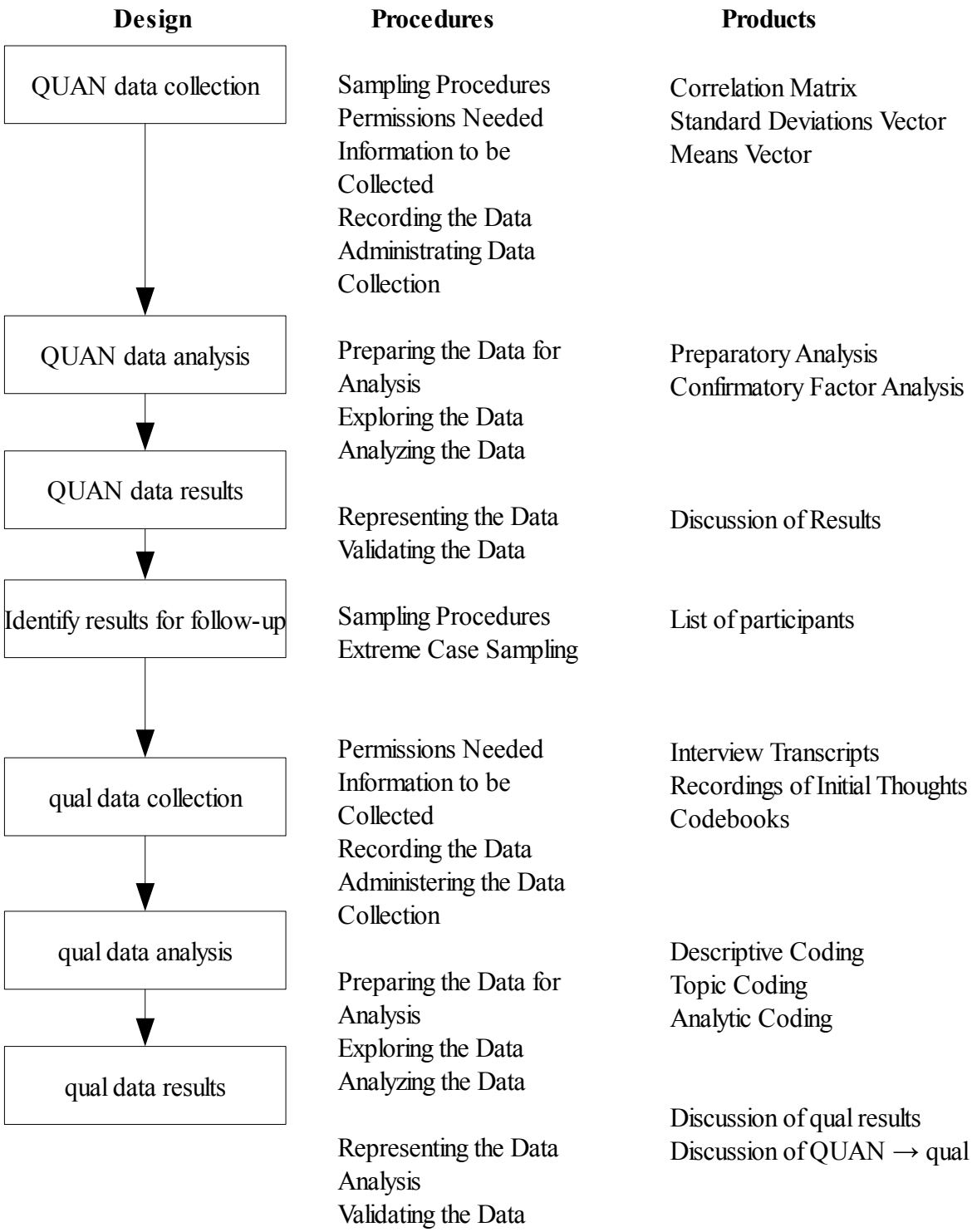
measure only CTSE or CPSE, or from using a non-standard self-efficacy instrument. This study also reflected the experience of participants in line with previous qualitative work.

The dissertation was designed to build measures of creative self-efficacy that reflect the experience of individuals who vary in their creative self-efficacy. These measures should be reliable and valid among the populations in which they are studied. Methodologically, this dissertation is built on the results of three of my previous studies. First, in my qualitative pilot study (Abbott, 2009a), I conducted interviews with four bloggers using their perspectives and voices to build an understanding of creativity and creative self-efficacy. The results of that study supported my assumption that creative performance and creative thinking are experienced differently by individuals, as are CTSE and CPSE. I used an abridged version of that study's interview protocol in the qualitative phase of this dissertation. Second, in my quantitative pilot study (Abbott, 2009b), I compared measurement models for the CTSE I and CPSE I inventories and found support for a view of creative self-efficacy that included the two dimensions of creative self-efficacy, CTSE and CPSE, as well as for a number of factors for each dimension. I used a revised version of the inventory from that study in the quantitative phase of this dissertation, along with an appropriate measurement model. Third, in a study parallel to both this dissertation and the quantitative pilot study, I investigated responses to creative self-efficacy items to attempt to detect multiple latent populations of creative self-efficacious individuals. Fourth, in my reanalysis of a classic study of creative self-efficacy (Abbott, 2010a), I conducted a structural equation model (SEM) reanalysis of Gist's (1989) pioneering work to demonstrate the utility of the SEM

approach in analyzing creative self-efficacy. The quantitative phase of this dissertation uses confirmatory factor analysis (CFA), which is conceptually similar to SEM.

In the current study, an explanatory mixed-methods design was used that began with collection and analysis of quantitative data, and then expanded on that data in a qualitative phase. In the quantitative phase, self-report measures from undergraduate students at a large Midwestern research university were collected. The purpose of this phase was to refine a measurement model for two new instruments for measuring creative self-efficacy, the CTSE II and CPSE II inventories. In the qualitative phase, participants who varied in creative self-efficacy were selected for interviews. The reason for this follow-up was to provide a richer context for the latent structure of the measurement model of the CTSE II and CPSE II inventories. A visualization of this design that describes the higher priority quantitative phase preceding the follow-up qualitative phase–or in Creswell and Plano Clark's (2007) notation, *QUAN* → *qual*–appears as Figure 1.1.

Figure 1.1
Visualization of the Design



Research Questions

Four research questions about creative self-efficacy were posed in this study. The first three of these were examined through quantitative methods, while the fourth of these questions was addressed through qualitative methods.

1. What is the latent structure of creative self-efficacy?
2. What is the relationship between creative self-efficacy and variables known to be related to creativity?
3. Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?
4. How do the themes that emerged from qualitative interviews provide context for the latent structure of creative self-efficacy?

This dissertation begins by summarizing existing research on creativity and creative self-efficacy. Next, two new inventories are created, CTSE II and CPSE II, based on items in my quantitative pilot study (Abbott, 2009b). Following this, data generated by a study conducted with 308 participants are explored. After this, several rival sets of indicators from this pool of items, and their associated measurement models, are tested and discussed. Next, a measurement model for the CTSE II and CPSE II inventories that reflect the changes made in this study–the Revised model–is selected as best reflecting the CTSE and CPSE constructs.

Definition of Terms

The focus of this study was on the design and testing of two instruments, and their associated measurement model, to measure two dimensions of creative self-efficacy,

based on the published literature as well as my prior research into creative self-efficacy (Abbott, 2009a, 2009b, 2010a). While self-efficacy enjoys a generally accepted definition, the fields of creativity and creative self-efficacy contain many competing voices. While the definitions listed below clarify the terms as they relate to this study, *creativity* and *creative self-efficacy*, especially, are defined differently by different researchers.

Creativity

Creativity is generally defined as a stable, continuously distributed trait, separate from intelligence, that is the source of novel, original, and appropriate solutions (Brown, 1989; Guilford, 1950). Creativity can be expressed through two state-like dimensions: creative thinking and creative performance. *Creative thinking* is an internal mental state-like expression of creativity in which fluency, flexibility, elaboration, and originality enables an individual to produce novel, original, and appropriate thoughts (Torrance, 2008). *Creative performance*, in contrast, is seen as an external social state-like expression of creativity in which an individual's internal drive, the domain-appropriateness of his or her work, and the approval of that domain's gatekeepers lead to recognition (Csikszentmihalyi, 1996). While research traditions on these two constructs often proceed without reference to each other, one participant in my qualitative pilot study (Abbott, 2009a) explained the relationship between creative thinking and creative performance this way: “My creativity isn't limited to activities, of course. What's going on inside my head when doing mundane tasks such as driving is plenty creative” (p. 25).

Self-Efficacy

Self-efficacy is a motivational state that is an individual's self-rated capacity to execute certain actions in order to achieve some objective. Self-efficacy "is concerned not with what one has but with belief in what one can do with whatever resources one can muster" (Bandura, 2007, p. 646). Self-efficacy is the "cognitive locus of operations" (Bandura, 1977a, p. 191) and operationalizes motivation as self-rated confidence in ability to perform specific tasks in order to achieve certain goals (Bandura, 2006). A self-efficacy construct exists for every domain of functioning, and a self-efficacy scale typically needs to be developed for each self-efficacy construct.

Creative Self-Efficacy

Creative self-efficacy is a motivational state that is an individual's self-efficacy for expressing creativity. This dissertation investigates two dimensions of creative self-efficacy: creative *thinking* self-efficacy (CTSE) and creative *performance* self-efficacy (CPSE). CTSE is an individual's belief in his or her own ability to express creative thinking. CTSE was earlier studied under the label of self-efficacy for idea-generating tasks (e.g., Gist, 1989). Guilford's (1950) address began his systematic study of creative thinking using standardized instruments (e.g., Wilson, Guilford, & Christenson, 1953), and later Torrance would build on Guilford's work identifying correlates with creative thinking over a lifetime (Torrance, 1966, 1972, 1990, 2004, 2008). CPSE is an individual's belief in his or her own ability to express creative performance. It is studied in social situations (e.g., Tierney & Farmer, 2002) and associated with creativity situated in authentic contexts (e.g., Csikszentmihalyi, 1994, 1996).

Audiences

This study is expected to have two different audiences. The first and more traditional audience will be academics. Creativity has been studied for more than sixty years, and more than a quarter century has passed since Locke et al.'s (1984) study of creative self-efficacy. Development of comprehensive instruments for measuring creative self-efficacy will continue this intellectual tradition and may lead to more sophisticated perspectives on creative self-efficacy. As educational psychologists, however, we also are concerned about the teachers and students we help educate. Computers and the Internet are rapidly changing an educational system that already is under pressure from budget cuts and increasing trends toward accountability. Teachers and students without creative self-efficacy, who do not think or perform creatively, are likely to be left behind in their careers and their intellectual lives. This study of creative self-efficacy does not exist solely for its own sake, but also so that its findings may be reproduced and applied in real classrooms in our schools, colleges, and universities.

CHAPTER II

REVIEW OF THE LITERATURE

The impact of Guilford's (1950) APA Presidential Address on creativity is still being felt. A special section of *American Psychologist* (Sternberg & Dess, 2001) and a special issue of the *Creativity Research Journal* (Plucker, 2001; Runco, 2001) were written in celebration of the fiftieth anniversary of Guilford's original address. Houtz and Krug (1995) edited *Educational Psychology Review's* special issue on creativity. Additionally, there have been several edited volumes published that furthered the study of creativity. The *Handbook of Creativity* was specifically designed to honor E. Paul Torrance (Glover, Ronning, & Reynolds, 1989), whose approach to the measurement of creative thinking is derived from Guilford's. A second work of the same name was published a decade later (Sternberg, 1999). In both of these edited works, Guilford's influence is immediately felt by the reader: his work is presented as beginning the rigorous study of creativity in the first chapters of both volumes (Brown, 1989; Sternberg & Lubart, 1999).

I begin this literature review by describing several general characteristics of creativity. Following this, I provide an overview of some attempts to understand motivation for creative expression. I then select the self-beliefs tradition, and the construct of creative self-efficacy in particular, as a potent approach for describing motivation for creative expression. Next, I synthesize existing research into creative self-efficacy as belonging to one of four streams: research on creative thinking test self-efficacy, research on self-efficacy for creative performance in authentic environments,

open-ended research into creative self-efficacy, and research on multiple dimensions of creative self-efficacy.

After qualifying the findings in these streams to provide a context for answering this study's quantitative research questions, I introduce two specific hypotheses concerning the latent structure of creative self-efficacy. Next, I briefly describe personality and other variables which have been associated with creativity, and introduce two more hypotheses concerning the nomothetic span of creative self-efficacy with regards to openness to experience and Beghetto's Creative Self-Efficacy (BCSE) construct. Finally, I present two last hypotheses that the specific creative self-efficacy model devised in the methodology section of this dissertation will survive comparison to several rival alternative models.

The General Characteristics of Creativity

Brown (1989) outlined several general characteristics of creativity derived from Guilford's (1950) positions. These are that creativity is a set of traits, should be stable, test reliability will be low, completion tests are needed for measurement, and is distinct from intelligence. In addition, creative performance is distinct from creative thinking and creativity is continuously distributed. A search of the literature on creativity, beginning with articles citing Guilford (1950) and expanding from there, revealed that modern research on creativity still falls within the general characteristics of creativity that Brown (1989) outlined. Familiarity with these general characteristics of creativity assists in understanding the context for research on creative self-efficacy.

Creativity is a Stable Set of Traits

Two general characteristics of creativity are that creativity is a set of traits that should be stable. Identification of creative traits in youngsters is an important objective of educational psychology. Friedrich Frobel, the inventor of kindergarten, stated that, “The young, growing human being should be trained early for outer work, for creative and productive activities” (Dewey & Dewey, 1915, p. 106). John Dewey likewise wrote that the school should “respond to the child's need of action, of expression, of desire to do something, to be constructive and creative, instead of simply passive and observing” (Dewey, 1899). Research into the traits that encourage creative expression in young people has focused on (1) investigation of children and (2) longitudinal studies.

1. Investigation of Children. A modern study of creativity in children which was modeled on early educational research, including Vygotsky's (1930/1990) theoretical work on creativity in childhood, was Garaigordobil's (2006) study of creativity interventions among 10 and 11 year old children. Garaigordobil demonstrated that a regime of practice, observation, and debate (reflection and dialogue) increased graphic-figural creativity and verbal creativity. Similarly, Tsao (2008) presented an overview of different approaches that used guided play to increase creativity and competence in literacy. Baer (1997) likewise conducted research on sex-differences of middle-school students that demonstrated a sex-by-reinforcer interaction in creativity among early adolescents.
2. Longitudinal Studies. The preeminent research on the development of children identified as creative (through the use of creative thinking tests) are the cohort studies of E. Paul Torrance. The full body of Torrance's research is exhaustive, but an illustrative case is his longitudinal study on two cohorts of highly creative students (Torrance, 2004). From data collection on children that began in 1958, Torrance identified *sociometric stars* (students who were highly rated by their peers as creative) as well as 10 *beyonders* (students whose creative work was rated as very high). Creativity had already been found to be a stable characteristic throughout life (Torrance, 1972), so it was expected both cohorts would have creative achievements later in life. While mini-case studies provided in the longitudinal study show a great range of personal outcomes, the 20 students in the two groups had earned between them 11 Ph.D. or M.D. degrees and 12 research grants.

From the outset, Guilford (1950) noted that the problem of exploring creativity led to two questions: (1) how to discover creative potential, and (2) how to encourage the development of creative expression. These questions strike at the core mission of educational psychology. The answers may depend on recognizing that though creativity is a trait, the expression of creativity is a state that can be motivated. Thus, this dissertation focuses on motivation for creative expression rather than on creativity itself.

Reliability of Creativity Tests will be Low

The third general characteristic of creativity is that creative expression is a difficult state to measure reliably. That is, any observation of an individual's creative expression will be moderated by other factors so that it will be difficult for two different instruments for measuring creative expression to agree on a rating. Research on the difficulty of improving the reliability of instruments has focused on (1) correlational and (2) factor analytic studies.

1. Correlational Studies. Charyton, Jagacinski, and Merrill (2008) emphasized reliability in their development of the Creative Engineering Design Assessment (CEDA) instrument. In their literature review, they noted that the Owens Creative Test (Owens, 1960) has reliabilities ranging from .38 to .91, while the Purdue Creativity Test (Lawshe & Harris, 1960) has reliabilities from .86 to .95. The Purdue Creative Test itself is only moderately correlated with other instruments, including the Creative Personality Scale (r = .29), the Creativity Temperament Scale (.26), and the Cognitive Risk Tolerance Scale (r = .19). While CEDA had a higher reliability (r = .98), this was achieved by focusing on creative expression in the specific domain of engineering.
2. Factor Analytical Studies. Following Plucker's (1999) call for a reanalysis of classic studies of creativity, Silvia and colleagues (Silvia, 2008; Silvia, Winterstein, & Wilse, 2008a) have dramatically increased our understanding of the relationship of creativity tests. Silvia began by using structural equation modeling to reinterpret the conclusions of Wallach and Kogan (1965), who appeared to find only a weak relationship between creativity and intelligence (r = .09). The reanalysis increased the estimate of the correlation to r = .20. In

> another paper, Silvia et al. (2008a) used factor analysis to question whether the accepted latent structure of creative thinking tests was valid. The work conducted by Silvia and colleagues helped expand analytical research of creativity beyond simple measures of correlation, and even beyond Guilford's own work on principal axis factor analysis, into the world of structural equation modeling and confirmatory factor analysis.

Guilford (1950) proposed the existence of several latent factors of creative thinking, including sensitivity to problems, fluency, novelty, flexibility, synthesizing and analyzing ability, and reorganization. Contemporary work often describes the four factors of creative thinking as fluency, flexibility, originality, and elaboration (Torrance, 2008). Likewise, creative performance is often described as a result of mastery of a domain, access to a field, and a creative personality (Csikszentmihalyi, 1996). Guilford urged creativity researchers to understand the factors specific to the expression of creativity as well as the factors specific to the domain in which creativity is expressed. This study is part of a program of research designed to build an understanding of creative self-efficacy as a complex motivational state that mediates the expression of creative thinking and creative performance.

Creativity is Best Measured with Completion Tests

The fourth general characteristic of creativity is that open-form instruments are needed to fully describe creativity. Guilford also developed closed-form tests of creativity, however, in which a creatively correct answer was required. For instance, while the Associations I subtest of the Remoteness-of-Association test is open-form, the Associations II subtest is closed-form (Wilson et al., 1953). Subsequent research has led to the development of (1) open-form and (2) closed-form creativity tests.

1. Open-Form Tests. Open-form tests include the unusual uses test, quick responses test, figure concepts test, plot test, numbers test, and Associations I sub-test (Wilson et al., 1953), the Guilford Tests (Guilford, 1967), the Torrance Tests of Creative Thinking (Torrance, 2008), the Instances Test (Wallach & Korgan, 1965), the Consensual Assessment Technique (Amabile, 1983, Hennesey & Amabile, 1999; King & Gurland, 2007), Tactics and Strategies (De Dreu & Nijstad, 2008), the Owens Creativity Test (Owens, 1960), the Purdue Creativity Test (Laweshe & Harris, 1960), the Changes in Society test (Joy, 2004), and the Creative Engineering Design Assessment, or CEDA (Charyton et al., 2008). Open-form instruments afford less reliability than closed-form instruments because items will not receive identical scores from all raters. A growing literature has developed around the question of best way to score open-formed instruments (Kim, 2008; Silvia et al., 2008a, 2008b).
2. Closed-Form Tests. Closed-form tests include the Associations II subtest (Wilson et al., 1953) Creative Personality Scale (Sheldon, 1995; derived from Gough, 1979), the Creative Achievement Questionnaire (Carson, Peterson, & Higgins, 2005), the Runco Ideational Behavior Scale, or RIBS, and the Attitudes toward Ideation scale (Runco, Plucker, Lim, 2001; Plucker, Runco, Lim, 2008), the Innovation Potential Index, or IPI (Burch, Pavelis, & Port, 2008; Patterson, 2000), the Problem Solving/Creativity scale (Marsh & O'Neill, 1984; Sheldon, 1995), the Emotional Creative Inventory (Averill, 1999), and supervisor ratings (Tierney, Farmer & Graen, 1999).

Guilford's criticism of closed-form tests was relatively mild. Guilford emphasized that completion tests were required to measure some creative abilities, but not others. Guilford concluded that the desire for easy, inexpensive, and reliable tests may lead to research that ignores aspects of creativity that can only be measured through more involved, more intensive, or more subjectively scored tests. Since Guilford's warning, however, progress has been made on building sophisticated, reliable, and closed-form inventories that measure complex aspects of cognition.

One example of such progress is Bandura's (1977a) concept of self-efficacy as a "cognitive locus of operations" (p. 191). Bandura's original research was on the motivational aspect of modeling for the expression of aggression by children (Bandura,

1963). Over time, introspective data from participants became available through rigorously developed self-efficacy instruments (Bandura, 2006). The study of self-efficacy has successfully developed beyond laboratory observations of behaviors into field-based measures that are both valid and reliable. In the same way, it is possible that the dichotomy between open-form and closed-form creativity tests one day may be overcome through the use of quantitatively-rated introspective measures that allow research on motivation for creative expression to reliably reflect the latent structure of creative self-efficacy.

Creativity is Distinct from Intelligence

The fifth general characteristic of creativity is that creativity and intelligence are distinct concepts, rather than mere indicators of the same latent factor. As Brown (1989) summarized, "Abilities tapped by standard intelligence tests are relatively unimportant for creative behavior and those underlying creativity are not tapped by intelligence tests" (p. 13). One excellent meta-review of creativity and intelligence was provided by Batey and Furnham (2006). Similar research has appeared since the beginning of psychology, such as Dearborn's (1898) study showing that intellectuals were not necessarily more capable than others of expressing creative thinking. More recently, Carroll (1993) used factor analysis to demonstrate that creative thinking as measured by open-ended questions is independent of measures of intelligence but that creative performance nonetheless is partially predicted by intelligence. The finding that creative thinking is separate from intelligence, though creative performance requires both creative thinking and intelligence, also appeared in Plucker's (1999) reanalysis of Torrance's research, as

well as Silvia's (2008) reanalysis of Wallach and Kogan's (1965) investigation of the creativity and intelligence of children.

Creative expression depends on factors other than intelligence. Bandura (2007) described self-efficacy as an important mediator of the "initiation, attainment, and maintenance" of the expression of an ability (p. 642). Thus, it is hoped that creative self-efficacy may prove critical to understanding the causes of the initiation, attainment, and maintenance of creative expression.

Creative Performance is Distinct from Creative Thinking

The sixth general characteristic of creativity is that creative thinking is distinct from creative performance. That is, the expression of creative performance has different causes from the expression of creative thinking. A review of the literature reveals four general traditions of research into creative performance as distinct from creative thinking: these are research on (1) the systems perspective, (2) motivation, (3) personality, and (4) other variables.

1. Systems Perspective. Some researchers have argued that the expression of creativity is so embedded in social situations that it is very difficult to determine what factors of individuals, as opposed to social environments, lead to creativity. Csikszentmihalyi (1996), for instance, briefly discussed brilliance and personality creativity before focusing on his research topic: creativity without qualification, or *big c* creativity. In the systems perspective, the causes of *big c* creativity exist in the social system and outside of the individual, except for an individual's mastery of a domain, ability to impress gatekeepers, and capacity for joy, wonder, and curiosity. Batey and Furnham (2008) defined this broad view of creativity as a focus on "Attributes of the environment (for creators or assessors), including the following: source of evaluation, source of support or resources, and source of stimulation or inspiration" (p. 359).
2. Motivation. Research on motivation for creative expression can be organized into the self-belief tradition and other traditions. The self-belief tradition of research on creativity is composed of work on locus of control (Pannells & Claxton, 2008),

general self-efficacy (e.g., Prabhu et al., 2008) and creative self-efficacy (e.g., Beghetto, 2006, 2007, 2009; Tierney & Farmer, 2002, 2004; Yang & Cheng, 2009). Research outside this tradition includes work on investment theory (Sternberg, 2006b; Sternberg & Lubart, 1992; 1993), motivated focus (De Dreu & Nijstad, 2007; Rietzchel, De Dreu, & Nijstad, 2007), self-determination theory (Deci & Ryan, 1985, 2008; Hennesey, 2000; Sheldon, 1995), reinforcement (Baer, 1997; Eisenberger & Cameron, 1996; Eisenberger & Shanock, 2003), and romantic/mating motivation (Griskevicius et al., 2006).

3. Personality. Contemporary research on creative expression and motivation has focused on the Five-Factor Model (FFM) of Personality, which includes constructs of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (McCrae, 1987; Goldberg, 1999). A correlation between openness to experience and creativity has been a consistent finding of creativity-personality research (Carson, et al., 2005; Hirsh & Peterson, 2008; McCrae, 1987; Prabhu et al., 2008). Mixed results have been found for the other factors of personality (Feist, 1998; McCrae, 1987).

4. Other Variables. Other person-level variables that have been studied in relation to creative expression are mood (De Dreu & Nijstad, 2008), experience (Audia & Goncalo, 2007; Diakidoy & Constantinou, 2001), and sex differences (Griskevicius et al., 2006). Research on the power of these variables to predict creativity has not converged in the same way as has research on motivation and personality.

Guilford (1950) wrote that the expression of creativity depends on more than just the trait of creativity. The systems perspective focuses on how creativity is expressed in authentic environments. Its emphasis on domain, field, and personality provide groundwork for operationalizing creative performance beyond the laboratory. Research on motivation for creative expression provides a number of new avenues for understanding what makes the expression of creative thinking and creative performance more likely, while research on personality emphasizes openness to experience as a correlate of creative expression. Likewise, research on other variables beyond motivation and personality provides ways of interpreting extracted factors and avoiding conceptual confusion. All of these approaches suggest that creative traits must be mediated through

some mental process—perhaps creative self-efficacy—in order for an individual to express creative thinking or creative performance.

Creativity is a Continuously Distributed Trait

The seventh general characteristic of creativity is that creativity, like intelligence or height, exists in all people to varying degrees. Subsequent research has focused on (1) everyday creativity, sometimes called *small c creativity*, (2) extraordinary creativity, sometimes called *big c* creativity, or (3) the ability to influence the mental concepts possessed by others, sometimes known as *middle c* creativity.

1. *Small C* Creativity. Everyday creativity in the general population has been studied through work on cognitive style (Renner, 1970), identity (Fromkin, 1970), mood (Baas, De Dreu, & Nijstad, 2008), counterfactual mind-set (Kray, Galinsky, & Wong, 2006), and problem solving (Schwert, 2007). Additionally, therapeutic research on creativity has focused on health and imagination in children (Russ, 2003) and creativity and dementia among older individuals (Hannemann, 2005).
2. *Big C* Creativity. Csikszentmihalyi (1996) contrasted brilliant individuals who express creative thoughts and personally creative individuals who are have new and original experiences against those who express creativity to exceptional levels and have an influence on our culture. The study of extraordinary creativity has been conducted through field research (e.g., Csikszentmihalyi, 1996) and case studies (Amabile, 2001; Gardner, 1993; Martindale, 2001; Nakamura & Csikszentmihalyi, 2001; Stokes, 2001b; Ward, 2001).
3. *Middle C* Creativity. A third concept of creativity, with less research behind it than for *big c* or *little c* creativity, is *middle c* creativity (Gardner, 2004). This tradition of research originates from Csikszentmihalyi's (1996) statement that extraordinary creativity is not an extension of brilliance or personal creativity. Csikszentmihalyi noted that “some of the people who have had the greatest impact on history did not show any originality or brilliance in their behavior, except for the accomplishments they left behind” (p. 26). Gardner (2004) extended this by writing that “while the extent of the mind change will vary, there is no reason to think that fundamentally different factors are at work” (p. 132). That is, while *big c creativity* may be manifested only in a small fraction of individuals, and while it is not simply a more developed form of *small c* creativity, the expression of *middle c* creativity may be distributed widely across the population.

Guilford (1950) described his view of the distribution of creativity as following the example of the rest of psychology by focusing on the expression of a trait in the general population. Guilford observed that “only about two in a million” individuals express creativity to exceptional levels (p. 444). Nonetheless, this minority only varies in the extent to which it expresses a widely distributed trait, and not in possessing a qualitatively different trait than other individuals.

The Value of Creativity

The seven general characteristics of creativity described above still capture the breadth of research on creativity. Groundbreaking work such as Torrance's (1966, 1972, 2004, 2008) longitudinal research on children and Gardner's (1993) case studies, as well as experimental interventions (e.g., Garaigordobil, 2006), all fit into the broad research program first sketched by J.P. Guilford. By themselves, however, these characteristics merely form a taxonomy, a description of what has come before, rather than a map of the way forward. Additionally, such an overview can serve to obscure as much as to clarify if it is not critically examined.

Writing six years after Guilford, Stanley (1956) noted that “One of the chief avowed objectives of modern education is the encouragement of creativity, originality, inventiveness, ingenuity, innovation, new ideas, novel solutions, and fresh approaches to all problems, all directed toward 'socially useful' ends” (p. 78). Stanley wrote that this presents two dilemmas for teachers: how do teachers recognize individual differences in creative expression, and how to teachers encourage their students to turn into creative adults. When Guilford's general characteristics of creativity are seen in this light, two

consequences of Stanley's challenges stand out: the need to motivate creative thinking and creative performance. We must understand the sources of motivation to think and perform creatively.

The rise of information technology and continuing trends toward assessment and accountability are disruptive to educators and students. Individuals, both in the field of education and the world more generally, risk being left behind if they are not motivated to respond to these challenges in creative, original, and useful ways. In this study, the general characteristics of creativity laid out by Guilford were used to guide the development of an improved way of understanding motivation for creative expression.

Motivation for Creative Expression

I now transition from describing the general characteristics of creativity to discussing motivation for creative expression. The study of motivation for creative expression is a rich subfield of the study of creativity. A variety of motivational approaches have been tried including the traditions of investment theory, motivated focus, self-determination, reinforcement, and romantic/mating motivation. Additionally, self-belief constructs such as locus of control, general self efficacy, and creative self-efficacy have been used to understand motivation for creative expression. Research on creative self-efficacy, although first appearing in the 1980s, has increased in intensity in recent years. After these traditions of motivational research are reviewed, creative self-efficacy is selected as the one most likely to produce useful findings.

Some Conceptions of Creative Motivation

In his analysis of Guilford (1950), Brown (1989) stated that "Motivational and temperamental traits determine whether an individual with creative abilities actually performs creative behavior" (p. 13). Several approaches to understanding motivation for creative expression have appeared in recent years. In no particular order, these motivational approaches can be identified as focusing on investment theory, motivated focus, self—determination, reinforcement, and romantic/mating motivation.

Investment Theory

The investment theory of creativity was developed by Sternberg and colleagues in an attempt to bring economic ideas to the study of creativity (Sternberg, 2006a, 2006b; Sternberg & Lubart, 1992, 1993, 1996). Sternberg and colleagues focused on the dedication of resources to undeveloped concepts and ideas that can pay off at a later time. That is, a creative individual is merely a person who invested resources in a way that appeared mistaken or speculative at one time, but who benefited when those investments became valuable. While Sternberg and Lubart (1996) emphasized the requirement for "intrinsic, task-focused motivation" (p. 684), the economic perspective created by Sternberg would allow the incorporation of economic theories of motivation, including utility maximization, profit-to-loss ratios, and so on.

Motivated Focus

De Dreu and Nijstad (2007) presented a new construct, motivated focus, that portrays creativity as a lens that focuses cognition. Building on earlier research on the moderating role of personal fears (Rietzchel et al., 2007), the authors wrote that the

motivated focus hypothesis "holds that conflict stimulates creativity in domains related to the conflict but hampers creativity in domains unrelated to the conflict" (p. 648). Mediation between conflict and motivation focus comes from a *conflict set*, wherein individuals are motivated in invest their cognitive resources toward solving salient problems, and are motivated to divert resources away from other areas. The authors described three experiments in which conflict set was associated with an increase in novelty of gameplay tactics.

Self-Determination

If research on motivated focus considered the effects of conflict between individuals, self-determination theory considered the effect of conflict between an instructor and learner. Deci and Ryan (1985) famously postulated that intrinsic motivation for internal control tends to be high, so attempts to shape behaviors through extrinsic reinforces are interpreted as attempts at control, and thus reduce intrinsic task interest. Therefore, research on self-determination theory and creativity focused on both the positive association between self-determination and creativity (King & Gurland, 2007; Sheldon, 1995), as well as the negative consequences of extrinsic rewards on creativity (Deci & Ryan, 2008; Hennesey, 2000).

Reinforcement

The scholarly debate on the effects of extrinsic reward on creativity parallels the scholarly debate on the effects of extrinsic rewards elsewhere in educational psychology: namely, does the presentation of an extrinsic reinforcer increase the strength of the targeted response? In two theoretical pieces, Eisenberger and colleagues (Eisenberger &

Cameron, 1996; Eisenberger & Shanock, 2003) criticized *romantic* views of creativity and argued that the behavioral perspective explains the utility of rewards in creativity training. Eisenberger and his co-authors also asserted that apparent decreases in the desire to be creative after exposure to extrinsic reinforcers can be explained through well-known behavioral constructs, such as satiation or inappropriate reinforcement schedules.

Romantic/Mating Motivation

Griskevicius et al. (2006) used evolutionary cognitive theory to hypothesize the existence of general and gender-typical effects of romantic/mating motivation on creativity. In study one, the authors primed participants through exposure to photographs of potential mates, and then asked participants to write short stories over ambiguous images. The creativity of the short stories was judged by four raters who were blind to the experiment. In the second experiment, participants read stories that placed them in potential short-term and long-term mating scenarios. In study one, male participants produced more creative stories when exposed to photographs of potential mates. In study two, female participants wrote more creative stories when exposed to stories presenting steady, long-term mating opportunities.

Why These Approaches Are Insufficient

The five approaches to creativity described here have examined creativity and motivation in distinct but interlocking ways. Investment theory emphasized the importance of diverting energy and personal resources to the mastery of fields currently undervalued by others, while motivated focus emphasized the importance of diverting energy and mental resources to the mastery of fields under dispute. Self-determination

theory underlined the importance of individual decision and choice, while the behaviorist emphasis on reinforcement argued for a view of creativity as a consequence of proper reinforcing scheduling. The romantic/mating perspective blurred the lines between intrinsic and extrinsic rewards, viewing humans as subconsciously adjusting their behaviors in order to achieve desirable social outcomes.

However, the productivity of all these approaches is overshadowed by the productivity of approaches to studying creative motivation that focus on self-beliefs. These approaches generally revolve around the work of Julian Rotter and Albert Bandura, two of the most cited and eminent psychologists (Haggbloom et al., 2002). In these approaches, motivation is viewed as a consequence of an individual's beliefs about how he or she interacts in a social environment. These approaches focus on the constructive agency of the individual, and the role that his or her self-beliefs play in leading to greater or lesser motivation.

The Role of Self-Beliefs in Motivation

Beginning in the 1960s, two theoretical perspectives emphasized the importance of social thinking in learning, particularly with respect to modeling and an individual's belief in his or her efficacy. The first of these, social learning theory, includes both Rotter's (1966, 1990) locus of control framework and Bandura's early work on modeling (Bandura, Ross, & Ross, 1961; Bandura, 1963). The second of these, social cognitive theory, built on social learning theory to emphasize the importance of self-efficacy as a motivational variable (Bandura, 1977a, 1977b, 1986, 1997, 2003, 2006). Likewise, researchers of these two perspectives have attempted to apply these theories to the study

of creativity. Pannells and Caxton (2008) used social learning theory to understand the relationship between locus of control and the expression of creativity, while other researchers have used social cognitive theory to understand the relationship between self-efficacy and the expression of creativity.

Social Learning Theory

Rotter's (1966, 1990) social learning theory emphasizes locus of control, or the motivational impact of a learner believing that he or she is able to control his or her own schedule of reinforcement. Locus of control was applied to the study of motivation for creative expression by Pannells and Claxton (2008). Panells and Claxton presented 182 participants with the Runco Ideational Behavior Scale, or RIBS (Runco et al., 2001) and Rotter's Locus of Control instrument (Rotter, 1966). A significant but weak correlation was found between these constructs ($r^2 = .067$, $p = .01$). Little has been done to apply social learning theory to the study of motivation for creative expression aside from Pannels and Claxton's study. More, however, has been accomplished through the use of social cognitive theory.

Social Cognitive Theory

In the context of motivation for creative expression, the most salient aspect of social cognitive theory is self-efficacy or the "cognitive locus of operations" (Bandura, 1977a, p. 191). "Perceived self-efficacy is conceptualized as perceived operative capability. It is concerned not with what one has but with belief in what can do with whatever resources one can muster" (Bandura, 2007, p. 646), with *resources* understood

broadly to include motor capability, mental structures, emotional states, personality attributes, and so on.

One social cognitive tradition is the study of general perceived self-efficacy, or GPSE (Schwarzer & Jerusalem, 1995). GPSE is a domain-general self-evaluation of ability to perform tasks. Prabhu et al. (2008) examined creative expression in the context of general self-efficacy. Items, which were rated on a 1 to 4 scale, included "I can always manage to solve difficult problems if I try hard enough" and "I can handle whatever comes my way" (p. 251). Creativity was measured by What Kind Of Person Are You, or the WKOPAY inventory, which contained fifty forced-choice self-descriptions (Khatena & Torrance, 1976). The instrument was given to 124 participants. GPSE accounted for about 9% of the variance in creativity ($p = .001$).

A much broader social cognitive tradition is the study of creative self-efficacy, which is composed of four streams of research. One stream of research into creative self-efficacy used strict operationalizations of self-efficacy for performance on creative thinking tests (Abbott, 2010a; Gist, 1989; Locke et al., 1984). Another stream of research focused on self-efficacy for creative performance in authentic environments (e.g., Phelan, 2001; Schack, 1989, Tierney & Farmer, 2002, 2004). A third stream of research focused on open-ended inquiry into the phenomenon of creative self-efficacy (Laws, 2003; Lemons, 2006, 2009). Finally, the present study is part of a fourth stream of research which has focused on identifying multiple dimensions of creative self-efficacy (Abbott, 2009a, 2009b, 2009c; Beghetto, 2009; Riley, 1989; Tan et al, 2008).

Review of the Creative Self-Efficacy Literature

Bandura (2003) wrote that “It was Edison's unshakable belief in his inventive efficacy that illuminated our environment and spawned the recording and movie industries, just to mention a few of his wondrous creations” (p. 456). However, Bandura did not elaborate on the nature of such creative or inventive self-efficacy. Therefore, research on creative self-efficacy developed independently of Bandura into four main streams of research.

I will now synthesize four streams to emphasize features necessary for research on creative self-efficacy. The first stream, composed of research on creative thinking test self-efficacy, operationalized self-efficacy in keeping with Bandura's (2006) recommendations. The second stream, composed of more recent research on authentic creative performance self-efficacy, examined creative self-efficacy in authentic environments with higher external validity. The third stream, composed of open-ended research, emphasized the voices of participants to craft conceptions of creative self-efficacy that match the subjective experience of the participants in the studies. The fourth stream, composed of research on multiple dimensions of creative self-efficacy, investigated whether creative self-efficacy can be conceptualized as motivating creative expression across multiple domains.

Creativity Thinking Test Self-Efficacy

The earliest stream of research into creative self-efficacy focused on self-efficacy for idea generating tasks. The three main studies in this stream are Locke et al.'s (1984) work on self-efficacy for listing potential uses for an object, Gist's (1989) study of

creativity training and self-efficacy, and my reanalysis of Gist's data (Abbott, 2010a). Except for my work, studies in this stream did not use the terms *creativity*, *creative thinking*, or *creative performance*. However, they generally operationalized self-efficacy in keeping with Bandura's (2006) recommendations. Indeed, the response scales used in the studies look remarkably similar to Bandura's model *practice rating* scale (p. 320).

Locke et al. (1984) described self-efficacy as a "key concept" (p. 242) in Bandura's (1977b, 1982) work, and defined it as belief in one's ability to correctly execute complex actions to deal with whatever situations may arise. Locke and colleagues created two scales designed to measure the magnitude and strength of self-efficacy to list potential uses of an object. The magnitude scale asked whether participants "Can do" creative thinking tasks, while the strength scale asked whether participants "Certainly" can do those tasks. Participants answered yes or no to eight items that were identical between the two scales. Example items were "I can list 2 uses in 1 minute" and "I can list 12 uses in 12 minutes." Performance on a uses test across many trials was positively correlated with strength and magnitude of self-efficacy. For instance, on the seventh trial with 112 participants, the strength component of the creative thinking self-efficacy scale predicted 23% of the variance in performance ($p < .01$), though the magnitude component predicted only 5% of the variance in performance ($p < .01$).

Gist (1989) sought to compare two methods of Innovation Problem Solving (IPS) training as proxies for creativity training. An initial sample of sixty participants was divided between two conditions, one of which received training that emphasized modeling of idea generation, and another received training that utilized a lecture-based

format. Both the number of ideas and the number of categories of ideas generated were measured. Additionally, a self-efficacy instrument similar to the that appeared in Locke et al. (1984) was used, though Locke et al. were not cited, and the instrument was described as following Bandura's (1977b) structure. An analysis of covariance (ANCOVA) was used to analyze the effect of the training adjusted for initial self-efficacy. The ANCOVA showed a significant main effect of the test condition on self-efficacy ($F(1,56)$ = 32.97, MSE = 42.65, $p < .001$) and idea generation ($F(1,56)$ = 49.93, MSE = 82.16, $p < .001$).

I have reanalyzed Gist's data using structural equation modeling (Abbott, 2010a). Specifically, I operationalized her self-efficacy variables as indicators of latent creative self-efficacy factors, and her idea generating variables as indicators of latent creative expression factors. I found that the more sophisticated statistical techniques generally support her conclusions. The larger sample size requirements of structural equation modeling led to my conclusion that her ANCOVA approach was the more statistically powerful way to answer her research questions given her sample size. My approach, however, had the advantage of avoiding multiplicity-introduced error, as my design tested her hypotheses simultaneously.

The creative thinking test stream of creative self-efficacy research helped lay the foundation for future research. Additionally, the careful operationalizations of creative self-efficacy used in these studies improved the scale construction validity of the studies. However, these studies lacked external validity, did not address the voices of the participants, and examined only one dimension of creative self-efficacy. Fortunately, the creative thinking test stream is complemented by three other streams: authentic creative

performance self-efficacy, open-ended research into creative self-efficacy, and research on multiple dimensions of creative self-efficacy.

Authentic Creative Performance Self-Efficacy

The second stream of research into creative self-efficacy broadened the conceptualization of creative self-efficacy. Instead of a strict operationalization of self-efficacy, work in this stream focused on measuring creative self-efficacy in authentic environments. At the cost of self-efficacy instruments that are farther from Bandura's suggestions, these studies gained external validity as the scales were often designed to measure creative self-efficacy as it was manifested in everyday life. This stream is composed of Schack's (1989) research on creative performance self-efficacy, Phelan's (2001) dissertation on creative confidence, Tierney and Farmer's (2002, 2004) work on creative self-efficacy in business settings, Choi's (2004) investigation on creative self-efficacy among business school students, Jaussi et al.'s (2007) investigation of creative self-efficacy among managers, Gibbs (2009) study of entrepreneurship self-efficacy and creative self-efficacy, Gong, Huang, and Farh's (2009) research on leadership and creative self-efficacy, Mathisen and Bronnick's (2009) experimental program to improve creative self-efficacy, and Yang and Cheng's (2009) research on creative self-efficacy among information systems workers.

Schack (1989) conducted a pioneering study on self-efficacy for creative performance. Schack provided 194 students in grades four through eight with a six-item self-efficacy instrument with questions that included “Doing a project that is more advanced than most kids my age would do” and “Working on a project that wasn't a class

assignment if it was about something that I was interested in" (p. 237). The study measured creative performance self-efficacy before and after a research methodology mini course, and then again after enriched instruction. Final self-efficacy was related to participation in enriched instruction and initial self-efficacy. Significant results were not found for grade, gender, previous enriched experience, years in talent pool, or participation in enriched activities. Creativity was not measured, although the number of enriched gifted education programs a student participated in was collected through self-report.

Phelan (2001) studied creative confidence and creative performance. She defined creative confidence as "an individual's belief in his or her ability or personal creative power to affect desired and valuable change, improvements, and innovations" (p. 6), and equated it to creative self-efficacy. Phelan defined creative performance as "creative behavior and resulting outcomes" (p. 33). Phelan used 108 participants in each of two graduate level courses (a first-year psychology course and a second-year psychology course) at a university on the west coast. Creative performance was measured through a total of 15 self-reported items, while creative self-efficacy or creative confidence was measured through 12 items. A hypothesized zero-order correlation between creative performance and creative confidence was found for both first-year ($r = .640$, $p \leq .01$) and second-year ($r = .695$, $p \leq .01$) students.

Two studies by Tierney and Farmer (2002, 2004) examined how self-efficacy predicts creativity. Understanding creative performance as the creation of novel and useful outcomes or products specific to a domain, the authors proposed that creativity in a

domain should be predicted self-efficacy for that domain, creative self-efficacy, as well as by other variables. Creative self-efficacy was measured on a seven-point scale, and creativity was rated by supervisors using Tierney et al.'s (1999) six-point scale. Results were poor, with all independent variables explaining only 13% of the variance in a sample of manufacturing employees, and only 7% of the variance in a sample of operations employees. Further, when used in a hierarchical regression analysis, creative self-efficacy only accounted for a .01 increase in R^2, though creative self-efficacy had a zero-order correlation of .24 with creative performance. A follow-up study of 191 workers at a research and development unit of a Midwest chemical company (Tierney & Farmer, 2004) found similar results, with creative self-efficacy possessing a zero-order correlation of .29 with creativity and a principal axis factor analysis (PAF) loading of .35 on creative performance. Interestingly, both studies found negative correlations between task expertise and creative performance.

Choi (2004) proposed that two latent factors, creative self-efficacy and creative intention, mediate the expression of creativity. To test this, Choi surveyed 430 students at a business school. Unlike Tierney and Farmer (2002), but like Tierney and Farmer (2004), domain-specific self-efficacy was not measured. Creativity was measured as the instructor's judgment of a student's creativity. Choi's creative self-efficacy items captured the context, task, and domain of relevant tasks through questions such as "I feel confident that I can introduce new ideas to the class in a convincing manner" and "I feel nervous when I present different views to classmates" (p. 139). A confirmatory factor analysis (CFA) showed that creative self-efficacy explained 34% of the variance in creative

performance, while creative intention explained 24%. Creative personality did not explain any additional variation after other variables such as cautious personality were considered.

The role of creative self-efficacy was further described by Jaussi et al. (2007) in a study of 219 professional senior managers. Creative self-efficacy was measured using the Tierney and Farmer (2002) scale, and creative performance through co-worker evaluation using Zhou and George's (2001) scale. Other variables such as gender were also gathered. Creative self-efficacy shared a zero-order correlation with creative performance at work of only .15 ($p < .05$), and a hierarchical regression relationship of .16 ($p < .05$).

Gibbs (2009) examined entrepreneurship self-efficacy and creative self-efficacy in a study that was distributed to 1321 members of three societies of entrepreneurs. 232 of the approached entrepreneurs participated, for a response rate of 17.56%. Creative self-efficacy was measured with Tierney and Farmer's (2002) three-item scale, while entrepreneurial self-efficacy was measured through Chen, Greene, and Crick's (1998) 22-item scale. Creative self-efficacy was correlated with entrepreneurial self-efficacy ($r = .357$, $p < .01$), and negatively correlated with business experience ($r = -.152$, $p < .05$) and age ($r = -.138$, $p < .05$), but not related to gender.

Gong et al. (2009) examined creative self-efficacy as a mediating variable between learning orientation and creative performance in a study of 277 insurance agents. Gong and colleagues used Tierney and Farmer's (2002) four-item creative self-efficacy inventory. A measurement model which included only the creative self-efficacy items and one latent creative self-efficacy factor achieved close fit, $\chi^2(2) = 6.92$, RMSR= .02, CFI =

.99. Significant zero-order correlations for creative self-efficacy were found with learning orientation ($r = .37$, $p < .05$), gender ($r = .27$, $p < .05$), rank in the company ($r = .15$, $p < .05$), creativity ($r = .24$, $p < .05$), and supervisor-rated employee job performance ($r = .15$, $p < .05$).

Mathisen and Bronnick (2009) conducted an experimental *intervention* to improve creativity and creative self-efficacy. Using a measure of creative self-efficacy from Tierney and Farmer (2002), Mathisen and Bronnick exposed treatment groups to a creative performance training session, while a control group received no training. The intervention group improved in creative self-efficacy ($t(25) = 5.15$, $p < .001$) while the control group did not ($t(46) = 1.23$, $p = .227$). This pattern of results held whether the participants who received treatment were professional employees or students. Likewise, the benefits of the treatment were still apparent two months later.

Yang and Cheng (2009) analyzed the predictors of creative self-efficacy in a study of 94 Taiwanese information system analysts and information systems developers. The authors introduced a 5-point creative self-efficacy scale, derived from the work of Zhou and George (2001), which ranged from *not at all characteristic* to *very characteristic*. Example items were "The belief that I would suggest new ways to achieve goal or objectives" and "The belief that I would suggest new ways of performing work tasks" (p. 433). The scale was given to two samples, one from the population of system analysts and another from the population of information systems developers. In both samples creative self-efficacy was correlated with domain-specific IT skills and the centrality of

the developers' social networks. Additionally, among developers, creative self-efficacy was also correlated with computer self-efficacy and the strength of social ties.

Research into creative performance self-efficacy in authentic environments built on research into creative thinking test self-efficacy. The practical focus of many researchers in this stream, however, came at the price of decreased attention to the construction of standard self-efficacy-style instruments for measuring creative self-efficacy. Additionally, as with research into creative thinking test self-efficacy, research into authentic creative performance self-efficacy did not use the voices of participants to better understand the phenomenon of creative self-efficacy and only examined one dimension of creative self-efficacy. Fortunately, research into self-efficacy for creative performance in authentic environments is complemented by the strong focus on scale construction provided by early research into creative thinking test self-efficacy, the focus on the voices of the participants provided by open-ended research, and the subtlety that is afforded by research into multiple dimensions of creative self-efficacy.

Open-Ended Research into Creative Self-Efficacy

The most recent stream of research into creative self-efficacy to emerge uses qualitative methods to assist in open-ended research into creative self-efficacy. This research stream includes a purely qualitative study (Laws, 2003), as well as work that embeds a single quantitative measure inside an otherwise qualitative instrument (Lemons, 2006, 2009). As with all qualitative research, these studies benefited from the freedom of the researcher to use herself as a research instrument, and the focus on open-ended

exploration over testing a statistical hypothesis. These open-ended attempts to understand creative self-efficacy are now described.

Laws (2003) performed phenomenological research on creative self-efficacy in 12 research and development scientists. Laws focused on creative performance, “The production of novel and appropriate solutions to open-ended problems in any domain of human activity” (p. 16) and creative self efficacy, “an individual's beliefs in his or her ability to be creative in a given situation.” The study used in-depth interviews, documents, and the researcher's reflective journal as sources of evidence. Laws called for a quantitative follow-up to her study: “efficacy beliefs need to be measured in terms of particularized judgments of capability that could vary across a wide range of activity, under different levels of task demands within a given activity domain, and under different situational circumstances” (p. 32). She concluded that this task would require a multiple measures of creative self-efficacy. Therefore Laws, who appears to have been unfamiliar with Riley's (1999) dissertation, emphasized the need to understand multiple dimensions of creative self-efficacy before other researchers would further develop this theme.

Lemons (2006) studied creative self-efficacy through a multimethod study of 242 undergraduate students at a university in the American West. Creative self-efficacy was measured through one six-level item: “How creative do you think you are?” (p. 179). Apart from demographic information, the survey contained nine open-ended questions, such as ”Where does creativity come from?” and “How would you come up with an original idea for a class project by next week? What would you do?” Lemons reported major themes that emerged from the open-ended questions, including how students

experience being creative and what students believe about creativity. Lemons' studies foreshadow the present study, with its more rigorous combination of quantitative and qualitative methods.

Open-ended research into creative self-efficacy by Laws and Lemons has expanded the scope of research into creative self-efficacy from only focusing on explaining variation to building an understanding of the phenomenon of interest. The qualitative research adopted by Laws and Lemons is of course unable to test a hypothesis, identify causation, or measure the relationship between variables. However, the findings of open-ended research can complement quantitative findings and literature reviews in generating testable hypotheses. Therefore, after describing research into multiple dimensions of creative self-efficacy and qualifying the findings of these four streams of creative self-efficacy research, I present a high-level summary of the creative self-efficacy literature and propose specific testable hypotheses concerning creative self-efficacy.

Multiple Dimensions of Creative Self-Efficacy

The fourth stream examined creative self-efficacy as a motivational construct with multiple dimensions. Research in this stream implicitly rejects the notion of a general factor of creative self-efficacy, and instead implies that multiple dimensions of creative self-efficacy must be analyzed in order to have a full understanding of what mediates the expression of creativity in different times and places. This stream is composed of Riley's (1999) dissertation on the mental and physiomotor components of creative self-efficacy, Beghetto's (2006, 2007, 2009) work on the correlates of self-efficacy, Tan et al.'s (2008)

work on creative self-efficacy and affect, and Abbott's (2009a, 2009b) pilot studies into creative thinking self-efficacy and creative performance self-efficacy.

Research into multiple dimensions of creative self-efficacy was the first stream of creative self-efficacy research to emerge after the initial stream of research into creative thinking test self-efficacy. Riley (1999) pioneered this stream with his dissertation, which appeared chronologically midway between the last of the creative thinking test self-efficacy studies (Gist, 1989; Shack, 1989) and the next studies into multiple dimensions of creative self-efficacy (Abbott, 2009a, 2009b, 2009c; Beghetto, 2009; Tan et al., 2008). Tan and colleagues hypothesized two dimensions of creative self-efficacy relating to cognitive style and working style. Independently from Tan, Beghetto examined creative self-efficacy in the domain of science education. Following that, in three unpublished studies, I examined multiple dimensions of creative self-efficacy using both quantitative and qualitative methods (Abbott, 2009a, 2009b, 2009c).

Riley (1999) conducted a study on creative self-efficacy, which he defined as “a person's belief about their confidence level regarding an art activity in which they are participating” (p. 7). He used two small samples composed of 22 students in a recreational art class and 21 students in a recreational exercise class. Riley's creative self-efficacy instrument had two dimensions, following Tomas' (1964) conception of creativity as pertaining both to mind-set and hand-eye coordination, and contained a total of 47 questions that were evaluated on a 15-point Likert-type scale. Example statements on the mental ability sub-scale were “I find it easy to be creative” and “I am ashamed to express feminine interests (if man), or masculine interests (if woman), if so inclined.”

Example statements on the hand/eye ability subscale were “I have good hand-eye coordination” and “I have a steady hand” (p. 103). Students in the art group experienced a significant increase in creative self-efficacy (t = -2.216, p = .038), though no significant increase in creative self-efficacy was found for the exercise group.

Beghetto (2006) conducted research with 1,322 middle and secondary school participants to measure correlates of creative self-efficacy. Beghetto's creative self-efficacy inventory (BCSE) consisted of the three items: “I am good at coming up with new ideas,” “I have a lot of good ideas,” and “I have a good imagination” (p. 450). Creative self-efficacy was positively correlated with mastery orientation (r = .30, p < .01) and performance-approach orientation (r = .21, p < .01). In a follow-up study, Beghetto (2007) surveyed 1289 secondary school students and analyzed data using hierarchical regression. He found weak but statistically significant effects for age (β = -.001, p < .01) and gender (β = -.09, p < .001). More recently, Beghetto (2009) examined the effects of domain-specific creative self-efficacy with respect to science education in a study of 585 elementary students. Beghetto found correlations between creative self-efficacy in science and intellectual risk taking (r = .52, p < .05), science ability (r = .09, p < .05), and interest in science (r = .42, p < .05).

Tan et al. (2008) examined the relationship of creative self-efficacy and affect in a study of 389 high school students in Singapore. Creative self-efficacy was measured through Tan's (2007) creative self-efficacy instrument, which is an expanded version of Beghetto's (2006) Creative Self-Efficacy (BCSE) scale. This multidimensional instrument examined both creative self-efficacy for cognitive style and creative self-efficacy for

working style. No general factor of creative self-efficacy was measured. Both hypothesized dimensions of creative self-efficacy were positively related to positive affect, satisfaction with life, and subjective happiness, while both dimensions were negatively related to negative affect.

In Abbott (2009a), I interviewed four individuals who jointly maintained a collaborative informal journal, or *group blog*. I asked the individuals questions about their creative performance, creative performance self-efficacy, creative thinking, and creative thinking self-efficacy. The themes that emerged from this study appear as Table 2.1. Throughout the interviews, participants emphasized both the attractive joy of creative expression as well as the painful sacrifices that creative expression sometimes entailed. Interestingly, participants generally reported both high creative thinking self-efficacy and an external locus of control for creative thinking. While the qualitative design prevented generalization of findings to a larger population, the interview protocol used in this dissertation is an abridged version of the interview protocol from Abbott (2009a).

Abbott (2009b) conducted principal axis factor analysis (PAF) and confirmatory factor analysis (CFA) on data gathered from 189 undergraduates in educational psychology classes at a large Midwestern university. Abbott introduced two inventories, the CTSE I inventory to measure creative thinking self-efficacy and the CPSE I inventory to measure creative performance self-efficacy. The four hypothesized factors of CTSE (elaboration, flexibility, fluency, and originality) and the three hypothesized factors of CPSE (domain, field, and personality) emerged from the PAF. Abbott then used CFA to test rival alternative models of CTSE and CPSE. The Optimized CTSE model achieved

close fit, $\chi^2(18) = 42.27$, $p < .001$, CFI = .98, RMSEA = .09, SRMR = .07. The Optimized CPSE model achieved exact fit, $\chi^2(11) = 12.04$, $p = 0.3609$, CFI > .99, RMSEA = .02, SRMR = .02. However, these results may be overfitted as these models were analyzed for their fit in only one study. The CTSE II and CPSE II inventories that were presented to participants for the present study are modifications of the CTSE I and CPSE I inventories first presented in Abbott (2009b).

Table 2.1
List of Themes, Codes, and Elements from Abbott (2009a)

Theme	Codes	Elements
The Joy of Creativity	Humor, Joy, Personality	Joy
The Ideal of Creativity	Confidence, Connections, Critical Thinking, Desire, Masculinity, Models, Nature, Problem solving, Recognition, Resistance, Reverse models	Motivated, Negative models, To be born with, To be desired,
The Expression of Creativity	Bursts/workstyle, Collaboration, Domain, Experienced, Practice, Writing	Collaboration, Experience, Writing
Creative Thoughts	Connections / doubt, Convergences, Discussions, Divergences, Multiple perspectives	Inner life, Mental connections, Multiple perspectives
CTSE	CTSE, Experience, Focus	Locus of control, Unidimensionality
Creative Performance	Creative Performance, Experience, Field, Goals, Mediator, Proper fit, Recognition, Skills / ability	Mediation, Recognition, Social situation
CPSE	CPSE, Focus, Overconfidence, Production	Easy, Powerlessness, Multidimensionality
The Pain of Creativity	Desire, Discouragement, Doubt, Efficacy, Locus of control, Lonely, Need for research, Worry	Alone, Curious

Note. This table presents the themes, codes, and elements that emerged in the qualitative pilot study (Abbott, 2009a). While Abbott (2009a) was conducted simultaneously to the quantitative pilot study (Abbott, 2009b), no mixed methods analysis was conducted.

In a study that parallels this dissertation (Abbott, 2009c), I analyzed the data sets generated by my quantitative pilot study as well as by the present study for the presence of multiple latent classes of individuals, based on their responses to items from the CTSE I, CPSE I, CTSE II and CPSE II creative self-efficacy inventories. This was the first work known to this researcher to empirically test for the presence of multiple classes of *individuals* based on their levels of creative self-efficacy, though the results of the tests did not lead to a clear solution. While Akaike's (1973) Information Criterion (AIC) indicated a slight increase in parsimony when a two-class as opposed to one-class solution for the data was tested for, and for a slight increase in parsimony in a three-class solution as opposed to a two-class solution, these results did not lend themselves to a clear interpretation. Therefore, I concluded there was at present no firm evidence for the presence of multiple types of creative self-efficacious individuals in the data from my quantitative pilot study and this present study.

Qualifications of the Findings of Existing Creative Self-Efficacy Research

The findings of the studies in these fourth streams of research in creative self-efficacy should be qualified in two ways. First, no research except for my own has used a response width in line with Bandura's (2006) recommendations. Second, no research except my own has attempted to clarify how creative performance self-efficacy might relate to creative thinking self-efficacy. These qualifications are now discussed.

Inappropriate Response Width. First, I would argue that the response width of most creative self-efficacy scales used thus far has been problematic. Bandura (2006) provided several guidelines for constructing measures of self-efficacy, including the

recommendation to measure self-efficacy on a hundred point scale. Empirical work has demonstrated that self-efficacy scales with a larger interval range predicts performance better than self-efficacy scales with smaller interval ranges (Pajares, Hartley, & Valiante, 2001). Further, the performance of shorter self-efficacy instruments may be unstable, as Smith, Wakely, de Kruif, & Swartz (2003) present evidence that, at least in one case, a 10 item self-efficacy instrument is even worse than a 4 item self-efficacy instrument. However, no work on creative self-efficacy, apart from my quantitative pilot study (Abbott, 2009b), has been conducted with such a response width. Early research on creative self-efficacy was conducted with binary scales (Locke et al., 1984), while Tierney and Farmer (2002, 2004) used seven-point scales and Riley (1999) used a fifteen-point scale. Many studies did not explicitly report the response width of the creative self-efficacy scales used.

Unclear Conceptualization. Second, to this researcher at least, it is not clear what the instruments used in the studies to operationalize creativity are measuring. For instance, Tierney and Farmer (2002, 2004) used ratings provided by work supervisors to measure creativity, while Jaussi and colleagues (2007) used co-worker rankings. Though such measures likely reflect popularity or charisma, it is not clear if they measure CTSE (the employee's self-efficacy for fluency, originality, and so on), CPSE (the employee's self-efficacy for mastery of a domain, accessing of a field, and creative personality), both, or neither. If there are two dimensions of creative expression, creative performance and creative thinking, there should be two dimensions of creative self-efficacy, CPSE and CTSE. Except for my own research into multiple dimensions of creative self-efficacy

(Abbott, 2009a, 2009b), however, no research has been conducted to understand the relationship between CPSE and CTSE.

The Need for Further Study

These shortcomings highlight the need for studies with self-efficacy inventories that possess sufficient response width that have clear statements of what they are measuring. Fortunately, each of these milestones is within sight. While self-efficacy measures should be constructed with care, Bandura (2006) has provided clear guidance for how to do so. Likewise, creative thinking and creative performance have been described in sufficient detail by such theorists as Torrance (1966, 1972, 2004, 2008) and Csikszentmihalyi (1996) to allow the construction of creative self-efficacy inventories that incorporates the appropriate dimensions and factors. My quantitative pilot study (Abbott, 2009b), for example, provided measures that captured the appropriate factors of creative thinking self-efficacy with the CTSE I inventory and creative performance self-efficacy with the CPSE I inventory. Using these resources, the construction of improved creative self-efficacy inventories could be conducted in a straightforward manner.

The Latent Structure of Creative Self-Efficacy

To this point, I have outlined the general characteristics of creativity, presented an overview of research on motivation for creative expression, including the self-beliefs tradition in general and creative self-efficacy in particular. I have described the most potent social cognitive construct used to study motivation for creative expression: creative self-efficacy. I then grouped studies of creative self-efficacy into four major streams—research on creative thinking test self-efficacy, research on self-efficacy for

creative performance in authentic environments, open-ended research into creative self-efficacy, and research on multiple dimensions of creative self-efficacy—and presented some qualifications of the findings of these studies. I now present a synthesis of the reviewed literature, focusing on the implications for capturing and understanding the latent structure of creative self-efficacy and developing new inventories for measuring creative self-efficacy.

The Dimensions of Creative Expression

As we have seen, creativity can be expressed in at least two dimensions, creative thinking and creative performance. Pioneering work on creative thinking began appearing soon after Guilford's (1950) presidential address, and was extensively developed through the Guilford and Torrance tests of creative thinking (Christensen & Guilford, 1957a, 1957b, 1958a, 1958b; Christensen, Merrifield, & Guilford, 1958; Guilford 1967, Torrance, 1966, 1972, 2004, 2008). The study of creative performance emphasized emphasis on the importance of mastery of a domain, access to a competitive field, and the role of personality (Csikszentmihalyi, 1996; Gardner, 1994; Nakamura & Csikszentmihalyi, 2001; Runco, 2008). Thus, the study of creative performance complements the study of creative thinking, by examining factors apart from creative thinking that lead to recognition.

The Dimensions of Creative Self-Efficacy

In the social cognitive perspective, each dimension of creative expression is an ability that can be motivated, analogous to other states that are mediated through self-efficacy such as self-regulation (Bandura, 2007) or metacognition (Coutinho, 2008). For

each dimension of creativity, there should be an analogous construct of creative self-efficacy. I have already identified creative thinking and creative performance as two dimensions of creative expression. Therefore, I would argue there similarly should be at least two dimensions of creative self-efficacy, CTSE and CPSE, and that a unique measure should be created for each.

The Factors of Creative Self-Efficacy

Instruments for measuring the two dimensions of creative self-efficacy, CTSE and CPSE, can be constructed along the lines presented by Bandura (2006) and their design informed by the theorized latent structure of creative thinking and creative performance. Creative thinking is generally viewed as composed of elaboration, flexibility, fluency, and originality (Torrance, 2008, but see Silvia et al., 2008b). Creative performance, in contrast, is generally viewed as dependent on the domain an individual works in, the field an individual works with, and that individual's personality (Csikszentmihalyi, 1996).

A Measurement Model for Creative Self-Efficacy

I therefore have proposed that a measurement model for creative self-efficacy inventory should include inventories for at least two dimensions of creative self-efficacy, creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE). CTSE and CPSE are expected to be correlated, but remain as distinct constructs. CTSE should be expressed through four latent factors (elaboration, flexibility, fluency, and originality). CPSE should be expressed through three latent factors (domain, field, and personality). These seven latent factors should each be identified by several manifest indicators, or questions. The Revised model of the CTSE II and CPSE II inventories

developed in the methodology section of this dissertation uses some indicators which appeared in the quantitative pilot study (Abbott, 2009b), as well as other items which are new to this study. A simple visualization of the Revised model appears as Figure 2.1.

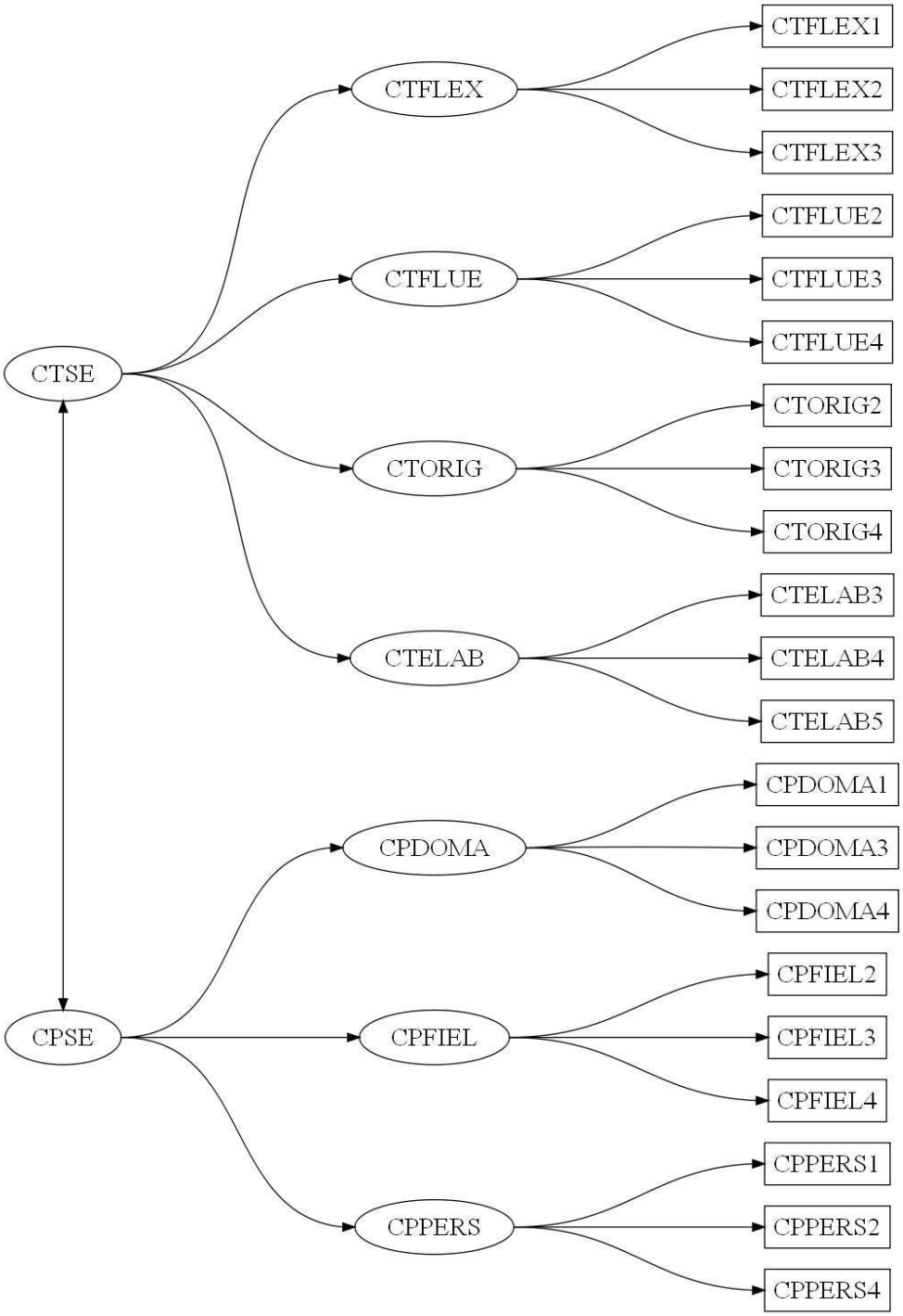
Hypothesis 1 and Hypothesis 2

Consistent with this conceptualization, this study's first research question, "What is the latent structure of creative self-efficacy," is operationalized by testing the performance of the Revised model as described in the methodology chapter. This requires testing the performance of the Revised model against Hu and Bentler's (1999) criteria, as well as testing the performance of a rival model that includes a general factor of creative self-efficacy.

H1: The Revised Model of the CTSE II and CPSE II Inventories is supported by data and provides adequate psychometric evidence

Hypothesis 1 would be judged as supported if the tests of close model fit described by Hu and Bentler (1999) were passed. These tests are the Comparative Fix Index or CFI (Bentler, 1988), the Root Mean Square Error of Approximation or RMSEA (Browne & Cudeck, 1993), and the Standardized Mean Square Square Residual or SRMR (Jöreskog & Sörbom, 1981). Specifically, the hypotheses is judged to be supported if the three following criteria–CFI > .95, RMSEA < .06, and SRMR < .09–were passed.

Figure 2.1
Visualization of the Revised Model



Note. CPSE, refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. A description of the manifest indicators appears in Table 3.1.

H2: There is no General Factor of Creative Self-Efficacy

Additionally, the issue of the presence of a general factor of creative self-efficacy was addressed by this study. The question is an empirical one, and refers to whether parsimony is improved through estimating a latent factor of which both CTSE and CPSE are indicators. As creativity is not expressed directly, but only through dimensions such as creative thinking and creative performance, the third hypothesis was that There is no General Factor of Creative Self-Efficacy. This hypothesis is judged as supported if the parsimony for the rival alternative model with a general factor of creative self-efficacy was worse than the parsimony for the Revised model. These two hypotheses are in keeping with the purpose of this study, which is to further develop an inventory for measuring creative self-efficacy. That is, this dissertation does not test the efficacy of an experimental program in changing the level of creative expression. Rather, this study is part of a program of research in which the end goal is development of a reliable measure of creative self-efficacy so that such an experimental manipulation can be conducted.

Personality and Other Variables

In this section I describe concepts other than motivation that affect the expression of creativity. I first discuss the Five Factor Model of personality, with special attention to openness to experience. Second, three other variables, experience, mood, and gender, are examined. Following this overview, I present two hypotheses designed to test the nomothetic span of the Revised model.

The Five Factor Model of Personality

Just as Guilford's APA Presidential Address arguably began the scientific study of creativity, the modern study of personality often has been judged to have begun with Thurstone's (1934) APA Presidential Address. Over time psychologists converged on the Five Factor Model (FFM) of personality, in which variation in personality is measured in terms of five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Goldberg, 1999; McCrae & John, 1992). The large body of personality and creativity research includes several meta-reviews that have established that openness to experience is the factor of personality most reliably related to creativity (Batey & Furnham, 2006; Silvia et al., 2008b).

Openness to Experience

The relationship between openness to experience and creativity is the best established connection between personality and creativity. McCrae (1987), for example, found that openness to experience was a significant predictor for five of six creative thinking tests: Associated Fluency I Form A (Christiensen & Guilford, 1957a), Expressional Fluency Form A (Christensen & Guilford, 1958a), Ideational Fluency Form A (Christensen & Guilford, 1957b), Word Fluency Form A (Christien & Guilford, 1958b), and Remote Consequences (Christensen et al., 1958), though not the Remote Consequences test (Christensen et al., 1958). A consistent pattern of significant relationships emerged between openness and creativity on multiple measures of creativity, including self-reports, peer ratings, and spouse ratings from the NEO personality inventory (Costa & McCrae, 1985), among other instruments. Replication of

the significant correlation between openness to experience and creativity has been achieved by Carson et al. (2005), Hirsh and Peterson (2008), Prabhu et al. (2008), Silvia et al. (2008b), and others.

Conscientiousness

While openness to experience appears to be associated with creativity, the role of consciousness seems more contextualized. George and Zhou (2001) presented evidence that under conditions of meaningful feedback and clear goals openness to experience predicted creative behavior, though under conditions of close monitoring and poor communication low conscientiousness predicted creative behavior. Feist's (1998) meta-review likewise found a modest negative effect of conscientiousness on creativity among scientists (Cohen's d = .30). Similarly, Silvia et al. (2008b, Study 2) found a negative relationship between conscientiousness and creative thinking (B = -.297 to -.464), in addition to the expected relationship between openness and creative thinking (B = .306 to .586). Among artists the effect of lack of conscientiousness was even larger (d = .75).

Extraversion

Feist (1998) demonstrated the importance of extraversion among creative scientists. In examining studies that compared creative versus less creative scientists, he discovered the effect of extraversion was d = .39, even larger than the effect of openness to experience, d = .31. Over 29 studies of creativity among artists, the effect sizes were d = .15 for extraversion and d = .01 for lack of extraversion. Feist qualified his findings by noting that the effect of extraversion on creative performance decreased over time. Additionally, Cheek and Stahl (1986) demonstrated that shyness led to a decrease in

creative performance when either self-consciousness or external evaluation become salient.

Agreeableness

Agreeableness may be weakly linked to creativity. King, Walker, and Broyles (1996) conducted a study of seventy-five undergraduates that measured creative thinking with the Torrance Tests of Creative Thinking (Torrance, 1990). Creative performance was measured by asking participants to list creative accomplishments, such as "make up my own recipes" and "designing my own stationary." Creative performance correlated with agreeableness ($r = -.23$, $p < .05$). This result, however, did not involve any rating of level of mastery of a domain or acceptance by a field, and has not been replicated by other researchers.

Neuroticism

The relationship between neuroticism and creativity is not clear. Feist (1998) found only one significant connection between neuroticism and creative performance– lack of neuroticism correlated with creative performance among scientists. The difference interacted with gender ($r = .36$, $p < .05$) and age ($r = -.34$, $p < .05$). Upmanu, Bhardwaj, and Singh (1996) conducted a factor analysis of a survey of 250 male graduate students, and identified verbal creativity (Torrance, 1996) as the first extracted factor and neuroticism (Cattell & Scheier, 1963) as the second. Neither a raw correlation matrix nor a factor correlation matrix was provided, however, so the interpretability of these findings is limited.

The Value of the Five-Factor Model

Since the emergence of the Five Factor Model of personality (McCrae, 1987), the study of what Guilford (1950) called *temperament* has developed a solid theoretical foundation. Any motivational study of creativity must be aware of the power of openness to experience to explain variation in creativity and creative expression. If this is not done, instruments may be created that have both construct and predictive validity, but have findings that might be equally well explained in terms of personality without recourse to motivation. Measures of creative self-efficacy, especially, may suffer from such a confusion. The dangers of such a possibility can be quickly shown by merely restating the empirical correlates that Feist (1998) found to the openness to experience construct of the five factor model: “Aesthetic, achievement via independence, change, creative, curious, flexible, humorous, imaginative, intelligent, open, open-minded, original, sensitive, sophisticated, wide interests” (p. 293).

Specific praise here should be given to Joy (2004), who constructed the vDiffer scale to measure the subjective need to be different. The vDiffer has been shown to correlate with openness to experience ($r = .67$, $p < .001$) and conscientiousness ($r = .23$, $p < .05$) in a study of 90 undergraduates. In Experiment 5, conducted with a sample of 76 undergraduates, Joy found that the vDiffer scale had a zero-order correlation of .36 ($p < .01$) with creative thinking as measured by Joy's Changes in Society test. Joy's work shows how researchers can examine both personality and motivational variables in understanding creativity.

From a theoretical perspective, the relationship between creativity and openness to experience nonetheless presents a challenge. A measure of motivation for creative expression that does not correlate strongly with openness to experience will be suspect. Such a result would seem to contradict the growing personality literature on the important of openness. At the same time, a measure which correlates too closely with openness to experiences may not have enough unique variance to yield meaningful predictions after the variation explained by openness to experience is factored out. Additionally, there is a risk of conceptual confusion, as openness to experience is a trait while creative self-efficacy is a state.

Investigators must take care to design and use sophisticated modeling tools, such as CFA (Kline, 2005; Worthington & Whitacker, 2006), to study creative self-efficacy. Likewise, qualitative data analysis ideally should have a role in post-hoc analysis of the results to help understand the quantitative findings (Creswell & Plano Clark, 2007), especially in fields of research—such as creative self-efficacy—where the confirmatory literature is not fully developed. A careful, mixed methods study of motivation for creative expression is needed.

Other Variables

In addition to personality, three other aspects of individuals have been shown to exert at least some influence on creativity or creative expression – experience, mood, and gender differences. Experience impacts creative expression by providing constraints and a frame for creative and intellectual development (Audia & Goncalo, 2007; Diakidoy & Constantinou, 2001). Mood is an established subfield of psychology in which affective

states described in terms of hedonic tone, activation, and regulatory focus may promote creative expression (De Dreu & Nijstad, 2008). Finally, research on gender differences has investigated gender-related differences in creative expression (Baer, 1997; Gong, et al., 2009; Griskevicius et al., 2006; Oral, Kaufman, & Agars, 2007). Unfortunately, research has not converged on understanding when or how these constructs correlate with creative expression.

Experience

Experience in the context of creative expression can be conceptualized in two ways: experience in the domain in which creativity is expressed, and experience in expressing creativity. Experience in the domain in which creativity is expressed was studied by Diakidoy and Constantinou (2001). Diakidoy and Constantinou used a twelve-item inventory of prior knowledge of physics in a study of 54 education majors to predict the creativity of answers to ill-defined problems. Prior knowledge was negatively correlated with the number of valid responses ($r = -.22$, $p < .01$), but not with the originality of responses. Similarly, experience in expressing creativity was studied by Audia and Goncalo (2007). The authors found that, among inventors in the hard drive industry, prior success positively predicted future incremental contributions and negatively predicted future breakthroughs.

Mood

The study of the effects of mood on creative expression has been an active research area since the first studies of creativity and mood in the early 1980s. De Dreu and Nijstad's (2008) meta-review of the literature divided the study of mood into research

comparing positive to neutral moods, negative to neutral moods, and positive to negative moods. Further, three conceptualizations of the effects of mood on creativity are presented: hedonic tone, activation, and regulatory focus. In hedonic tone, "all positive moods (relaxed, happy) will promote creativity, whereas all negative moods (sad, fearful) will not" (p. 794). In activation, "all activating moods (fearful, happy) will promote creativity and that deactivating moods (sad, relaxed) will not." In regulatory focus, "activating and promotion-focused moods will enhance creativity, whereas activating and prevented-focused moods will impede creativity." However, there is neither agreement on which mood states nor which conceptions of mood are best for encouraging creativity or motivation for creative expression.

Gender Differences

The study of gender differences with regard to creative expression generally shows gender as a moderating variable that influences creative expression differently depending on the context. Baer (1997) used poetry-writing and story-writing in an experimental study where levels of extrinsic reward and evaluation were manipulated. In the study of 128 eighth-grade students, a motivation-by-gender interaction effect was observed ($F(1,378) = 6.999$, $p = .01$, MSE not reported). While little difference was observed depending on whether intrinsic or extrinsic reward was used for boys, a difference of half a standard deviation was observed for girls. Additionally, Oral et al. (2007) reported gender differences in creative expression in the absence of motivational manipulation (stepdown $F(3,308) = 21.00$, $p < .01$, MSE not reported), though the

authors discuss this in the context of other studies that did not find such an effect of gender differences.

Studies have not converged on the relationship between creative self-efficacy and gender differences. Schack (1989) failed to find a significant effect of gender differences on creative self-efficacy, and Beghetto (2007) found only a weak relationship, (β = -.09, p < .001). Gong et al. (2009) reported a zero-order correlation between gender differences and creative self-efficacy of r = .27 (p < .05), however, though the meaning of this finding was not discussed in the article text.

The Additional Value of Other Variables.

The role of these other variables in the study of creative expression is problematic. Specific hurdles stand in the way of researchers who seek to investigate the role of experience, mood, or gender differences with respect to creative expression. It is clear that some domain-specific knowledge is required for creative expression. Most artists have an in-depth knowledge of their field, and even celebrated "outsider" artists spend years at their craft (Bonesteel, 2000). At the same time, research points to only a qualified relationship between experience and creative expression (Audia & Goncalo, 2007; Diakidoy & Constantinou, 2001). Similarly, there is no theoretical agreement over how mood affects creativity, or whether it would operate through hedonic tone, activation, or regulatory focus (De Dreu & Nijstad, 2008). Finally, while gender differences often appear in creativity research, understanding of how and where these differences will manifest is still being built. Therefore, while personality research indicates that openness to experience is consistently associated with creative expression,

research on other variables do not converge on any reliable predictors of creative expression.

Hypothesis 3 and Hypothesis 4

The second research question is, "What is the relationship between creative self-efficacy and variables known to be related to creativity." This study's review indicated that, among all the other variables discussed, openness to experience was the additional factor most likely to be related to creativity. The second research question, therefore, was operationalized by testing the significance of the correlation of creative self-efficacy and openness to experience, as well as to another measure of creative self-efficacy, Beghetto's Creative Self-Efficacy (BCSE) construct.

H3: Beghetto's Creative Self-Efficacy (BCSE) construct is related to Creative Self-Efficacy

H4: Openness to Experience is related to Creative Self-Efficacy

The model from Hypothesis 1 is modified, so that items from the openness to experience and BCSE scales indicate openness to experience and BCSE factors, respectively, instead of being modeled as saturated correlates. The model is tested against Hu and Bentler's (1999) criteria, and the latent correlations between BCSE, openness to experience, CTSE and CPSE is examined. Hypothesis 3 is judged to be supported if all zero-order correlations between BCSE and all latent factors of creative self-efficacy are significant at the $p < .05$ level. Hypothesis 4 is judged to be supported if all zero-order correlations between openness to experience and all latent factors of creative self-efficacy are significant at the $p < .05$ level.

Summary

This literature review was intended to serve three purposes. First, it discussed what creativity is, describing both the general characteristics of creativity and how creative expression relates to personality and other variables. Second, this review attempted to synthesize the literature on creative self-efficacy in the context of research on motivation for creative expression. Third, this literature review highlighted several gaps in the creative self-efficacy literature through an analysis of the distinctive features of four streams of research into creative self-efficacy, and how the affordances of the four streams complemented each other. The findings of the streams was qualified, however, by noting that most inventories currently in use do not possess appropriate response widths and do not clearly relate to one another. The need for a creative self-efficacy instrument that is responsive to these deficiencies is clear.

To this point, four hypotheses have been put forward for the present study.

H1: The Revised Model of the CTSE II and CPSE II Inventories is supported by data and provides adequate psychometric evidence

H2: There is no General Factor of Creative Self-Efficacy

H3: Beghetto's Creative Self-Efficacy (BCSE) construct is related to Creative Self-Efficacy

H4: Openness to Experience is related to Creative Self-Efficacy

Two additional hypotheses now are presented, along with a discussion of the expected findings from the qualitative portion of this study.

Hypothesis 5 and Hypothesis 6

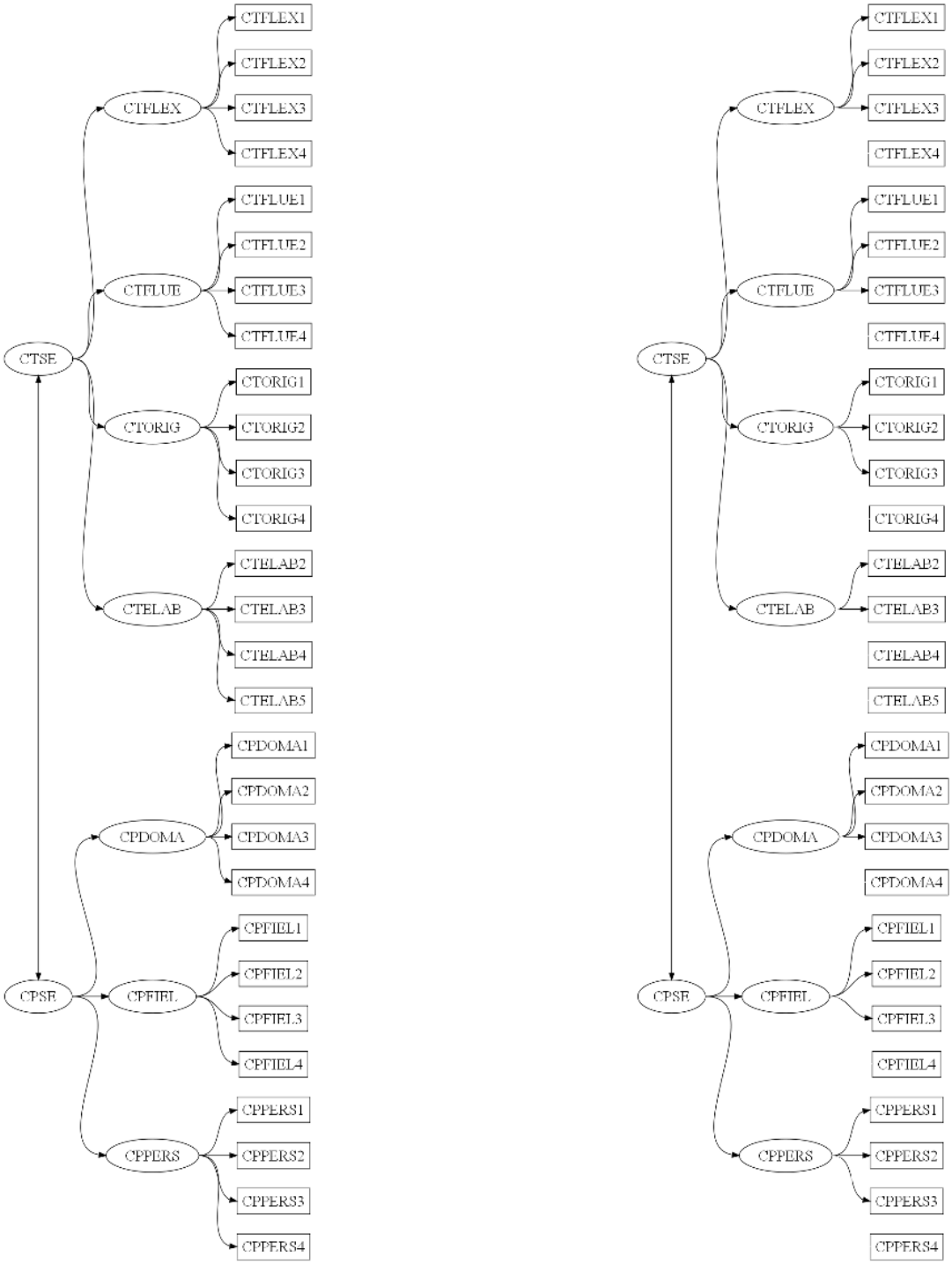
Hypotheses 5 and 6 relate to the third research question, "Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?" This was operationalized by comparing the model fit of the Revised model with several rival alternative models, as described in the methodology section. These hypotheses were:

H5: The Revised model better reproduces the observed covariance matrix than the two theoretically justified rival alternative models

H6: The Revised model reproduces the observed covariance matrix no worse than the empirically justified rival alternative model

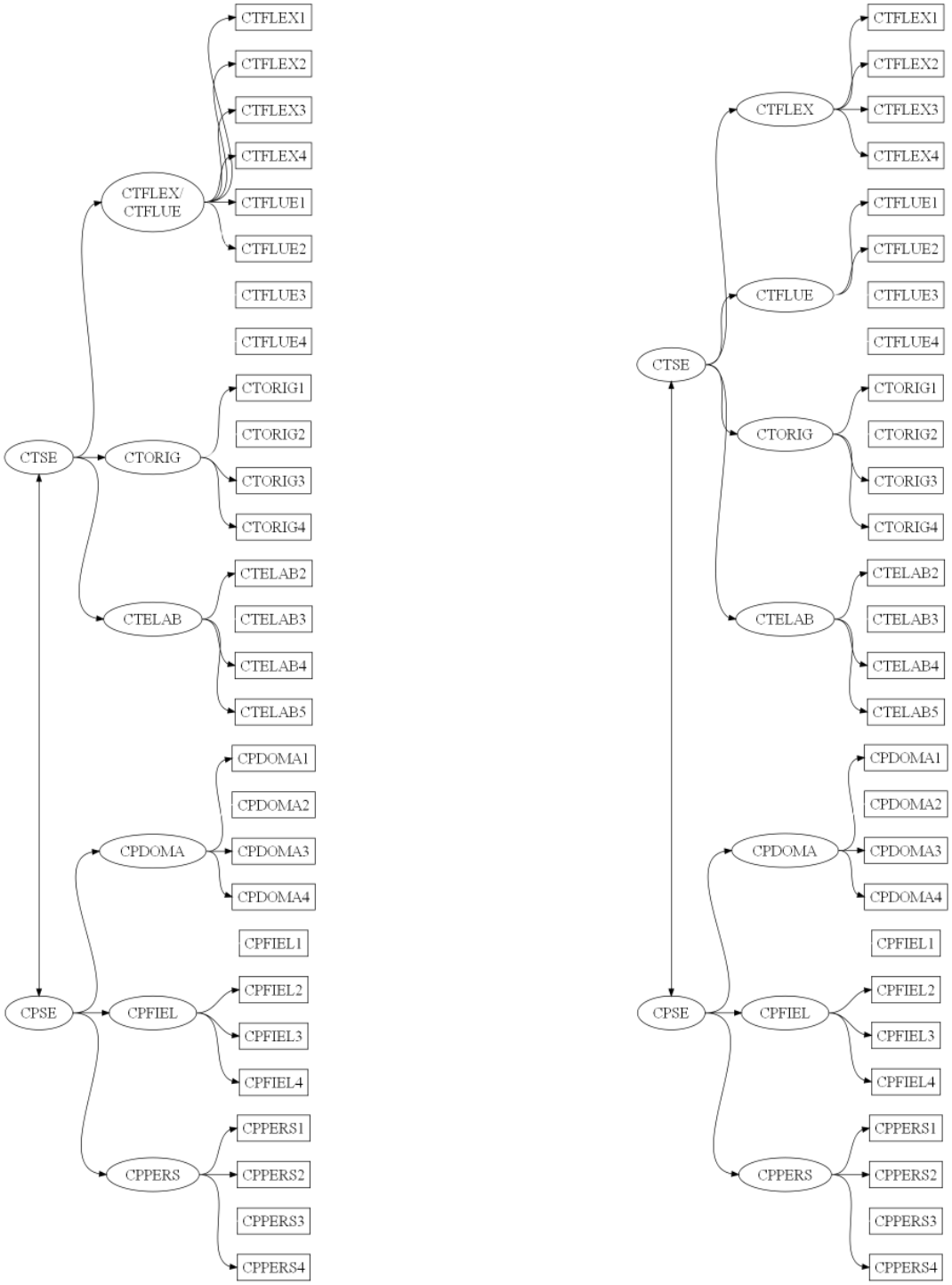
The model from Hypothesis 3 is modified. From this two rival alternative models are formed, the Held model which includes only those items that also appeared in Abbott (2009b)), and the All model, which includes all items presented to participants in this study. These models were formed by varying which items that are saturated correlates, and which items indicate latent factors of CTSE and CPSE. The performance of these models was determined, using Hu and Bentler's (1999) criteria. Additionally, the parsimony of the models was determined using Akaike's (1973) Information Criterion (AIC) Hypothesis 5 is judged to be supported if the Revised model is more parsimonious than either theoretically justified rival model. Hypothesis 6 is judged to be supported if the Revised model is more parsimonious than either empirically justified rival model. A visualization of the All and Held models appears as Figure 2.2, and a visualization of the Implied Structure and Implied Indicators models appears as Figure 2.3.

Figure 2.2
The Theoretically Justified Models



Note. From left to right, this figure shows the theorized latent structure of the CTSE II and CPSE II inventories in the All and Held models. The All and Held models are theoretically justified rival alternative models.

Figure 2.3
The Empirically Justified Models



Note. From left to right, this figure shows the theorized latent structure of the CTSE II and CPSE II inventories in the Implied Structure and Implied Indicators. The Implied Structure and Implied Indicators models are empirically justified rival alternative models.

Expected Qualitative Findings

The fourth and final research question was, "How do the themes that emerged from qualitative interviews provide context for the latent structure of creative self-efficacy?" As this research question relates to qualitative research, no hypothesis can be generated from it. Rather, answers to this research question were explored through the voices of the participants. Following this exploration, the themes that emerge are described in the context of the loadings, composite validity, and themes of the factors and dimensions of creative self-efficacy. In the discussion chapter at the end of this dissertation, these themes are used to hypothesize an extension of the nomothetic span of creative self-efficacy.

CHAPTER III

METHODOLOGY

This study utilized an explanatory mixed-methods design, a two-staged approach that begins with quantitative analysis and continues on to a qualitative follow-up. The reasoning behind such a design has three parts. First, the choice of a mixed methods design, as opposed to simply a quantitative or qualitative design, is explained. Second, four major types of mixed methods designs are outlined. Third, the decision to use the two-stage explanatory approach is presented. After the need for an explanatory mixed methods design is justified, the specific methods of the study's quantitative and qualitative phases are addressed.

Justification for Mixed Method Design

Mixed methods research is most useful when both quantitative and qualitative approaches have weaknesses that leave those designs independently as non-ideal approaches but quantitative and qualitative approaches, in combination, can offset those weaknesses. As part of the argument that a mixed methods approach is best for this study, the defining features of quantitative and qualitative research are described, followed by a discussion of the weaknesses of each. After this, a justification of why the mixed methods approach is best for answering the study's central research questions is presented.

Quantitative Methods

Quantitative research is concerned with the mathematical relationship of at least two variables. One variable, which is sometimes called the predictor in observational research and the independent variable in experimental research, is assumed to explain

variance in another variable, sometimes called the criterion or dependent variable, respectively. After data is collected, the quantitative researcher often analyzes the data in accordance with a predetermined design. In general, quantitative research is confirmatory research, in which the researcher either rejects or fails to reject a null hypothesis.

The greatest benefit of quantitative research is that it can be fit to generally accepted scientific methods. That is, quantitative research allows the researcher to test models, reject ones that do not work, and demonstrate that one model is superior to another (Popper, 1963). Quantitative research can result in presumably objective results that are less subject to argument than qualitative research. Additionally, quantitative research allows results to have a measurable precision and accuracy. These qualities lead to a further benefit. Quantitative methods often are preferred by grant-funding agencies because researchers can demonstrate the practical effect of new treatments that other, skeptical researchers can test and verify using the same methods and instruments.

Qualitative Methods

Qualitative research is concerned with understanding a phenomenon. Several characteristics of qualitative research are that it occurs in a natural setting, includes the perspective of participants, uses the researcher as a data-gathering instrument who is personally engaged with the participants, and has a design which can change as new perspectives become available (Hatch, 2001). Qualitative research is an exploratory method in which discovering and understanding a phenomenon is more important than establishing a statistical relationship between two sets of variables (Creswell & Plano Clark, 2007). Further, because qualitative research focuses on describing and

understanding rather than generalizing, information about participants, research location, and so on is included in the main narrative rather than in a separate section.

The main benefit of qualitative research, however, is that while quantitative research can produce information about the manifestation of a phenomenon, qualitative research can assist in understanding the phenomenon. Many research questions cannot be completely answered through quantitative analysis alone. The identification of mediation and moderation, for instance, requires both a model to have certain statistical properties and for the proposed solution to make theoretical sense. Qualitative research can complement reviews of the literature in providing the understanding required to make such theoretical judgment calls.

Choice of Mixed Methods

Considering the present study's purpose statement and research questions, either a quantitative or a qualitative approach alone would be inappropriate. The goal of this study, to develop a measurement model for measuring creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE) using the CTSE II and CPSE II inventories, cannot be achieved by exclusive reliance on qualitative or quantitative designs. The qualitative approach is clearly insufficient, as scales are intended to be used in quantitative situations, and the contemporary literature on scale development heavily emphasizes the quantitative approach (Worthington & Whittaker, 2006). However, the development of a creative self-efficacy inventory also requires a theoretical understanding derived from qualitative analysis that is not currently present in the literature.

The development of any new creative self-efficacy inventory ideally should capture the strengths of existing streams of research into creative self-efficacy. Such streams include the stream of research into creative thinking test self-efficacy (e.g., Gist, 1989), research into authentic creative performance self-efficacy (e.g., Tierney & Farmer, 2002, 2004), open-ended research into creative self-efficacy (e.g., Laws, 2005; Lemons, 2006, 2009), and research into multiple dimensions of creative self-efficacy (Beghetto, 2009; Abbott, 2009a, 2009b, Riley, 1999; Tan et al., 2008). Therefore, a mixed methods approach is appropriate.

Mixed methods research, however, is more than simply conducting a quantitative study alongside a qualitative study. There are several types of mixed methods designs, each of which are suited to different research intentions. These designs are now discussed, and one—the two-stage explanatory mixed-methods design—is selected as the most appropriate design for this dissertation.

Major Types of Mixed Methods Designs

Creswell and Plano Clark (2007) have categorized mixed methods research into four broad designs: *triangulation design*, *embedded design*, *explanatory design*, and *exploratory design* (p. 59). The choice of design depends on the purpose and intention of the researcher. In turn, the choice affects the procedures that will be used to implement the design. Each of these designs has accumulated variants in the literature, as the intentions of researchers using the designs often differ. Additionally, each of these designs also present unique challenges.

Triangulation Design

The triangulation design is used to compare, contrast, validate, or explain quantitative results together along with qualitative results (Creswell & Plano Clark, 2007). Triangulation is a mixed methods design with a purpose of better understanding a phenomenon of interest by viewing it from the perspective of multiple methods. In the triangulation design, the methods used are assumed to be equally important or valid in building understanding. The data may be analyzed in multiple ways until the quantitative and qualitative findings converge.

Procedures. The triangulation design occurs in one phase. That is, while the physical collection and analysis of quantitative and qualitative data may occur at different times, the quantitative and qualitative data are interpreted together at the same time. This is true whether the raw quantitative and qualitative data are interpreted together, as in the classical triangulation design; whether the quantitative and qualitative data are first analyzed into results which are then analyzed together, as in the *converge model*; whether the qualitative data is coded into quantitative data first, as in the *data transformation model*; or whether the data is analyzed with a view towards validating quantitative results, as in the *validating quantitative data model* (p. 62-63).

Benefits. The triangulation design is the most intuitive mixed methods design and was also the first mixed method design to emerge. The triangulation design is efficient and requires few new techniques. It is efficient because there is only one phase, so the design itself adds little overhead. Quantitative and qualitative data also can be collected and analyzed at separate times within a single phase.

Challenges. There are two general drawbacks to the triangulation design, the first of which can be known before the research is complete, and the second of which can only be known after. The first is that it requires the researcher to be knowledgeable of both quantitative and qualitative methods to an equal extent, as the quantitative and qualitative results are weighted equally. Many researchers are primarily trained in only one of these methods and so are challenged in implementing the triangulation design. Additionally, the triangulation design's ability to present the same phenomenon from different perspectives can cause problems if the qualitative and quantitative analyses do not converge. For instance, if a quantitative analysis implies that a treatment is worthwhile, but the qualitative analysis does not lead to this conclusion, additional data will need to be collected or else existing data has to be reexamined.

Embedded Design

In the embedded design, analysis in one method is used to complement analysis in another method. The embedded design is used to include qualitative analysis within a quantitative study, or vice versa (Creswell & Plano Clark, 2007). In the embedded design, one approach (quantitative or qualitative) is given precedence and the other is used as a tool to help answer some question generated by the more important approach. That is, the results of the lower priority design would not have use or meaning without the results of the higher priority design.

Procedures. Data collection and analysis in the embedded design can occur in two phases so that the quantitative and qualitative portions may be published as separate studies, or in one phase, so that they can only reasonably be reported as one study. In a

one-phase embedded design, research in the less important design can be conducted during research in the more important design. For instance, a qualitative analysis can be used as a way of determining why a particular model performs better with or without a particular indicator, or how an ongoing experimental treatment affects a dependent variable. Alternatively, in a two-phase embedded design, the results of one design can be used in guiding the construction of another design. For instance, in an experimental treatment, the results of a case study of a school may be used to determine the appropriate manner in which an experimental intervention may proceed.

Benefits. The benefits of the embedded design come from the priority it gives to one method over another. The embedded design is attractive when the researcher does not have time to give to an analysis with the lower priority method, does not wish to collect as much data, or has to pass through a funding agency or other gatekeeper which is generally skeptical of either quantitative or qualitative research. As such, the embedded design has a clear advantage when an essentially quantitative approach is called for but the researcher also wants to generate some meaning that is only available with some qualitative assistance, or else when a qualitative approach is called for and some piece of quantitative analysis will be used within the qualitative design.

Challenges. The embedded design can lead to problems, whether priority is given to quantitative research or to qualitative research. In quantitative designs, the concerns are less serious. The differing priority of the methods means that the researcher needs to have two purpose statements in the study, one quantitative and one qualitative, and also must describe how the lower priority approach relates to the higher priority approach.

Additionally, the researcher needs to determine how to handle possibly contradictory results from the quantitative and qualitative analysis though, unlike with the triangulation design, there is no expectation that these results have to agree with each other or be given equal priority. Embedding a quantitative design into a qualitative design, however, is as yet a new and underdeveloped approach.

Exploratory Design

In an exploratory design, the results from a first, qualitative phase can help develop a second, quantitative phase, especially in cases where there is a lack of guiding theory about the best way to conduct the quantitative phase (Creswell & Plano Clark, 2007). The qualitative phase therefore can complement a review of the literature in guiding the development of the second, quantitative phase. The exploratory design often is used for scale and instrument development in which a literature review does not provide sufficient theoretical guidance.

Procedures. The exploratory design occurs in two phases. A qualitative design occurs in the first phase and then is followed by a quantitative design in the second phase. The order of these two phases is the same, whether the qualitative results have overall priority, as in the traditional and *taxonomy development* models, or whether the quantitative results have priority, as in the *instrument development* model.

Benefits. The three main benefits of the exploratory mixed-methods design are that it is easy to implement, attractive for qualitative researchers, and is straightforward to include within a broader mixed methods research program. First, as the design occurs in two phases with the quantitative phase following the qualitative phase, such a study is

easier to implement than a mixed-methods design that features deeper integration between the two phases. Second, the design is attractive for researchers whose expertise is in qualitative research, but who need to present their work to institutions or boards more comfortable with quantitative analysis. Third, it is straightforward to embed an exploratory study into a mixed-methods program of research.

Challenges. The challenges of the exploratory model are closely tied to the benefits of the model. First, while the two distinct phases make each phase more manageable, their consecutive nature means that data gathering can extend for a longer period of time than with other mixed-methods designs. Second, as the first phase is qualitative, and thus often features an emerging design, it may be necessary for a researcher to change the quantitative portion of the design to reflect the greater understanding obtained during the qualitative portion. This may lead to delays with internal review boards or other managing agencies. Third, the decision of whether or not to use the same population for the qualitative and quantitative portion must be addressed, and either answer to this dilemma may lead to further complications.

Explanatory Design

In the explanatory design, a qualitative design is used to understand the meaning of the results of a quantitative design. This is done regardless of the relative priority of the quantitative and qualitative designs that form the phases of the explanatory design. Unlike with the triangulation design, however, the quantitative and qualitative portions occur in a specific temporal order. Unlike with the embedded design, results from both stages may be appropriately used for stand-alone reports or papers. Also unlike the

exploratory design, the explanatory design is conducted when there is sufficient theory to develop the second phase before knowing the results of the first.

Procedures. The explanatory design occurs in two phases. A quantitative design is conducted in the first phase, and this is followed by a qualitative design in the second phase. The order of these two phases is the same, whether the quantitative results have overall priority, as in the classic explanatory design; whether results are identified after the quantitative phase for follow-up, as in the *follow-up explanations model*; or whether the quantitative phase is used to select participants for a higher-priority qualitative phase, as in the *participant selection model*.

Benefits. The benefits of the explanatory design are similar to the benefits of the exploratory mixed-methods design. Like the exploratory design, the explanatory design has two distinct phases which are straightforward to implement, can be published separately, and can easily be applied to an ongoing program of research. A second advantage is a mirror-image of a benefit of the exploratory design: as the design often gives priority to quantitative research, it is attractive to researchers whose primary background is in quantitative research but who still require the understanding that can be provided by qualitative research.

Challenges. Just as the benefits of the explanatory design are similar to the benefits of the exploratory design, the challenges are similar as well. Implementation can be lengthy, as the two phases must be conduced sequentially. Further, the method for selection of participants has to be determined before research begins for internal review board (IRB) approval, but quantitative data analysis may force a revision if interesting

features emerge from the data. Lastly, as with the exploratory design, a decision must be made as to whether the same or different participants will be used in the two phases.

Each of the four mixed-methods designs identified–triangulation, embedded, exploratory, and explanatory–afford different benefits and challenges. The process of selecting a design is now discussed, in which the explanatory design was judged to be best able to assist in developing a model of the appropriate latent structure of the CTSE II and CPSE II inventories.

Selection of Appropriate Mixed Method

In general, the choice of an appropriate mixed methods design should be made with respect to a study's *weighting*, *mixing,* and *timing* (Creswell & Plano Clark, 2007, p. 79-84). Weight refers to the relative emphasis on quantitative and qualitative data. Mixing refers to the manner in which quantitative and qualitative approaches are explicitly related to each other. Timing refers to the order in which a study will use data.

Of the four mixed methods designs, the explanatory design was judged to have the best combination of weighting, timing, and mixing for answering this study's four research questions. First, this study seeks to capture and understand the latent structure of creative self-efficacy. The quantitative components of instrument development are well developed, as the purpose of closed-form measures is to be used for future quantitative research. Therefore, the weighting of a design should give higher priority to the quantitative phase. Second, most research on scale development has heavily, if not exclusively, quantitative (e.g., Worthington & Whittacker, 2006). In contrast, this dissertation uses the qualitative phase to provide context for the latent structure of

creative self-efficacy that emerges from the quantitative phase. Therefore, the mixing of this design should connect the qualitative phase to the quantitative phase. Third, as the qualitative phase is understood as a follow-up or extension of the quantitative results, it would be inappropriate to conduct the two phases simultaneously. Therefore, the timing of the study should be sequential, with qualitative analysis following quantitative analysis. With these characteristics in mind, the appropriate choice for this study is the two-phase explanatory mixed methods design.

Mixed Methods Design

Introduction

In Creswell and Plano Clark's (2007) view, the introduction of a mixed methods study should describe the mixed methods approach, how it is conducted, and what procedures are required to test the appropriate research questions. This is required because some readers may have more experience in either quantitative or qualitative research than in mixed methods. Further, the rapid development of mixed methods research means that work only a few years old can appear to be incomplete or arbitrarily organized when compared to more recent publications. Therefore, this introductory chapter of this dissertation follows guidelines set forth by Creswell and Plano Clark (2007). In particular, the statement of the problem, purpose statement, and visualization for this research are now addressed.

Statement of the Problem

Creswell and Plano Clark (2007) wrote that the problem statement should serve to highlight an important gap in the literature and can include several main paragraphs. The

purpose of these paragraphs is into identify the topic in an interesting way, discuss a problem in the topic that should be addressed, provide an overview of published literature on the problem, highlight gaps in the literature, and then identify audiences and state how they will benefit from a study of the research problem.

The statement of the problem for this study may be summarized by stating that it is important that we study creativity. Creativity, more than ever, is the competitive advantage of the human brain. Given that an important reason for understanding creativity is to help individuals better express creativity, a theoretical conception of creative self-efficacy that reflects the lived experience of creative self-efficacy should allow any potential experimental programs to improve creative self-efficacy to be more meaningful to the researcher and the participant. To help people better express creativity, a need exists for an instrument that does not oversimplify creative self-efficacy. To aid in interpretability, a study ideally should lead to a quantitative, generalizable instrument that captures creative self-efficacy while also developing a qualitative context for the latent structure that emerges from the use of the instrument. A need exists for an inquiry into the dimensions of creative self-efficacy that emphasizes quantitative methods while also providing the additional meaning that can emerge from a structured, follow-up qualitative study.

Purpose Statement

Creswell and Plano Clark (2007) stated that the purpose statement of explanatory designs should incorporate a justification for the qualitative follow-up. In explanatory purpose statements, the nature of the second phase is understood to be tentative, as the

qualitative purpose may change depending on the results of the quantitative phase. The purpose statement for this study is incorporated into The Proposed Study section of this dissertation's introductory chapter (see pp. 6-10). Specifically, the purpose of this study is to capture and understand the latent structure of creative self-efficacy. This requires developing a Revised model of the CTSE II and CPSE II inventories and then as a follow-up, using the voices of participants in four groups–Low CTSE, High CTSE, Low CPSE, and High CPSE–to provide context for the latent structure of creative self-efficacy.

Visualization

A visual diagram of a research study should include boxes for all stages of data collection, analysis, and interpretation, use letter casing to indicate priority, and concisely specify the intended procedures and products of each stage of the research. A visualization of this study that follows these guidelines is provided in this dissertation's introductory chapter as Figure 1.1.

Quantitative Phase

Quantitative research is the first phase of a two-phase explanatory mixed methods model. Quantitative research is composed of collection, recording, exploring, and analyzing the data. These steps are conducted according to the overall study design and recommendations in the literature.

Collecting Data

The five phases of quantitative data collection concern the sampling procedures, permissions needed, information to be collected, recording the data, and administrating the data collection.

Sampling Procedures

This study is part of a program of research in which understanding of motivation for creative expression has developed through off-site qualitative interviews (Abbott, 2009a), on-site instrument participation (Abbott, 2009b), and off-site survey participation (Abbott, 2007). Therefore, with an eye to future survey research and a desire to maximize comparability between these quantitative studies, this section is described in keeping with Dillman's (2007) recommendations for designing data collection in survey research.

Population. Dillman (2007) stated that a survey population is composed of all members of the population to which the researcher wishes to generalize. Ideally, the properties of the instrument under development would hold true, or be invariant, across all populations. However, resource constraints narrow the choice of survey population. Therefore, the population of this study was undergraduates, typically between 19 and 22 years old, who were attending a large midwestern research university.

Sample Frame. Dillman (207) wrote that the sample frame is the subset of the population from which the sample is drawn. For this study, the sample frame consisted of all undergraduate students who were taking cognition, learning, or development (CLD) coursework in Educational Psychology in the Fall 2009 semester. Students were induced to participate either through a course requirement or an offer of extra credit. In keeping

with ethical guidelines all students were treated with respect. An alternative activity was also provided, and students participated only if they granted informed consent throughout the quantitative phase.

Sample. Dillman (2007) describes the sample as composed of all members of the population that are included in the study. For this study, the sample consisted of all participants from the population, who were contained in the sample frame, and were able and willing to participate in the study. The sample was composed of 308 individuals, 93 males and 215 females, who attended an educational psychology class at a large, Midwestern research university in the Fall of 2009. The average age of the sample was 20.71 years (*SD* = 1.92 years). This sample included 297 complete observations from 90 males and 207 females. The average age of the participants with complete observations was 20.69 years (*SD* = 1.93 years).

Permissions and Approvals

Most research requires permission on three different levels. These levels are from the potential participants, individuals who control access to the potential participants, and supervising agencies who can approve or prohibit the research. These three levels, and the procedures that were used to acquire permission at each, are now discussed.

Potential participants were approached both in class and through class email to inform them of the opportunity to participate in research through the instructor script in Appendix A and the email script in Appendix B. Participants were induced through extra credit or a class requirement to engage either in research or the alternative activity that appears in Appendix H. Professors who controlled access to the sample frame were

individually approached. A convenient time for data collection and a method for tracking participating students was agreed upon As the quantitative portion of this research was conducted online using the form in Appendix D, little class-time was spent on the research. This approach met both the desire of the professors to expose students to the methods of psychology while also guaranteeing the students' right to anonymity and freedom to withdraw. Finally, this study's application for IRB approval appears in Appendix K. This application also covers the qualitative portion of the research and is based on information submitted to the IRB for my pilot studies (Abbot, 2009a, 2009b).

Information Collected

Five different inventories were used in the quantitative data gathering phase. The properties of two instruments for measuring CTSE and CPSE based on my quantitative pilot study (Abbott, 2009b), CTSE II and CPSE II, were the substantive focus of the quantitative phase of this dissertation. Latent factors indicated by two other scales, BCSE and an openness to experience inventory, were also included. A demographic inventory included self-report items for the age and gender of the participants. Items for all measures appear in Appendix D.

CTSE II Inventory. The creative thinking self-efficacy inventory is composed of measures of self-efficacy for the four factors of creative thinking identified by Torrance (2004): fluency, flexibility, elaboration, and originality. Each of the four factors is indicated by four manifest indicators. The CTSE II inventory is a revision of the CTSE I inventory that was pilot tested in late spring 2009 (Abbott, 2009b). As with the CTSE I, the CTSE II uses a response width of 100 as suggested by the self-efficacy literature

(Bandura, 2006; Pajares et al., 2001). The CTSE II inventory is an original contribution of this study.

The process of creating the CTSE II inventory was as follows. First, all indicators of the three factors of the CTSE I inventory were considered. If the PAF (principal axis factor analysis) loading from the original study was greater than .50, the indicator was kept. Next, new indicators were devised with wording similar to kept indicators until each of the factors had four indicators. All CTSE II items appear within Table 3.1.

CPSE II Inventory. The creative performance self-efficacy (CPSE) inventory is composed of measures of self-efficacy for the three factors of creative performance identified by Csikszentimalyi (1996): aptitude for the domain, impressing the field, and maintaining a creative personality. Each of the three factors is indicated by four manifest indicators. The CPSE II scale is a revision of the CPSE I scale that was pilot-tested along with the CTSE I scale in late spring 2009 (Abbott, 2009b). As with the CPSE I, the CPSE II uses a response width of 100 as suggested by by the self-efficacy literature (Bandura, 2006; Pajares, Hartley, & Valiante, 2001). The CPSE II scale is an original contribution of this study.

The process of creating the CPSE II scale was as follows. First, all indicators of the four factors of the CPSE I subscale were considered. If the PAF loading from the original study was greater than .50, the indicator was kept. Next, new indicators were devised with wording similar to kept indicators until each of the factors had four indicators. All CPSE II items appear within Table 3.1.

Beghetto's Creative Self-Efficacy (BCSE) Inventory. The three-item Beghetto's Creative Self-Efficacy (BCSE) inventory was also included in this study. In previous studies (Beghetto, 2006, 2007, 2009), data from the BCSE showed adequate internal consistency as evidence by Cronbach's α values of .86, .86, and .83, respectively. BCSE, derived from Plucker, Beghetto, and Dow's (2004) work on creativity, was also incorporated in Abbott (2009b). In that pilot study, the three items were found to uniquely indicate one latent factor with confirmatory factor analysis (CFA). All BCSE items appear within Table 3.1.

Openness to Experience. Openness to experience was measured through the four-item Intellect/Imagination subscale of the Mini-IPIP scale (Donnellan, Oswald, Baird, & Lucas, 2006). The Mini-IPIP was derived from the Goldberg's (1999) five factor personality inventory. Donnellan et al. found the intellect/imagination scale to be reliable in their samples (α = .79), and identified *intellect/imagination* with *openness to experience*. This four-item openness inventory allows for a latent openness construct to be locally identified, which is not possible with other inventories (e.g., Gosling, Rentfrow, & Swann, 2003) that have less than three indicators for each latent factor (Kline, 2005).

Demographic and Other Data. Participants were asked to self-report their age and gender. In addition the participants were asked for an email address and whether they would be willing to engage in a follow-up qualitative interview.

Table 3.1
Manifest Indicators of Latent Factors

Factor	Question Text
	Creative Thinking Self-Efficacy (CTSE)
Fluency	Get a large number of different ideas or responses
	Come up with many possible solutions to a problem
	Arrive at a variety of conclusions given a difficult situation
	Think of many answers to a difficult problem or situation
Flexibility	Come up with different kinds of responses, not just different responses?
	Answer problems in different ways, each of which are unique and special?
	Think of many types of ideas while considering a problem?
	Answer problems in different forms or styles?
Elaboration	Think of ways to defend a 'crazy' thought, by thinking back on what you already know?
	Talk to your friends about wild ideas, and make them sound reasonable?
	Tell stories based on dreams you had, even if you need to fill in answers?
	Connect day-dreams or new ideas to things you have already learned?
Originality	Be the first in a group to come up with an original suggestion?
	Arrive at a novel solution before other people?
	Beat other people in imagining a brand new idea first?
	Think of ideas no one else has?

(table continues)

Factor	Question Text
	Creative Performance Self-Efficacy (CPSE)
Domain	Make sense of something you want to learn to do?
	Start to learn to do something, even if there are obstacles to doing so?
	Teach yourself how to do something new?
	Choose to do something that is more important within your culture?
Field	Create a novelty that people will choose, over other novelties available?
	Find an audience that is well-connected to others in society?
	Network with people to convince them that what you made is the best?
	Convince others that you have made a valuable contribution?
Personality	Be motivated to come up with new ideas?
	Have fun coming up with new ideas, after having learned from others?
	Wake up feeling like you can come up with new ideas if you want to?
	Sustain wonder about something, even after working with it for years or decades?
	Beghetto's Creative Self-Efficacy (BCSE)
BCSE	I have a lot of good ideas
	I am good at coming up with new ideas
	I have a good imagination
	Openness to Experience
Openness	I have a vivid imagination
	I am not interested in abstract ideas
	I have difficulty understanding abstract ideas
	I do not have a good imagination
	Demographic Information
Sex	What is your sex?
Age	What is your age?

Note. Quantitative data collected included inventories for measuring the latent constructs of Creative Thinking Self-Efficacy (CTSE), Creative Performance Self-Efficacy (CPSE), Beghetto's Creative Self-Efficacy (BCSE) , and Openness to Experience (Openness). CTSE is in turn composed of factors for fluency, flexibility, originality, and elaboration. CPSE is likewise composed of factors for domain, personality, and field. The online form used for data collection appears in Appendix D.

Recording the Data

In cases where a researcher is personally observing behavior or reading questions to a participant, physically entering the collected data must be conducted through a form or checklist (Creswell & Plano Clark, 2007). For this study, data was collected online through Google Docs (Google, 2009), using the form included in Appendix D. Data entered into the form was automatically stored in a spreadsheet by Google Docs, which is then downloaded in the comma separated value (CSV) format for data analysis.

Administering Data Collection

The standardization of procedures and ethics are important issues in quantitative data collection. Standardization of procedures refers to eliminating sources of bias. Ethics refers to participants being treated professionally, according to a code of conduct designed to protect their rights and prevent harm from coming to them. Both of these aspects of administering data collection are now discussed.

Standardization of Procedures. One potential way to reduce bias may be to utilize an Internet form instead of a classroom environment for collecting data. Specifically, Google Docs (Google, 2009) was used to collect information through a form-based interface (see Appendix D). While Internet-based data collection means that the quality of an individual student's computer may vary, classroom-based measurement introduces the additional factor of classroom environment. While residual effects of classroom environment may well still appear, they are unlikely to be as large when data are collected asynchronously than if conducted at the same time in the same classroom.

Ethical Issues. The American Psychological Association's (2002) list of ethical principles highlights, among other issues, institutional approval, informed consent, special rights of students, inducements, and debriefing. These ethical standards exist to protect participants' rights and to protect participants from harm. In the present study, the rights and safety of participants were respected by following APA and IRB guidelines and through an attempt to exhibit professional and respectful conduct throughout the research process. In order to partake in the quantitative phase, participants first granted informed consent after reading the form that appears in Appendix F.

Analyzing Data

According to Creswell and Plano Clark (2007), the five steps for data analysis in the quantitative phase of a mixed methods study are to prepare, explore, analyze, represent, and validate the data. The implementation of these general procedures has specific steps that are listed below. Quantitative analysis was generally conducted with the R programming language (R Development Core Team, 2009), though when specifically mentioned, analysis was conducted with Mplus software (Muthén & Muthén, 2006) or SAS software (SAS institute Inc, 2008).

Preparing the Data for Analysis

Creswell and Plano Clark (2007) have outlined data preparation procedures that serve to facilitate the analysis of quantitative information with statistical software. These steps, such as checking the data for errors and recoding the data as necessary, are largely mechanical and depend on the specific research tools used.

Exploring the Data

Creswell and Plano Clark (2007) also suggested exploring the data in quantitative research before analysis is conducted. This requires five steps. First, the sample is analyzed, which includes a presentation of the means vector, standard deviations vector, and correlation matrix, as well as a discussion about the sufficiency of the sample size. Second, non-response is discussed. Third, the multivariate normality of the data is analyzed. Fourth, the presence of multivariate outliers is explored. Fifth, the factorability of the data is tested.

The Sample. The descriptive statistics for the sample appears in Table 3.2. These statistics include the means vector, standard deviations vector, and correlation matrix for the items presented to participants. Items include measures of CTSE (including elaboration, flexibility, fluency, and originality), CPSE (including domain, field, and personality), BCSE (Beghetto's Creative Self-Efficacy construct), and openness to experience, as well as age and sex.

Estimation of the power of model parameters was conducted through an empirical power analysis using Monte Carlo methods. These methods are commonly used to determine statistical power and required sample size (Muthén and Muthén, 2002). Knowing the results of such an analysis is important, as otherwise results may be overlooked or overstated. By comparing the estimated statistics against the actual parameters a large number of times, this empirical power analysis analysis allows a researcher to know if an intended sample size is appropriate for given assumptions of the theorized population parameters.

Table 3.2
Correlation Matrix, Means Vector, and Standard Deviation Vector

Measure	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
1: BCSE1	5.3	1.1	–																																				
2: BCSE2	5.2	1.2	.70	–																																			
3: BCSE3	5.8	1.3	.42	.53	–																																		
4: CPD1	79.1	16.6	.40	.38	.28	–																																	
5: CPD2	75.5	19.8	.31	.26	.22	.53	–																																
6: CPD3	79.6	17.2	.36	.33	.27	.76	.57	–																															
7: CPD4	81.6	17.2	.32	.27	.27	.62	.54	.77	–																														
8: CPF1	24.6	10.7	.16	.12	.05	.23	.11	.20	.20	–																													
9: CPF2	61.1	22.0	.39	.37	.27	.40	.53	.44	.45	.25	–																												
10: CPFI	68.1	21.0	.42	.35	.36	.47	.52	.51	.56	.23	.65	–																											
11: CPF4	66.3	22.8	.49	.43	.25	.45	.41	.45	.46	.36	.59	.67	–																										
12: CPP1	76.9	19.2	.49	.45	.30	.46	.35	.46	.44	.34	.54	.55	.60	–																									
13: CPP2	80.7	18.9	.42	.46	.35	.47	.37	.44	.43	.32	.60	.56	.59	.77	–																								
14: CPP3	71.9	22.6	.32	.29	.25	.38	.31	.38	.38	.12	.34	.52	.40	.45	.45	–																							
15: CPP4	75.8	21.3	.49	.46	.34	.49	.35	.44	.44	.32	.50	.58	.63	.69	.72	.56	–																						
16: CTE2	77.3	21.3	.26	.21	.27	.51	.38	.47	.45	.09	.29	.43	.35	.32	.31	.38	.45	–																					
17: CTE3	76.7	19.5	.29	.23	.25	.46	.34	.45	.48	.18	.43	.53	.41	.47	.39	.35	.47	.44	–																				
18: CTE4	80.0	18.4	.31	.23	.22	.45	.39	.48	.48	.10	.37	.46	.38	.32	.34	.23	.42	.57	.66	–																			
19: CTE5	80.7	21.3	.24	.19	.25	.39	.40	.46	.47	.09	.34	.45	.33	.28	.24	.34	.39	.73	.45	.63	–																		
20: CTFx1	68.4	21.7	.30	.26	.24	.49	.39	.45	.43	.09	.47	.50	.44	.42	.38	.36	.44	.35	.54	.39	.34	–																	
21: CTFx2	68.3	21.1	.32	.23	.22	.53	.41	.46	.44	.11	.50	.51	.45	.45	.37	.33	.43	.39	.58	.42	.38	.79	–																

(table continues)

Measure	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
22: CTFx3	74.2	19.0	.26	.21	.29	.49	.35	.43	.44	.09	.35	.43	.32	.41	.34	.35	.40	.42	.54	.43	.34	.60	.71	–															
23: CTFx4	71.4	19.5	.28	.26	.29	.52	.39	.47	.50	.14	.37	.49	.44	.47	.35	.32	.45	.45	.60	.46	.39	.68	.74	.72	–														
24: CTFu1	74.8	18.1	.37	.33	.29	.44	.35	.43	.37	.18	.49	.51	.52	.51	.49	.34	.44	.35	.45	.39	.35	.60	.63	.54	.60	–													
25: CTFu2	77.5	17.8	.31	.23	.20	.44	.36	.40	.43	.10	.36	.45	.42	.40	.33	.34	.38	.39	.48	.38	.33	.67	.68	.65	.63	.63	–												
26: CTFu3	22.5	10.5	.15	.14	.12	.28	.08	.19	.16	.31	.21	.19	.19	.29	.22	.16	.23	.15	.28	.11	.10	.28	.32	.31	.28	.26	.36	–											
27: CTFu4	74.8	52.3	.23	.17	.12	.28	.21	.26	.23	.10	.24	.22	.20	.24	.21	.18	.24	.20	.27	.21	.18	.32	.34	.32	.30	.32	.35	.20	–										
28: CTO1	63.8	24.0	.48	.47	.34	.56	.34	.42	.41	.24	.59	.58	.53	.47	.51	.45	.60	.42	.46	.39	.40	.52	.56	.42	.42	.49	.51	.28	.26	–									
29: CTO2	70.5	22.2	.50	.46	.32	.47	.34	.41	.40	.26	.51	.60	.53	.53	.49	.45	.60	.46	.53	.42	.40	.61	.58	.44	.55	.51	.51	.27	.24	.70	–								
30: CTO3	67.2	21.7	.46	.40	.30	.51	.39	.45	.46	.22	.52	.59	.49	.50	.44	.51	.57	.48	.59	.39	.40	.64	.62	.49	.55	.49	.54	.24	.27	.70	.86	–							
31: CTO4	64.6	22.8	.51	.48	.40	.54	.36	.43	.45	.24	.60	.64	.60	.57	.58	.53	.67	.48	.54	.45	.42	.59	.63	.48	.53	.54	.56	.30	.27	.86	.81	.81	–						
32: Open1	5.5	1.4	.29	.40	.70	.19	.17	.22	.21	-.02	.23	.31	.25	.19	.27	.21	.25	.24	.20	.19	.26	.18	.20	.21	.22	.26	.14	.00	.11	.25	.20	.21	.32	–					
33: Open2	3.1	1.6	-.22	-.21	-.22	-.15	-.11	-.14	-.12	-.11	-.11	-.15	-.13	-.26	-.20	-.23	-.23	-.18	-.13	-.12	-.13	-.17	-.13	-.15	-.17	-.21	-.08	-.05	-.12	-.20	-.27	-.25	-.25	-.12	–				
34: Open3	3.3	1.5	-.28	-.30	-.24	-.19	-.15	-.18	-.24	.02	-.16	-.22	-.13	-.20	-.15	-.24	-.21	-.19	-.23	-.14	-.17	-.25	-.24	-.22	-.20	-.16	-.20	-.07	-.17	-.26	-.25	-.26	-.29	-.18	.47	–			
35: Open4	2.2	1.5	-.32	-.31	-.61	-.26	-.22	-.31	-.29	-.07	-.15	-.29	-.25	-.25	-.22	-.20	-.25	-.26	-.25	-.27	-.23	-.21	-.19	-.19	-.22	-.23	-.16	-.07	-.11	-.28	-.28	-.27	-.33	-.48	.34	.29	–		
36: Sex	1.3	.5	.10	.05	.09	.06	-.05	.04	.07	.08	.01	.03	.05	.10	.06	.12	.07	-.02	.12	.14	-.08	.07	.08	.13	.08	.11	.14	.13	.02	.06	.03	.08	.11	.02	-.12	-.14	-.10	–	
37: Age	20.7	1.9	.15	.14	.04	.08	-.03	.03	.01	.01	-.05	-.02	-.07	-.11	-.05	.01	.01	-.04	-.01	-.08	-.12	.06	.07	.07	.05	.07	.04	.07	.22	.13	.07	.12	.08	-.01	-.10	-.15	-.03	.10	–

Note. The sample size is n = 296. All correlations (r > 0.10) significant at the p < .05 level. All correlations (r > 0.13) significant at the p < .01 level. All correlations (r > 0.18) significant at the p < .001 level. Indicator names are abbreviated to economize space. BCSE is indicated by measures beginning with *BCSE*, CPSE Domain by indicators beginning with *CPD*, CPSE Field by indicators beginning with *CPF*, CPSE personality by indicators beginning with *CPP*, CTSE Elaboration by indicators beginning with *CTE*, CTSE Flexibility by indicators beginning with *CTFx*, CTSE Fluency by indicators beginning with *CTFu*, CTSE originality by indicators beginning with *CTO*, and Openness to Experience by indicators beginning with *Open*.

The empirical power analysis in this study was conducted by inputting the estimated population values taken from the quantitative pilot study that appear along with the appropriate Mplus (Muthén and Muthén, 2006) code in in Appendix I. Following Muthén and Muthén's (2002) recommendations, sample size was modified until model power was at least .80 for any model parameter, no standard error bias of interest was greater than .05, no standard error bias in the model was greater than .10, and parameter bias for all model parameters was smaller than .10. Selected output from the empirical power analysis, demonstrating that the appropriate sample size is 200, also appears in Appendix I.

Non-Response. Non-response is discussed through inspection of missing data as well as by Little's (1988) test of missing completely at random (MCAR). Little's (1988) test of missingness completely at random (MCAR) using Enders' (n.d.) implementation is conducted with SAS software (SAS institute Inc, 2008) and then reported. The null hypothesis of Little's test is that the data is MCAR, and therefore a non-significant result is desired. Additionally, the number of individuals who completed all items is presented, and compared against the number of individuals who attempted to complete the instrument.

FIML estimation with robust standard errors is used in Mplus (Muthén & Muthén, 2006) to estimate the values of latent constructs even when specific manifest indicators were not answered by participants. FIML is a method of estimating parameter estimates by calculating which estimates are most likely considering the observed data (Wothke, 2000). FIML is an alternative to imputation methods that attempt to estimate the true

values of missing data (Tufis, 2008). In FIML, by contrast, the focus is not on determining the values of missing data, but on estimating model parameters from the data that is present.

The MLR estimator was used to estimate model parameters in this study. MLR is an extension of the FIML model provided by Mplus (Muthén & Muthén, 2006) that incorporates robust standard errors and is robust to non-response (Yuan and Bentler, 2000). MLR is a method of estimating model parameters based on results that are most likely given the observed manifest indicators in which a scaling factor is used to correct for deviation from multivariate normality. MLR performs better than non-robust maximum likelihood estimation under small sample sizes (B.O. Muthén, 1988-2004). As the sample size of this study is near the lower bound of CFA sample sizes (e.g., Nyulund, Asparouhov, & Muthén, 2007), the MLR estimator is used instead of a non-robust estimator.

As all models are tested under FIML with MLR, the reported χ^2 value is asymptotically equivalent to Yuan and Bentler's (2000) T_2 statistic. This is to say the χ^2 value obtained by MLR is robust both to the presence of missing data and to the presence of non-normal distributions. This allows the tests of non-normality and missing data to be conducted for informational purposes, without the risk that the results might lead to procedures that would further limit this study's findings, such as multiple imputation (which may lead to less likely estimation of model parameters), listwise deletion (which systematically removes observations from participants who share a common characteristic of not responding to at least one item), or so on.

Multivariate Normality. In the present study, population parameters are estimated through FIML using the MLR estimator. Skewness and kurtosis are calculated using Mardia's (1970; Mardia, Kent, & Bibby, 1979) method under Mplus (Muthén & Muthén, 2006) . Specifically, the statistical significance between the reproduced and observed skewness and kurtosis is reported (L.K. Muthén, 2008). This model-based approach can be contrasted against non-model based measures of skew and kurtosis. DeCarlo's (1997) discussion of kurtosis, for instance, describes kurtosis as the fatness of the tails in the distribution of the observed data. The method used in this study, however, examines the extent to which the model accurately predicts the skew and kurtosis observed in the population. This is because the MLR estimator used in this study is robust to non-normal data (Yuan & Bentler, 2000). Therefore, skew and kurtosis as such are not of interest (B.O. Muthén, 2008), though knowledge of the discrepancy between observed and reproduced skew and kurtosis may be useful to understanding the causes of poor model fit.

Multivariate Outlier Detection. Multivariate outlier detection is conducted through a visual inspection of Cook's (1977) distance and the standardized residuals. Both of these approaches first regress all indicators in the model against an ID variable. Cook's distance is a measure of influence that reports how the regression coefficients would change if an observation—that is, a participant—is excluded (Stevens, 1984). In this study, Cook's Distance is calculated through the *cookd* function of the *car* module (Fox, 2009) in R (R Core Development Team, 2009) . The standardized residual or *z* score is conducted using the *stdres* function of the *MASS* module (Venables & Ripley,

2002) in R. Cook's distance and standardized residuals are calculated, plotted, and then visually inspected. Outliers will be considered to be present in the data if any observations has an absolute standardized residual greater than Tabachnick and Fidell's (2006) recommended cut-off of 3.29 (p. 73), or if 5% or more of the observations have a Cook's distance greater than Cohen, Cohen, West, and Aiken's (2003) suggested cut-off of 1.0 (p. 404).

While these steps were taken to minimize the presence of multivariate outliers, the true nature of such observations are unclear. Samples from multiple populations might be contained in any given sample. If this is the case, multivariate outliers may well be sensible observations from one of the mixed populations in the sample. My own study (Abbott, 2009c) added more uncertainty to the issue, as I found an increase in parsimony as more latent classes of self-efficacious individuals were added (1 class AIC = 73656.116, 2 class AIC = 70922.587, 3 class AIC = 70244.581), though this increase was slight and the theoretical interpretation was unclear. Therefore, considering these warnings, multivariate outlier detection proceeds cautiously.

Factorability. Two procedures are used to test for factorability of the data. The first procedure is the Kaiser-Meyer-Olkin (KMO) index, which is used to examine the partial correlation of manifest variables that indicate a latent variable (Kaiser, 1970, 1974). KMO is calculated with Ranpura's (2005) procedure in R (R Core Development Team, 2009) using Hutcheson and Sofroniou's (1999) recommendation of KMO > .6. The second procedure uses Tabachnik and Fidell's (2006) suggestion that zero-order correlations of manifest indicators for the same latent factor should not be below .30 (p.

614). The data is judged to be factorable if correlations greater than .30 exist in the data and the calculated KMO statistic is greater than .6.

Analyzing the Data

As described in the literature review, six hypotheses are tested using quantitative methods. These hypotheses are designed to test the latent structure, the nomothetic span, and the changes made to the Revised model of creative self-efficacy. The Revised model of the CTSE II and CPSE II inventories contains the theoretically suggested factor structure of four CTSE factors (Elaboration, Flexibility, Fluency, and Originality) and three CPSE factors (Domain, Field, and Personality). The CTSE and CPSE indicators of the Revised model appear in Table 3.3 Additionally, items indicating BCSE and openness to experience are estimated in the Revised model tested for Hypotheses 3 and 4. Further, all CPSE and CTSE indicators are included in all models tested for Hypotheses 5 and 6, though indicators that are not used to estimate a latent factor are treated as saturated correlates.

Table 3.3
CTSE and CPSE Indicators of the Revised Model

Factor	Question Text
	Creative Thinking Self-Efficacy (CTSE)
Fluency	Come up with many possible solutions to a problem
	Arrive at a variety of conclusions given a difficult situation
	Think of many answers to a difficult problem or situation
Flexibility	Come up with different kinds of responses, not just different responses?
	Answer problems in different ways, each of which are unique and special?
	Think of many types of ideas while considering a problem?
Elaboration	Think of ways to defend a 'crazy' thought, by thinking back on what you already know?
	Talk to your friends about wild ideas, and make them sound reasonable?
	Tell stories based on dreams you had, even if you need to fill in answers?
Originality	Be the first in a group to come up with an original suggestion?
	Arrive at a novel solution before other people?
	Beat other people in imagining a brand new idea first?
	Creative Performance Self-Efficacy (CPSE)
Domain	Make sense of something you want to learn to do?
	Start to learn to do something, even if there are obstacles to doing so?
	Teach yourself how to do something new?
Field	Create a novelty that people will choose, over other novelties available?
	Find an audience that is well-connected to others in society?
	Network with people to convince them that what you made is the best?
Personality	Be motivated to come up with new ideas?
	Have fun coming up with new ideas, after having learned from others?
	Sustain wonder about something, even after working with it for years or decades?

Note. This table describes outlines the two inventories, Revised CTSE II and Revised CPSE II, that ere formed to measure the two dimensions of creative self-efficacy: Creative Thinking Self-Efficacy (CTSE) and Creative Performance Self-Efficacy (CPSE). CTSE is composed of four factors: fluency, flexibility, elaboration, and originality. CPSE is composed of three factors: domain, field, and personality.

Latent Structure. The first research question is, "What is the latent structure of creative self-efficacy?" The first hypotheses to be developed, phrased as a prediction, is:

H1: The Revised Model of the CTSE II and CPSE II Inventories is supported by data and provides adequate psychometric evidence

Hypothesis 1 is tested through Hu and Bentler's (1999) criteria for establishing lack of practically significant difference between the observed and reproduced covariance matrixes. Hu and Bentler recommend that models have acceptable values for the Comparative Fix Index or CFI (Bentler, 1988), the Root Mean Square Error of Approximation or RMSEA (Browne & Cudeck, 1993), and the Standardized Mean Square Square Residual or SRMR (Jöreskog & Sörbom, 1981). In addition, Akaike's (1973) Information Criterion of parsimony and χ^2, the test of a statistical significant difference between the observed and reproduced covariance matrixes, are also reported.

Hu and Bentler's criteria are considered to be passed if CFI > .95, RMSEA < .06, and SRMR < .09. Hypothesis 1 is judged to be supported if Hu and Benter's criteria are passed. Following the hypothesis test, the statistical output is inspected for empirical evidence of residual correlations between manifest indicators. Such correlations may appear if two indicators share a common source of variance. This may be theoretically sensible in cases where participants interpreted two items as being especially similar. In such cases, the Revised model is refined to explicitly include these theoretically and empirically sensible residual correlations. Next, as an exploratory follow-up, a Satorra (2000; Satorra & Bentler, 2001) scaled χ^2 difference test difference test is conducted, to

detect if the additional constraints lead to a statistically significant improvement in the difference between the observed and reproduced covariance matrixes.

Additionally, Akaike's (1973) Information Criterion or AIC and χ^2 are reported. AIC is a commonly used measure of model complexity that allows models to be directly compared against each other as long as they incorporate the same manifest indicators. The smaller the AIC value, the more parsimonious the proposed latent structure is for explaining variance in the manifest indicators included in the model. If it is the case that two models which incorporate the same manifest indicators both pass Hu and Bentler's (1999) criteria, then the model with the lower AIC, being the more parsimonious, is preferred.

The χ^2 statistic and its associated *p* value are also reported. Under CFA, χ^2 tests for a significant difference between the observed covariance matrix and a reproduced covariance matrix that is calculated from the latent factor model. A non-significant χ^2 indicates exact fit, while a significant χ^2 indicates a lack of exact fit. The Revised model is expected to fail the test of exact fit, however, as the χ^2 test fails to differentiate between a statistically significant difference and a meaningful difference between the observed and reproduced covariance matrixes. For this reason, fit indices are judged to be acceptable based on Hu and Bentler's (1999) criteria for CFI, RMSEA, and SRMR.

The second hypothesis, stated as a prediction, is:

H2: There is no General Factor of Creative Self-Efficacy

Hypothesis 2 is operationalized by testing the parsimony of the Revised model against the parsimony of a rival alternative model in which a general factor of creative

self-efficacy, for which CTSE and CPSE are latent indicators, is estimated. As only two dimensions of creative self-efficacy are hypothesized in the model, however, simply estimating a general factor of creative self-efficacy by fixing the variances of CTSE and CPSE at 1.0 is statistically equivalent to simply modeling a correlation between CTSE and CPSE. Therefore, this alternative model is modeled by constraining the variances of the CTSE and CPSE, as well as their covariance, to 1.0. Hypothesis 2 is judged to be supported if the addition of a general factor of creativity leads to worse parsimony when compared to the Revised model. As an exploratory follow-up, a Satorra (2000; Satorra & Bentler, 2001) scaled χ^2 difference test difference test will be conducted, to detect if the additional constraints lead to a statistically significant improvement in the difference between the observed and reproduced covariance matrixes.

Nomothetic Span. The second research question was, "What is the relationship between creative self-efficacy and variables known to be related to creativity?" This research question attempts to establish the construct validity of creative self-efficacy by examining its nomothetic span, or the *network of relationships* that the Revised model of creative self-efficacy has with other constructs (Embretson (Whitely), 1983). As a measure of construct validity, nomothetic span is more inclusive than Cronbach and Meehl's (1955) concept of the nomological network, as nomothetic span includes not only how a construct relates to other construct, but also how measures of the same construct relate to each other (Messick, 1989). In order to test the nomothetic span of the Revised model, the relationship of the factors in the Revised model to the constructs of

Beghetto's Creative Self-Efficacy (BCSE) construct and openness to experience will be examined. Two hypotheses are developed to assist in answering this research question:

H3: Beghetto's Creative Self-Efficacy (BCSE) construct is related to Creative Self-Efficacy

H4: Openness to Experience is related to Creative Self-Efficacy

Answering these hypotheses requires two steps. First, the manifest indicators of BCSE and openness to experience are modeled as loading onto latent BCSE and openness to experience factors. Second, empirically justified residual correlations arising from the BCSE and openness to experience items are modeled. The psychometric properties of the use of both of these two scales in the same study has not previously been studied, and the similarity in wording between the items (for instance, a BCSE item is, "I have a good imagination", while an negatively loaded openness to experience item is "I do not have a good imagination") imply that these two constructs may share some common error variance with other items. Thus, latent correlations between manifest indicators suggested by Mplus modification indices, or the output that presents the expected drop in χ^2 if the latent correlation is allowed (Muthén & Muthén, 2006), are modeled, and the final model fit is reported.

Hypothesis 3 and Hypothesis 4 are judged to be supported if Hu and Bentler's (1999) criteria are passed and if all CTSE and CPSE constructs correlated with both BCSE and openness to experience at the $p < .05$ level. If the refined model does not achieve close fit, the latent constructs inside the model cannot be interpreted, and the hypotheses are judged not to be supported. Likewise, if the correlation between the CTSE

and CPSE constructs and BCSE and openness to experience are not significant, the external validity of the model is undermined and these hypotheses are judged not to be supported. Following this, the relative magnitude of the correlations will be examined and their implications for future research discussed.

Evaluating Changes. The third research question is, "Were the changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?" Phrased another way, this research question asks whether the Revised model is an improvement over rival alternative models of creative self-efficacy. In order to test this, Hypothesis 5 tests the Revised model against two theoretically justified rival models that include items not included in the Revised model but which appeared in quantitative pilot study (Abbott, 2009b). Following this, Hypothesis 6 tests the Revised model against two empirically justified rival alternative models optimized based on the findings of a principal axis factor analysis (PAF) and hierarchical cluster analysis (HCA).

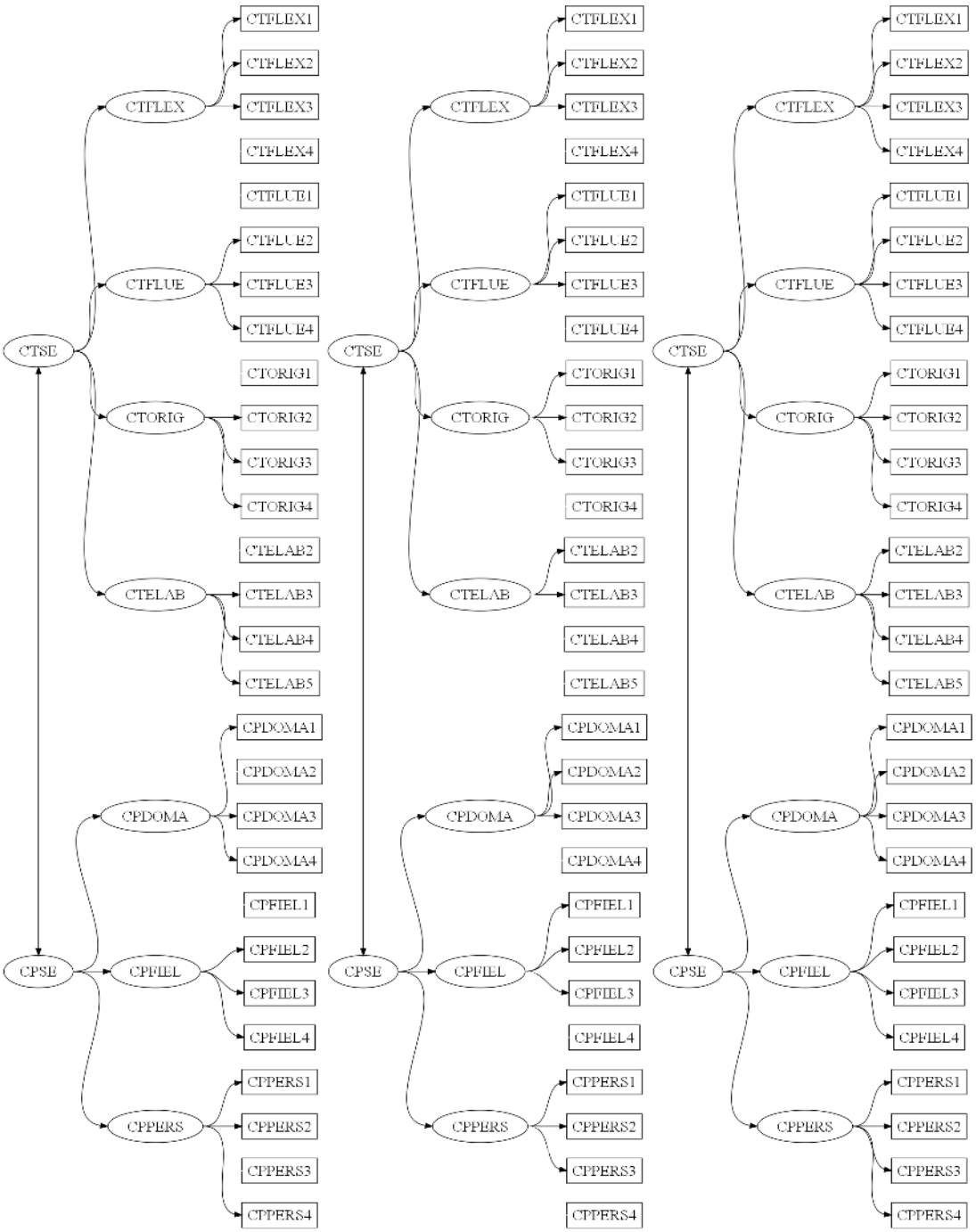
The fifth hypothesis, phrased as a prediction, is:

> *H5: The Revised model better reproduces the observed covariance matrix than the two theoretically justified rival alternative models*

The two theoretically justified rival alternative models are the All model and the Held model. A visualization of the latent structure of the CTSE II and CPSE II inventories in the Revised, Held, and All models appears as Figure 3.1. The first alternative model, the All model, refers to the full set of CPSE II and CTSE II items that were presented to participants, along with their associated measurement model. The All

model allowed Mplus to have access to all information contained by all indicators in determining the best model fit, but has the potential for introducing unnecessary statistical error to the model if items included in Abbott (2009b) but not included in the Revised model cross-load on inappropriate latent factors. The second theoretically justified rival alternative model, the Held model, refers to those items presented to participants in this study but also presented to participants in Abbott (2009b), along with their associated measurement model. The Held model does not include any indicators which were added to the inventories since Abbott (2009b). These items would fit better than the All model if the revisions made in constructing the Revised model of the CTSE II and CPSE II inventories as a result of the findings in Abbott (2009b) have been for the worse.

Figure 3.1
Latent Structure of the Revised, Held, and All Models



Note. From left to right, this figure shows the theorized latent structure of the CTSE II and CPSE II inventories in the Revised, Held, and All models. The models differ in which items are considered to be indicators of the factors of CTSE and CPSE.

The models tested for Hypotheses 5 and 6 include all indicators from the CTSE II and CPSE II inventories, as well as all BCSE and openness to experience indicators. Indicators included in the analysis but not used to indicate a latent factors are treated as saturated correlates using Graham's (2003) recommendations. Though Graham's approach of modeling saturated correlates was designed for missing data problems, Graham's procedure has the consequence of allowing AIC parsimony indices to be directly compared as models account for the same variance. Because the models are accounting for the same variance, whether through a structural component or through saturated correlations, the model with the lowest AIC can be simply interpreted as the most parsimonious model. The code used to test each model with the Mplus language is included in Appendix J.

Hypothesis 5 is judged to be supported if the Revised model is more parsimonious than both the All and Held models. Such a finding would indicate that the Revised model better reproduces the observed covariance matrix than a model that did not remove items that were judged to perform badly (the All model) or a model that did not include new items that were intended to perform well (the Held model). Conversely, if Hypothesis 5 is judged not to be supported, such a finding would indicate that the modifications made to create the Revised model have been in error.

As exploratory follow-ups, tests of composite and predictive validity are conducted. The composite validity test is a modern alternative to the well-established use of Cronbach's (1951) α. Predictive validity may be thought of as test of nomothetic span,

in which the degree to which a measure of a construct predicts other measures is examined.

An older method of establishing the internal reliability of an instrument is Cronbach's (1951) α. Cronbach's α, a generalization of Kuder and Richardson's (1937) KR-20 indicator among other measures of internal reliability, is one of the most commonly reported psychometric constructs (Sijtsma, 2009). Some assumptions have to be made about the data in order to properly interpret α. For instance, the use of α requires that the components of the construct measure the same underlying dimension and use the same measures (Raykov, 2004). In this study, however, many constructs are intentionally multidimensional. CPSE, for instance, is modeled as possessing three dimensions: domain, field, and personality. Therefore, a newer method of establishing reliability, known as composite validity, is reported instead of α.

Composite validity, sometimes called composite reliability, is conceptualized as the ratio of variance in a construct's manifest indicators accounted for by the latent construct over the sum of that variance plus variance left unexplained. That is, composite validity can be represented as the sum of the square of the loadings divided by the sum of the sum of the square of the loadings plus the sum of the residual error variances, or CV $= \Sigma\lambda^2 / (\Sigma\lambda^2 + \Sigma\varepsilon)$. Raykov and Shrout (2002) discuss composite validity both on a per construct basis and for estimating composite validity over all manifest indicators. As most of the revised alternative models in this study treat some indicators as saturated correlates, however, composite validity over all manifest indicators would not be

appropriate, and so composite validity on a per construct basis for the measured population is calculated.

Follow-on exploratory analysis is also conducted through testing the predictive validity of the models. This is done through comparing the latent correlations of CTSE and CPSE to Beghetto's Creative Self-Efficacy (BCSE) construct and to openness to experience. A model with larger latent correlations may have more predictive validity for the measured population. As with composite reliability, however, predictive validity is properly interpretable only for models that pass Hu and Bentler's (1999) criteria.

The sixth hypothesis, phrased as a prediction, is:

H6: The Revised model better reproduces the observed covariance matrix than the empirically justified rival alternative model

The two empirically justified rival alternative models are the Implied Structure model and the Implied Indicators model. The Implied Structure model combines factors in a data mining attempt to maximize close fit as indicated by the results of a principal axis factor analysis (PAF) and a hierarchical cluster analysis (HCA). The Implied Indicators model contains the same indicators as the Implied Structure model and the same latent factor structure as the Revised model. Thus, the Implied Structure model attempts to optimize model fit through varying both the latent structure and manifest indicators according to PAF and HCA, while the Implied Indicators model only optimizes the manifest indicators.

PAF is a method for improving the parsimony of a model by producing linear combinations of latent factors (Tabachnick & Fidell, 2006). PAF differs from CFA in that

no latent model is tested by the researcher. Rather, PAF generates a list of latent factors that are linear combinations of manifest variables. Likewise, PAF differs from principal component analysis (PCA) in that while PAF allows some extracted variance to be accounted for by unique item-level error, PCA attempts to account for all observed variance as belonging to an extracted factor. While CFA models are tested through a number of fit indices, such as CFI, RMSEA, and SRMR, χ^2, and AIC, PAF models are tested against the extent they parsimoniously explain variance and make sense to the researcher. That is, the computed solutions to PAF procedures are presented on the basis of their parsimony, which is the criterion used in the CFA portion of this study. Therefore, PFA is used to help test Hypothesis 6, whether the *a priori* Revised model is more parsimonious than *ad hoc* Implied models.

Another method, hierarchical cluster analysis (HCA), is also used to develop the empirically justified models. Like both PFA and cluster analysis generally, HCA is a method of reducing the complexity of a data set by categorizing objects into a small number of groups (Langfelder, Zhang, & Horvath, 2008; Suzuki & Shimodaira, 2006). Unlike PFA, however, HCA establishes a hierarchical relationship between the estimated latent groups. This hierarchical relationship, however, is empirically justified rather than theoretically justified. Therefore, while HCA creates a latent structure in which a manifest indicator belongs to only one factor, and all factors are in a simple factor structure, a factor solution in HCA may be built on chance variation in the data and be theoretically meaningless.

The PAF and HCA are conducted with R (R Development Core Team, 2009). The oblique *oblimin* rotation algorithm from the *GPArotation* package (Bernaards & Jennrich, 2005) is used to rotate the PFA results. The oblimin rotation is selected in order to maximize simple structure and minimize cross-loadings during PAF. HCA was conducted with the *hclust* and *pvclust* functions of the *pvclust* package (Suzuki & Shimodaira, 2009).

As with tests of the All and Held models, tests of the Implied Structure and Implied Indicators models are conducted through an evaluation of χ^2, CFI, RMSEA, SRMR, and AIC. Hypothesis 6 is judged to be supported if the Revised model is more parsimonious than both the Implied Structure model and the Implied Indicators model. Additionally, exploratory tests of composite validity and predictive validity are conducted for the empirically justified models, as well.

Representing the Data

Data representation in quantitative research is composed of short statements, summary tables, and illustrative figures (Creswell & Plano Clark, 2007). These elements are incorporated into a separate discussion or results section, which follows the methodology section. Specifically, correlation matrixes, path diagrams, and results from PAF and HCA analysis are included where appropriate.

Validating the Data

According to Creswell and Plano Clark (2007), it is important to validate the use of the instruments in the populations for which they are used. Therefore, this study conducts several validation tests during hypothesis testing. Hypothesis 1 and Hypothesis

2 help validate the use of Revised model, by testing its performance against Hu and Bentler's (1999) criteria and then comparing it to a rival alternative model that contains a general factor of creative self-efficacy. Hypothesis 3 and 4 help externally validate the use of Revised model by testing for their relationship to BCSE and openness to experience. Likewise, Hypothesis 5 and Hypothesis 6 help validate the use of Revised model by testing it against four rival alternative models, two of which are theoretically justified and two of which are empirically justified. As part of testing Hypotheses 5 and 6, the composite and predictive validity of the use of models in this study's population are assessed as well. Of course, generalizations as to the validity of the use of these models are limited to this study's population.

Qualitative Phase

Qualitative research is the second phase of explanatory mixed methods research. As with quantitative research, qualitative research includes data collection and data analysis phases. Also as with quantitative research, both the collection and the analysis of data must be conducted according to the overall study design and recommendations in the literature. Therefore, the steps of collecting and analyzing the data are now discussed.

Collecting Data

Qualitative research has the same five phases as quantitative research (Creswell & Plano Clark, 2007). Data collection begins with sampling, proceeds through acquiring permission and determining the desired information, moves on to recording the data, and concludes with administrating data collection.

Sampling Procedures

In qualitative research, participants are not selected to be representative of a population. Rather, they are chosen so that they can provide complementary perspectives of a central phenomenon. Three aspects of sampling participants—the types of purposeful sampling strategies, the method of participant selection, and the sample size—are now discussed.

Purposeful Sampling Strategies. Purposeful sampling, or sampling whereby participants are selected because of a special experience with the phenomenon of interest, was used in this study. Many forms of purposeful sampling exist in qualitative research, including confirming or disconfirming sampling, critical sampling, extreme case sampling, homogeneous sampling, opportunistic sampling, snowball sampling, theory or concept sampling, and typical sampling (Creswell, 2008). A form of extreme case sampling, along with an approach analogous to Creswell's (2006) multiple case study approach, was used to generate four groups, Low CPSE, High CPSE, Low CTSE, and High CPSE, which were then contrasted with each other.

Participant Selection. Participants in the qualitative phase were recruited from the participants of the quantitative phase. This was in line with both Creswell and Plano Clark's (2006) recommendations as well as published studies in the explanatory literature (e.g., Baumann, 1999; Way, Stauber, Nakkula, & London, 1994).

Sample Size. A small sample size was used as otherwise the analysis would have been less likely to provide an in-depth understanding of the participants' perspectives. Creswell and Plano Clark (2007) recommended between 4 and 10 participants in a case

study. In order to accommodate the 4 anticipated groups (High CPSE, Low CPSE, High CTSE, and Low CTSE), a total of 8 participants were used so that each group could be explored with 2 participants each.

Permissions and Approvals

The three levels of permission required for most qualitative research are the same as in quantitative research: permission from participants, gatekeepers, and the IRB. Participants were first selected for inclusion in the qualitative survey if they included their email address in the quantitative survey form and also indicated willingness to participate in a follow-on qualitative survey. If they did so, they were emailed using the script that appears as Appendix C. If a participant agreed, a mutually convenient time was scheduled for a follow-up interview. If not, the participant was thanked and another participant contacted instead. Gatekeepers were not contacted separately for the qualitative portion of the study unless it was difficult to reach a potential participant. Gatekeepers were informed of the dual-phase nature of the study when permission was granted during the quantitative phase. Finally, only one IRB form was submitted for this two-phase project. That form is included as Appendix K, and outlines both the quantitative and qualitative phases of this research.

Information to be Collected

Four types of data often included in qualitative research are open-ended interviews, open-ended observations, documents, and audiovisual materials (Creswell & Plano Clark, 2007). Because the purpose of the qualitative phase is to provide a context for the quantitative phase, only open-ended interviews were used in the qualitative phase

of this study. Participants were asked to explain and share their views of their creativity and creative self-efficacy. The interviews were conducted according to the protocol that appears in Table 3.4, using the data collection form that is included in Appendix E. This protocol is an abridged version of the protocol in the qualitative pilot study (Abbott, 2009a). In this study, the instant messaging interviews were conducted over the Google Talk, MSN, Facebook, and the Yahoo IM networks, depending on the request of the participant.

Recording the Data

Interview transcripts were automatically recorded by the Internet-based Instant Messaging (IM) applications used to conduct the interviews. This medium was chosen to maximize the amount of useful data collected during the interview, shield participant privacy, and encourage increased participation. The IM interviews were conducted in text, which made the transcription completely reliable and also provided information on the timing of specific comments. Additionally, IM afforded increased privacy. Participants did not have to worry about involuntary or potentially embarrassing postures, positions, or body language, as in face-to-face interviews. Further, the use of IM made research participation accessible to off-campus participants. IM was previously used to conduct interviews in the qualitative pilot study (Abbott, 2009a).

Table 3.4
Qualitative Questions and Follow-Ups

Question Type	Question Text
Creative Thinking Prompt	First, could you tell me a little about thinking creative thoughts?
Creative Thinking Self-Efficacy (CTSE) Prompt	Are you confident in your ability to do things, like think of things no one else have, or come up with many different responses to a problem?
Experience of Creative Thinking Prompt	What does thinking creative thoughts feel like?
Creative Performance Prompt	Great. Could you tell me a little about doing creative things?
Creative Performance Self-Efficacy (CPSE) Prompt	Are you confident in your ability to do things like, find an audience for what you do, or impress people who have the power to publicize your work?
Experience of Creative Performance Prompt	What does doing creative things feel like?
Internal or External Blocking Follow-Up	What stops you from being creative: issues inside you or issues outside you?

Note. This table presents the question type and question text of each prompt used in the qualitative phase of this study. The physical form used for data collection appears in Appendix D. Additionally, the text of the last item was reworded for each participant, as it served as a follow-up to points made by the participants, as opposed to serving as a pre-determined prompt.

Administering Data Collection

While both quantitative and qualitative data collection raise ethical issues, qualitative research raises field issues instead of issues relating to variation (Creswell & Plano Clark, 2007). This is because while the ideal in quantitative research is the creation of a homogeneous testing environment so as not to introduce bias, the ideal in qualitative research is allowing the participants' voices to be heard.

The field issues relevant in this study were time requirements, the role of the researcher, and the performance of recording equipment. The time requirement for the interviews was handled by using an abridged interview protocol and conducting the interviews online, which led to 8 interviews of around 30 to 45 minutes each. The IM-based interviews minimized problems introduced by body language, same-sex or different-sex interviewer-interviewee pairs, pronunciation patterns, and so on. Lastly, transcripts of the interview were automatically generated, and these transcripts were automatically backed up several times during the interview.

The ethical core principles of lack of coercion, participant privacy and identity, time commitment, respect for participant cooperation and informed consent, and honesty were outlined in Bogdan and Biklen's (2003) discussion on ethical issues in qualitative research. These guidelines both ensure that participants receive a fair benefit from participating (at the very least, a debriefing indicating how they have contributed to understanding some phenomenon) and that they do not risk harm. These principles were adhered to in this study. Participants were free to decline to participate, informed of their rights, and allowed to withdraw at any time. In order to partake in the quantitative phase,

participants first granted informed consent after reading the form that appears in Appendix G. No record of student names or uniquely identifiable information were permanently kept. The time burden of participation was minimized and all participants were debriefed at the end of their interviews. A copy of the IRB proposal for this study appears in Appendix K.

Analyzing Data

The general procedures for the qualitative phase are the same as for the quantitative phase: preparing, exploring, analyzing, representing, and validating the data (Creswell & Plano Clark, 2007). However, the specific data analysis procedures are different than the qualitative procedures that already have been outlined. These specific procedures are now discussed.

Preparing the Data for Analysis

Data was prepared for analysis by organizing the interview transcripts. The interview transcripts were formatted as documents in a word processor program (OpenOffice.org, 2008). Then, line spacing and margins were set to facilitate data exploration and analysis. Finally, the documents were printed out and analyzed by hand.

Exploring the Data

The steps of data exploration in qualitative research are reading through the interviews, recording initial thoughts, and developing a list of themes, codes and elements (Creswell & Plano Clark, 2007). Reading through all interviews before continuing onto analysis helped build understanding of what the participants said. Recording initial thoughts using short phrases or ideas written in the margins of the

interview transcripts helped move the researcher from a general understanding to preparing to code the data. The themes, codes, and elements from my previous study on the creative self-efficacy of bloggers (Abbott, 2009a) were kept in mind while developing the list of themes, codes, and elements. That list of themes, codes, and elements appears as Table 2.1.

Analyzing the Data

The analysis of qualitative data was conducted through coding, or the meaningful organization and categorization of ideas from the interview transcripts. Coding itself can be broken down into three stages: descriptive coding, topic coding, and analytic coding (Morse & Richards, 2002). These stages form a process of first disaggregating the words of the participants into codes and then re-aggregating the codes into themes. In the first stage, descriptive coding was used to highlight certain words with as little interpretation as possible. This data management procedure facilitated higher-level coding later. In the second stage, descriptive coding was used to categorize the descriptive into broader topics to link passages that were phrased differently but shared a common meaning. Last, analytic coding was used to combine topics into a small number of broad themes, through which the interviews were interpreted. This coding process was conducted in the margins of the interview transcripts, except for a final step of organizing codes into themes.

Representing the Data Analysis

The results of data analysis in qualitative research are presented in a discussion section that appears after the methodology section. Discussion sections of qualitative research typically are organized by the major themes that emerge during coding. Each of

these themes is then discussed in a way that incorporates generous quotations from the participants, along with analysis of the meaning of these quotations. In the context of an explanatory design, the themes were selected and explained in a way that provided context for the quantitative phase while also providing authenticity for the qualitative phase.

Validating the Data

Validation is another important aspect of qualitative research. One approach recommended by Creswell and Plano Clark (2007) is reporting disconfirming evidence. This requires presenting a perspective contrary to the one that is generally indicated by the narrative. This approach is used to provide texture, subtly, and realism to the discussion of themes that emerged from the qualitative phase. It should be emphasized that the presence of disconfirming evidence does not make a qualitative finding incorrect. Indeed, the presence of disconfirming evidence can support a qualitative finding by providing a scope and context for understanding under what circumstances some perspective or experience of a phenomenon of interest may emerge.

CHAPTER IV

RESULTS

In this chapter I present the results of this explanatory two-phased study. I first review the study's four research questions. Following this, I describe the quantitative results, first by discussing data exploration and then by discussing data analysis. I then discuss the qualitative results in order to provide context for the latent structure of creative self-efficacy.

Research Questions and Hypotheses

This study was designed to answer four specific research questions. The first three research questions led to six hypotheses, as described in the literature review chapter. These research questions, and their associated hypotheses stated as predictions, were:

1. What is the latent structure of creative self-efficacy?

   H1: The Revised Model of the CTSE II and CPSE II Inventories is supported by data and provides adequate psychometric evidence

   H2: There is no General Factor of Creative Self-Efficacy

2. What is the relationship between creative self-efficacy and variables known to be related to creativity?

   H3: Beghetto's Creative Self-Efficacy (BCSE) construct is related to Creative Self-Efficacy

   H4: Openness to Experience is related to Creative Self-Efficacy

3. Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?

H5: The Revised model better reproduces the observed covariance matrix than the two theoretically justified rival alternative models

H6: The Revised model better reproduces the observed covariance matrix than the two empirically justified rival alternative models

4. How do the themes that emerged from qualitative interviews provide context for the latent structure of creative self-efficacy?

Answers to all four research questions are discussed in this chapter. The first research question, relating to the latent structure of creative self-efficacy, is tied to Hypothesis 1 and Hypothesis 2. The second research question, relating nomothetic span of creative self-efficacy, is investigated with Hypothesis 3 and Hypothesis 4. The third research question, relating to changes made to the model in this study, is explored with Hypothesis 5 and Hypothesis 6. The fourth research question is answered through the context provided to the quantitative results by the themes that emerged in and between four groups of participants, Low CTSE, High CTSE, Low CPSE, and High CPSE.

Quantitative Results

Data Exploration

Data exploration did not raise red flags that would prevent data analysis. Non-response was minimal. Multivariate normality was not detected. Multivariate outliers were not detected. The data was judge to be factorable through examination of the appropriate partial and zero-order correlations.

Non-Response

Non-response was minimal. Of the 308 individuals (93 males and 215 females) who completed at least part of the instrument, 297 individuals (90 males and 207 females) completed the entire instrument. That is, 3.57% of all participants (3.22% of males and 3.72% of females) did not completely answer all measures. Little's (1998) test of missing completely at random (MCAR) was statistically insignificant, $\chi^2(362) < 001$, $p > .99$. Thus, the null hypothesis that the incomplete data is MCAR cannot be rejected, and the MCAR assumption can be tentatively inferred.

Multivariate Normality

Results of Mardia's (1970; Mardia, Kent, & Bibby, 1979) multivariate normality test showed significant differences between the observed and reproduced skew (Sample Value = 673.824, $M = 169.026$, $SD = 2.899$, $p < .01$), and kurtosis (Sample Value = 2035.004, $M = 1359.775$, $SD = 5.628$, $p < .01$). In the event of poor model fit, further analysis may benefit from attempting to explicitly model the kurtosis and skewness of the data. As CFA with MLR is robust to violations of multivariate normality (B.O. Muthén, 2008), however, analysis continued.

Multivariate Outlier Detection

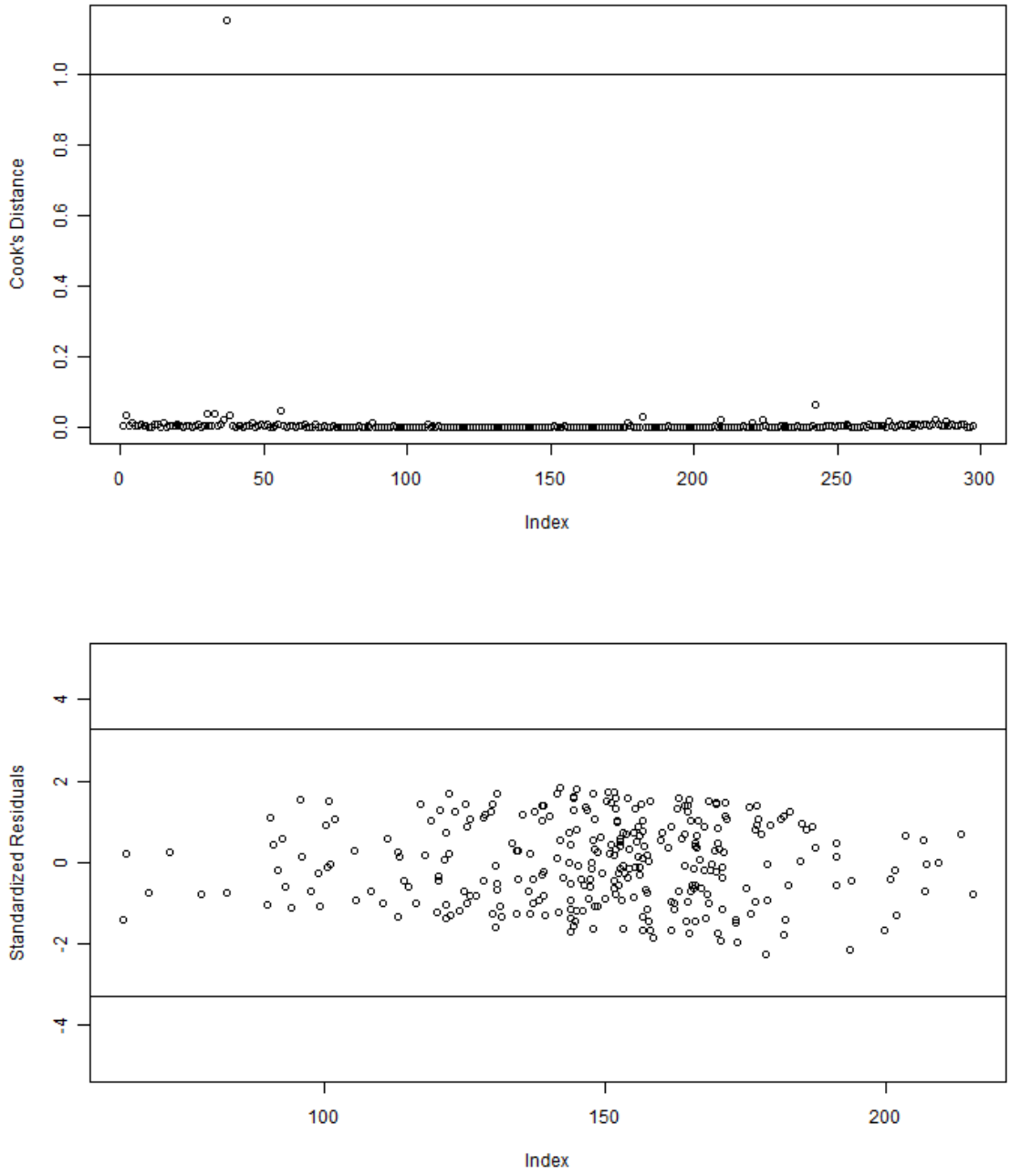
Multivariate outlier detection was conducted through visual analysis of Cook's distance and the standard residuals. The residual plots of the CTSE II and CPSE II inventories appear as Figure 4.1 A visual analysis of these plots suggests no outliers, as no standard residual from any participant is greater than Tabachnick and Fidell's (2006) suggested cut-off of 3.29. Likewise, fewer than 50% of the observations possessed

Cook's distances of greater than Cohen et al.'s (2003) suggested cut-off of 1.0. Given these results, no observations are removed as outliers.

Factorability

Two methods were used to test for factorability. First, the Kaiser-Meyer-Olkin or KMO index (Kaiser, 1970, 1974) was used to examine the partial correlations of manifest variables (Hutcheson & Sofroniou, 1999; Ranpura, 2005). KMO > .6 was interpreted to suggest that the data was factorable. Additionally, Tabachnick and Fidell's (2006) measure of the fraction of zero-order correlations greater than .3 was calculated. The fraction of the correlations between manifest indicators greater than .30 was .66, and the KMO criteria for the sets of indicators was .93. Based on these criteria, the data appear to be factorable.

Figure 4.1
Standardized Residual and Cook's Distance Plots



Note. This displays two methods of multivariate outlier detection. The top plot displays Cook's Distance while the bottom plot displays standardized residuals. No outliers appear in either plot, all standardized residuals < 3.29, and only one observation has a Cook's Distance > 1.0.

Data Analysis

The goal of this dissertation was to improve the creative self-efficacy inventory previously studied by Abbott (2009b). In that study, the CTSE I and CPSE I inventories were introduced. As a result of the findings of that study, revised version of the CTSE I and CPSE I inventories, refereed to as CTSE II and CPSE II, were introduced in this dissertation. The Revised model of creative self-efficacy is taken from those CTSE II and CPSE II indicators that either performed well in the quantitative pilot study or have been included in the inventories since then. The next step is to test the latent structure and nomothetic span of the Revised model, as well as evaluating the changes made to create the Revised model. Confirmatory factor analysis (CFA) was conducted on the Revised model, a rival alternative model that included a general factor of creative self-efficacy, two theoretically justified rival models (the All model and the Held model), and two empirically justified rival models (the Implied Structure model and the Implied Indicators model).

Latent Structure

The first research question for the present study was "What is the latent structure of creative self-efficacy?" Answering this question required addressing two specific hypotheses:

H1: The Revised Model of the CTSE II and CPSE II Inventories is supported by data and provides adequate psychometric evidence

H2: There is no General Factor of Creative Self-Efficacy

This analysis was conducted by examining the fit and parsimony indices. First, adequate psychometric evidence was found for the current model. Second, no evidence was found for the existence of a general factor of creative self-efficacy.

The Revised Model. The Revised model was tested. After loadings of the four factors indicating CTSE (elaboration, flexibility, fluency, and orientation) and the three factors indicating CPSE (domain, field, and personality) were inputted, the model does not initially pass Hu and Bentler's (1999) criteria, $\chi^2(181) = 350.161$, $p < .01$, Scaling = 1.456, CFI = .934, RMSEA = .055, SRMR = .061, and AIC = 52830.056 . Several empirically justified latent correlations between three pairs of manifest indicators were suggested by Mplus (Muthén & Muthén, 2006), however, which led to refinements in the Revised model. The first pair of indicators is composed of two items designed to measure creative thinking self-efficacy for elaboration: “Tell stories based on dreams you had, even if you need to in fill answers?” and “Connect day-dreams or new ideas to things you have already learned?” It may be that these two indicators are also asking for experience with dreams, an area of psychology outside the scope of this dissertation. The second pair of indicators is composed of two items designed to measure creative performance self-efficacy for mastery of a domain: “Make sense of something you want to learn to do?” and “Choose to do something that is more important within your culture?” It may be that these two items are asking for an evaluation of desire or will, which is a distinct concept from self-efficacy (Bandura, 2007) and likewise outside the scope of this dissertation. The third pair of indicators is composed of one item designed to measure creative performance self-efficacy for creative personality, and another item designed to measure

creative performance self-efficacy for access to a field: “Have fun coming up with new ideas, after having learned from others?” and “Find an audience that is well-connected to others in society?” It may be that these two items are asking for a measure of agreeableness or extraversion, which is likewise outside the scope of this dissertation.

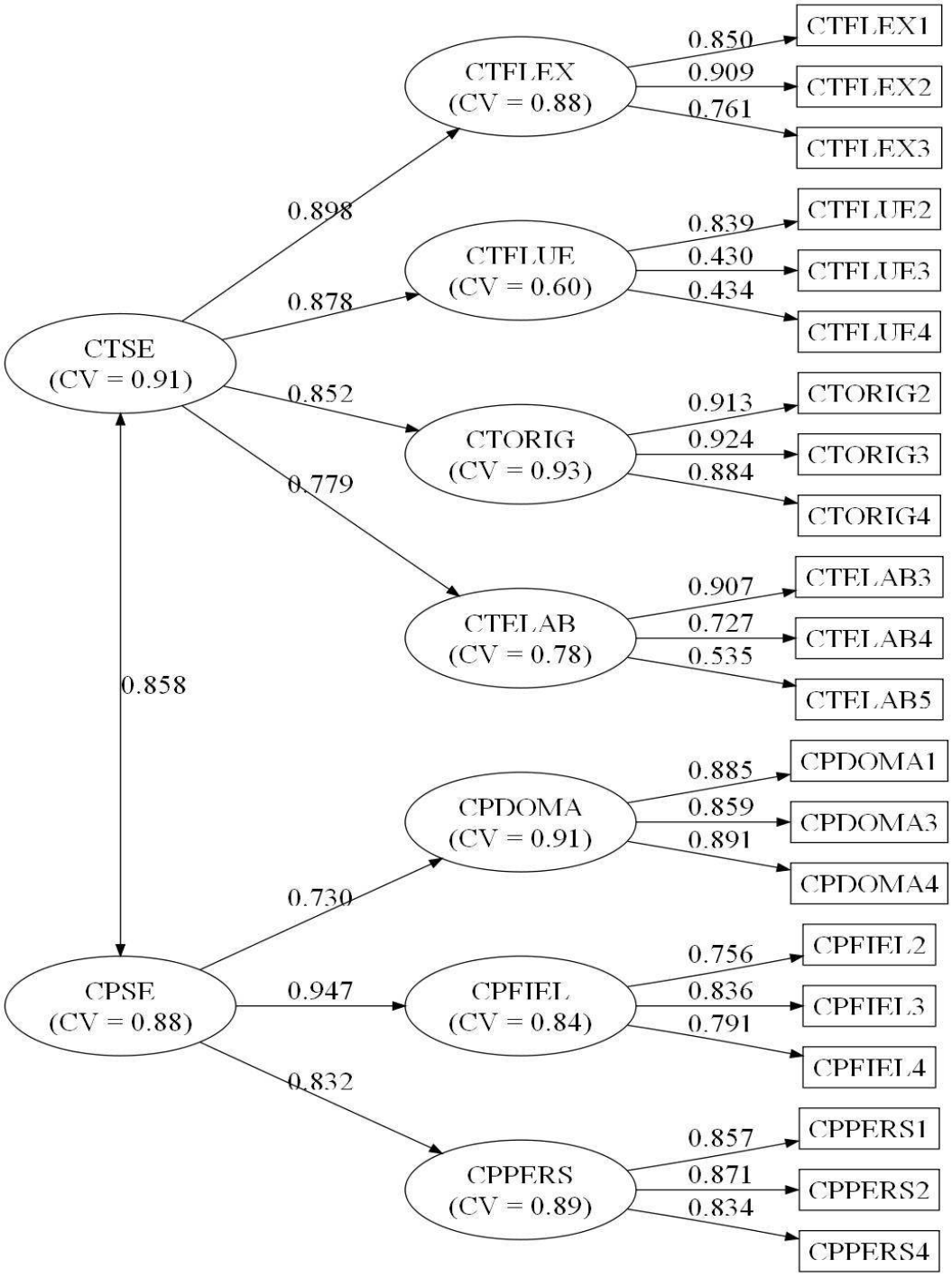
The Revised model was therefore refined to model the expected residual correlations between these three empirically and justified pairs of manifest indicators. This refined Revised model passed Hu and Bentler's (1999) criteria, $\chi^2(178) = 295.571$, $p < .01$, Scaling = 1.463, CFI = .954, RMSEA = .046, SRMR = .057, and AIC = 52758.669. A Satorra (2000; Satorra & Bentler, 2001) scaled χ^2 difference test indicated a significant improvement in performance between these models, Satorra-Bentler $\chi^2(3) = 52.457$, $p < .01$. A visualization of this refined Revised model appears as Figure 4.2. Note that the correlated residuals between indicators are not included in the visualization for the sake of readability. However, the Mplus code used to generate this model is included in Appendix J.

A General Factor of Creative Self-Efficacy? Hypotheses 2, that There is no General Factor of Creative Self-Efficacy, was tested through comparing the refined Revised model against a rival alternative model in which the variances of CTSE and CPSE, along with their covariance, were fixed at 1.0. This operation is conceptually identical to creating a construct General Factor of Creative Self-Efficacy construct with a variance of 1.0 and locally identifying it by fixing the loadings of CTSE and CPSE upon it as 1.0. This method has the advantage of allowing the General Factor of creative self-efficacy model to be contrasted as a nested model against the refined Revised model. This

rival alternative model, however, did not pass Hu and Bentler's (1999) criteria, $\chi^2(179) = 319.462$, $p < .01$, Scaling = 1.488, CFI = .945, RMSEA = .050, SRMR = .055, and AIC = 52799.519. A visualization of this rival model appears as Figure 4.3. A Satorra (2000; Satorra & Bentler, 2001) scaled χ^2 difference test of these models produced a negative result, Satorra-Bentler χ^2 (2) = -21.803, which means that the difference test is not interpretable (B.O. Muthén, 2006).

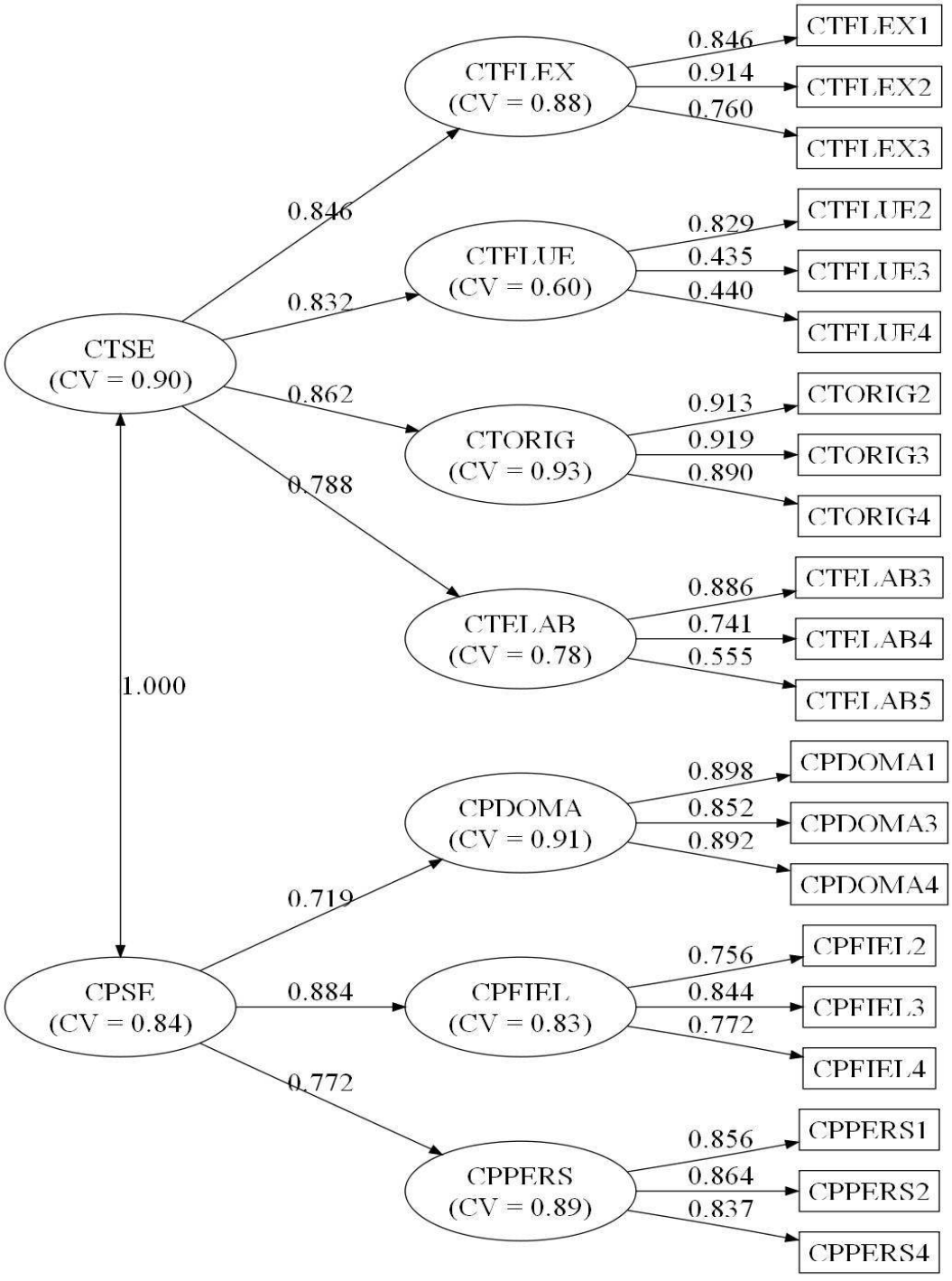
While the General Factor model of creative self-efficacy did not pass Hu and Bentler's criteria, the small difference between the general factor's model CFI (.054) and Hu and Bentler's criterion for CFI (.05) made it reasonable to examine this rival model more closely. The general factor model is less parsimonious than the Revised Model, AIC = 52758.669 against AIC = 52799.519. Likewise, the Revised model has better composite validity than the General Factor model. Composite validity fell for CTSE (.91 against .90), CPSE (.88 against .84), and Field (.84 against .83), and was the same for the other latent factors. As the General Factor model does not pass Hu and Bentler's criteria, is less parsimonious, and has less composite validity, Hypothesis 2 was judged to be passed.

Figure 4.2
Path Diagram of the Revised Model



Note. CPSE, refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Cross-loadings between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to composite validity.

Figure 4.3
Path Diagram of the General Factor Rival Model



Note. CPSE, refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Cross-loadings between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to composite validity.

Nomothetic Span

The second research question was "What is the relationship between creative self-efficacy and variables known to be related to creativity?" Answering this question required addressing two hypotheses:

H3: Beghetto's Creative Self-Efficacy (BCSE) construct is related to Creative Self-Efficacy

H4: Openness to Experience is related to Creative Self-Efficacy

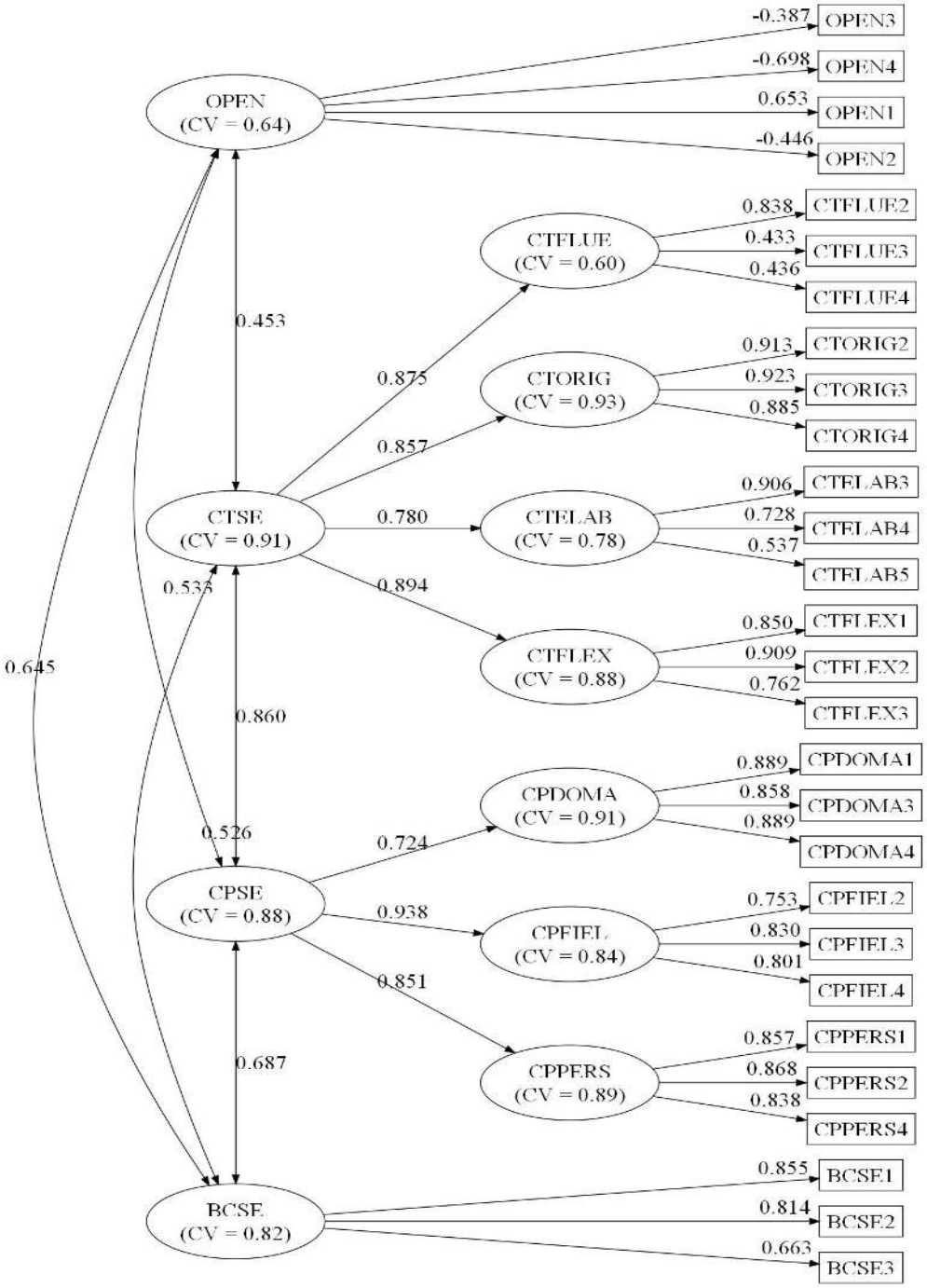
This analysis was conducted by examining the latent correlation matrix for a Revised model in which BCSE and openness to experience factors were included. Following adjustment for correlated manifest residuals, this refined Revised passes Hu and Bentler's (1999) criteria, $\chi^2(326) = 514.150$, $p < .01$, Scaling = 1.261, CFI = .950, RMSEA = .043, SRMR = .058, and AIC = 59249.022. This fit allows the model's latent correlations in Table 4.1 and the model's visualization in Figure 4.4 to be interpretable.

Table 4.1
Latent Correlation Matrix and Standard Deviation Vector for the Revised Model

Latent Factor	SD	1	2	3	4	5	6	7	8	9	10	11
1: BCSE	0.93	–										
2: CPDOMA	14.6	0.50	–									
3: CPFIEL	16.51	0.64	0.68	–								
4: CPPERS	16.46	0.58	0.62	0.80	–							
5: CPSE	10.57	0.69	0.72	0.94	0.85	–						
6: CTELAB	17.65	0.42	0.48	0.63	0.57	0.67	–					
7: CTFLEX	18.55	0.48	0.56	0.72	0.65	0.77	0.70	–				
8: CTFLUE	15.04	0.47	0.55	0.71	0.64	0.75	0.68	0.78	–			
9: CTORIG	20.03	0.46	0.53	0.69	0.63	0.74	0.67	0.77	0.75	–		
10: CTSE	13.16	0.53	0.62	0.81	0.73	0.86	0.78	0.89	0.88	0.86	–	
11: OPEN	0.88	0.65	0.38	0.49	0.45	0.53	0.35	0.41	0.40	0.39	0.45	–

Note. The sample size is n = 308. All correlations (r > 0.10) significant at the p < .05 level. All correlations (r > 0.13) significant at the p < .01 level. All correlations (r > 0.18) significant at the p < .001 level. Measure 1, BCSE, refers to Beghetto's Creative Self-Efficacy. Measure 5, CPSE, refers to Creative Performance Self-Efficacy. Measure 10, CTSE, refers to Creative Thinking Self-Efficacy. Measure 11, *OPEN*, refers to openness to experience. Domain, Field, and Personality are latent indicators of CPSE. Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Note that these correlations are for a Revised model with no saturated correlates. For all Latent Factors, $M = 0$.

Figure 4.4
Nomothetic Span of the Revised Model



Note. BCSE refers to Beghetto's Creative Self-Efficacy inventory; OPEN refers to Openness to Experience; CPSE refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Correlations between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to Composite Validity.

Creative Self-Efficacy and BCSE. As can be seen in Table 4.1, BCSE was correlated with CPSE (r = .69) and CTSE (r = .53). Among CPSE constructs, BCSE was correlated with Domain (r = .50), Field (r = .64), and Personality (r = .58). Among CTSE constructs, BCSE was correlated with Elaboration (r = .42), Flexibility (r = .48), Fluency (r = .47), and Originality (r = .46). All of these correlations are significant at the $p < .001$ level. Therefore, Hypothesis 3 was judged to be supported. These findings provide external validity for the Revised model. Interestingly, BCSE's correlations with CPSE factors are greater than BCSE's correlations with CTSE factors. Further research is necessarily to determine if this implies greater external validity for CPSE, or if BCSE is better conceptualized as a short measure of creative performance self-efficacy than as a short measure of creative self-efficacy.

Creative Self-Efficacy and Openness to Experience. As can be seen in Table 4.1, Openness to experience was correlated with CPSE (r = .53) and CTSE (r = .45). Among CPSE constructs, openness to experience was correlated with Domain (r = .38), Field (r = .49), and Personality (r = .45). Among CTSE constructs, BCSE was correlated with Elaboration (r = .35), Flexibility (r = .41), Fluency (r = .40), and Originality (r = .39). All of these correlations are significant at the $p < .001$ level. Therefore, Hypothesis 4 was judged to be supported. These findings provide external validity for the Revised model. Surprisingly, the correlations of openness of experience to the factors of CPSE are generally larger than the correlations of openness to experience to the factors of CTSE. Future research is required to replicate this finding, and to determine if this pattern is

sensible in the context of the published literature on creativity and openness to experience.

Evaluating Changes

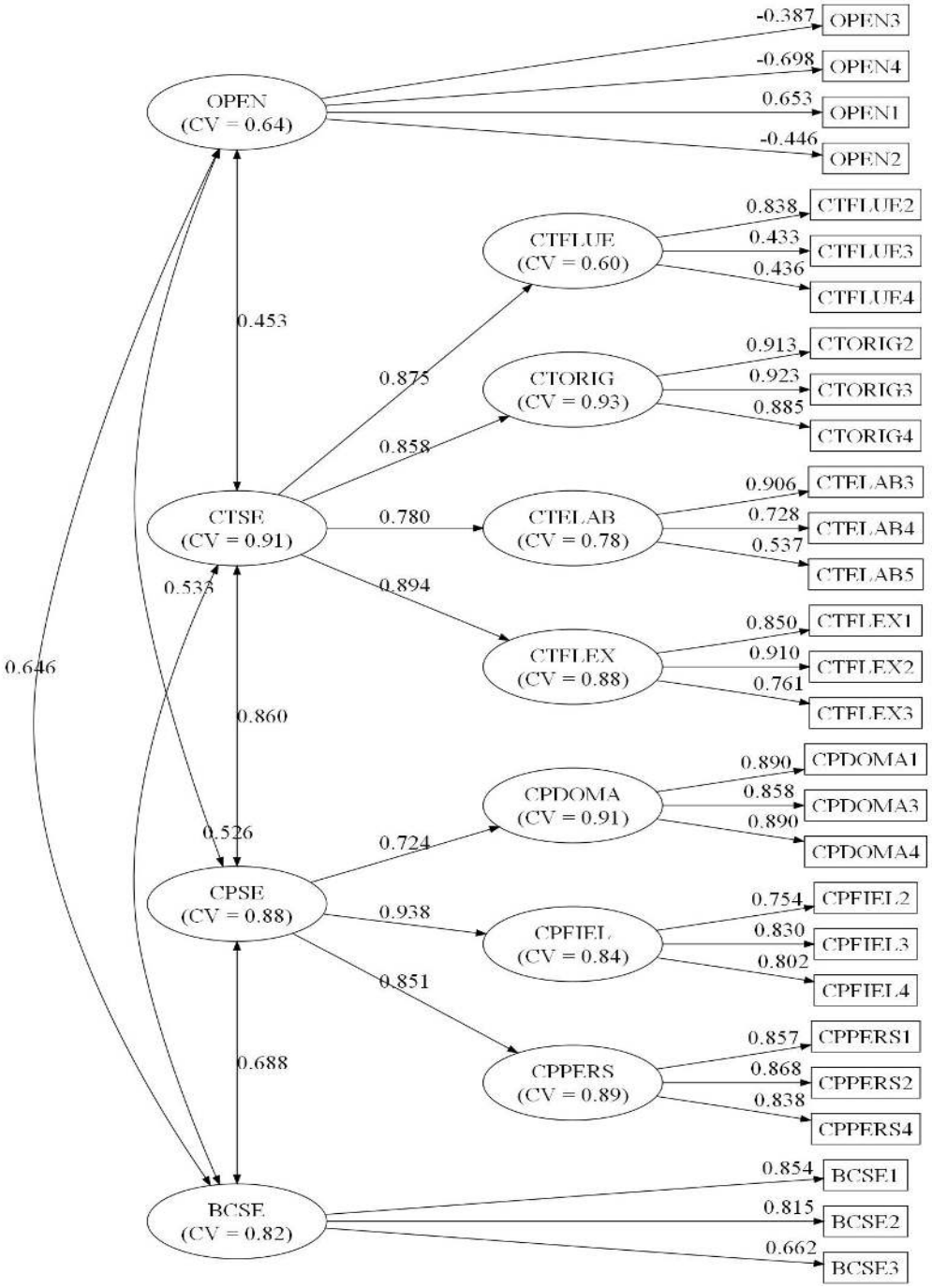
The third research question was "Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?" Answering this research question required addressing two specific hypotheses.

H5: The Revised model better reproduces the observed covariance matrix than the two theoretically justified rival alternative models

H6: The Revised model better reproduces the observed covariance matrix than the empirically justified rival alternative model

This analysis was conducted by comparing the model fit and parsimony of the All, Held, Implied Structure, and Implied Indicators models against the model fit and parsimony of the Revised model. Unused manifest indicators were treated as saturated correlates, and the tested models all included estimation of BCSE and openness to experience. A new version of the Revised model was tested, which also included the remaining CTSE and CPSE items as saturated correlates. This version of the Revised model also passed Hu and Bentler's (1999) criteria, χ^2 (326) = 514.108, $p < .01$, Scaling = 1.261, CFI = .963, RMSEA = .043, SRMR = .054, and AIC = 76438.957. A visualization of this model appears as Figure 4.5.

Figure 4.5
Path Diagram of the Revised Model with Saturated Correlates



Note. BCSE refers to Beghetto's Creative Self-Efficacy inventory; OPEN refers to Openness to Experience; CPSE refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Correlations between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to Composite Validity.

As all models accounted for variance from all CTSE II and CPSE II indicators, AIC parsimony indices could be directly compared. For Hypothesis 5 and Hypothesis 6, if the Revised model had a lower parsimony or AIC score than the rival alternative models, it would be judged as the best fitting model. In addition, the inclusion of BCSE and openness to experience in all models allowed exploratory tests of predictive validity and composite validity to be conducted. Predictive validity is operationalized as the extent to which the CTSE and CPSE constructs predict openness to experience and BCSE. Composite validity is operationalized as the ratio of variance explained in CTSE and CPSE manifest indicators by loadings on the latent factors (e.g., elaboration, flexibility, and so on) to the variance that is either explained by these factors or else not explained by any loading, $\Sigma\lambda^2 / (\Sigma\lambda^2 + \Sigma\varepsilon)$ (Raykov and Shrout, 2002).

Does the Revised model perform better than Theoretically Justified Models? Two theoretically justified rival alternative models were used to test Hypothesis 5. The first theoretically justified rival model, All Indicators, consisted of a measurement model that incorporated all manifest indicators in the CTSE II and CPSE II. The second theoretically justified rival model, Held Indicators, contained only elements that also appeared in Abbott (2009b). Both the All model and the Held model failed to pass Hu and Bentler's (1999) criteria, and both were less parsimonious than the Revised model. Therefore, Hypothesis 5 was judged to be supported.

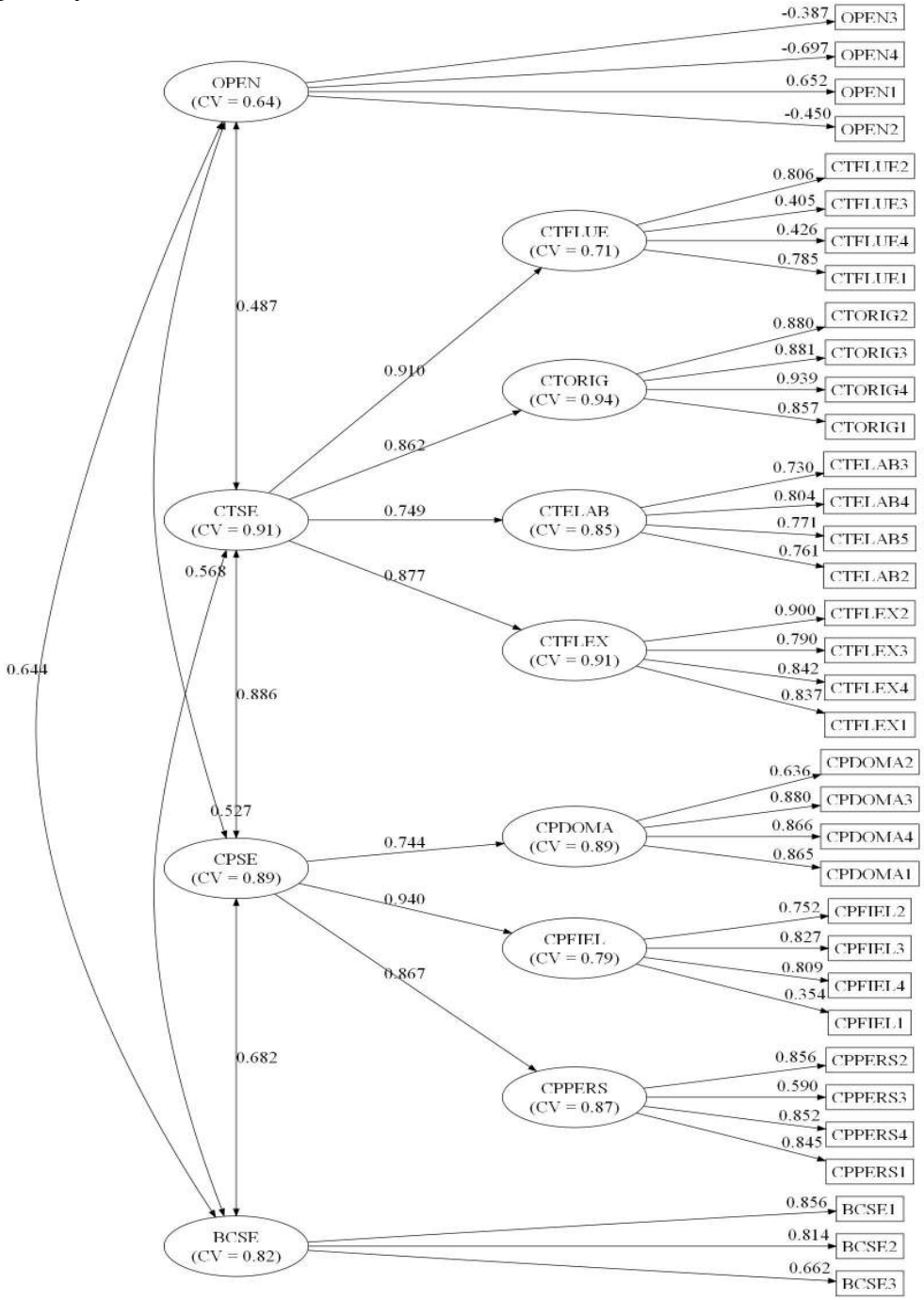
The first theoretically justified rival model tested was the All model. The All model did not pass Hu and Bentler's (1999) criteria, χ^2 (536) = 1047.897, $p < .01$, Scaling = 1.244, CFI = .900, RMSEA = .056, SRMR = .062. A comparison of the AIC of the All

and the Revised models revealed that the Revised model is also more parsimonious, with an AIC of 76438.957 against an AIC of the All model 76674.046. Therefore, the Revised model was judged to perform better than the All model in this sample. A visualization of the All model appears as Figure 4.6.

The second theoretically justified rival model tested was the Held model. Initially the Held model did not converge, but no longer allowing the residual correlations between BCSE and openness to experience fixed this problem. The Held model did not pass Hu and Bentler's (1999) criteria, χ^2 (311) = 739.173, $p < .01$, Scaling = 1.295, CFI = .917, RMSEA = .067, SRMR = .060. A comparison of the AIC of the All and the Revised Models reveals that the Revised Model is also more parsimonious, with an AIC of 76438.957 against an AIC for the Held model of 76777.647. Therefore, the Revised model was judged to perform better than the All model in this sample. A visualization of the Held model appears as Figure 4.7.

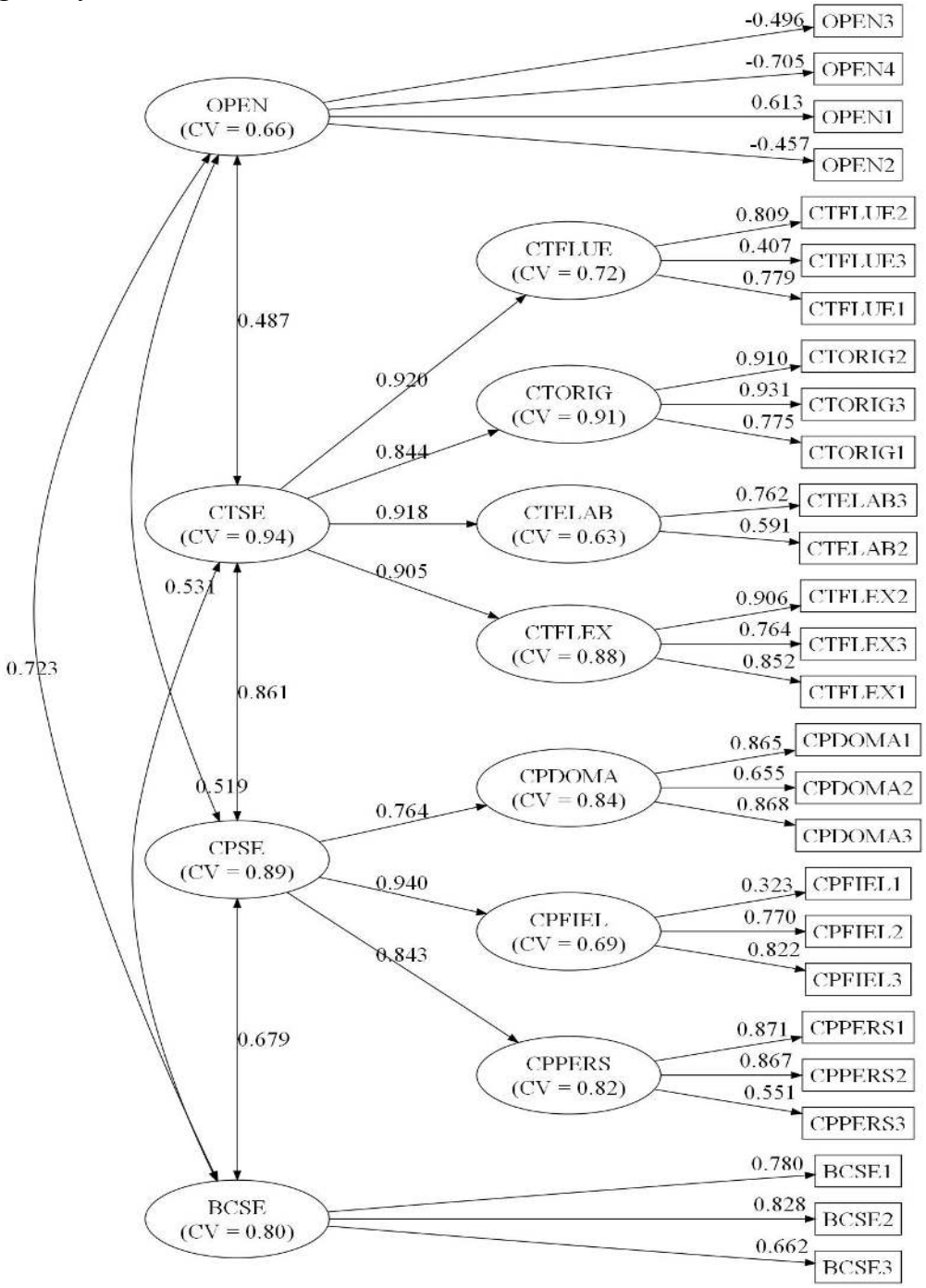
Among the Revised, All, and Held models, only the Revised model passed Hu and Bentler's criteria. Only the Revised model, therefore, has an internal factor structure that is interpretable. The composite and predictive validity of the factors within the three models is now compared, however, as part of an exploratory analysis. Though this analysis must be done hesitantly, as the All and Held models do not pass Hu and Bentler's criteria and are less parsimonious, if a clear pattern of evidence emerges which indicates that the All or Held models is superior with respect to composite or predictive validity than the Revised model, this may provide an avenue for future research.

Figure 4.6
Path Diagram of the All Model



Note. BCSE refers to Beghetto's Creative Self-Efficacy inventory; OPEN refers to Openness to Experience; CPSE refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Correlations between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to Composite Validity.

Figure 4.7
Path Diagram of the Held Model



Note. BCSE refers to Beghetto's Creative Self-Efficacy inventory; OPEN refers to Openness to Experience; CPSE refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Correlations between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to Composite Validity.

The results of the composite and predictive validity tests were mixed, as can be seen in Figures 4.6 and 4.7. To ease the comparisons, a table of the predictive and constructive validity of the factors in the Revised, All, and Held models appears as Table 4.2. As demonstrated in the table, composite validity in CTSE factors is generally higher for the All or Held models, except for Flexibility. Likewise, composite validity in CPSE factors in consistently higher for the Revised model. Predictive validity for both BCSE and openness to experience, however, is generally greater in the All or Held models than in the Revised models, except for the predictive validity of the Field factor on BCSE. These results do not provide a clear pattern that would indicate a problem with using the AIC parsimony criterion as a method of selecting between rival models, and do not provide a clear path for future research.

Does the Revised Model perform better than Empirically Justified Models? In order to test Hypothesis 6, principal axis factor analysis (PAF) and hierarchical cluster analysis (HCA) were conducted to develop two empirically justified models, one which only varied in its manifest indicators, and the other of which varied in its factor structure. The purpose of building these two rival alternative models was to determine whether the Revised model, which was developed based on the published literature and theory, performs better in this sample population than models which are empirically justified on the data of this study alone.

Table 4.2
Composite and Predictive Validity of the Revised, All, and Held Models

Factor	Model								
	Revised			All			Held		
	CV	PV—B	PV—O	CV	PV—B	PV—O	CV	PV—B	PV—O
Creative Thinking Self-Efficacy (CTSE)									
Fluency	0.60	0.47	0.40	0.71	0.52	0.44	0.72	0.49	0.45
Flexibility	0.93	0.48	0.41	0.91	0.50	0.43	0.88	0.48	0.44
Elaboration	0.78	0.42	0.35	0.85	0.43	0.36	0.63	0.49	0.45
Originality	0.88	0.46	0.39	0.94	0.49	0.49	0.91	0.45	0.41
Creative Performance Self-Efficacy (CPSE)									
Domain	0.91	0.50	0.38	0.89	0.51	0.51	0.84	0.52	0.40
Field	0.84	0.65	0.49	0.79	0.64	0.64	0.69	0.64	0.49
Personality	0.89	0.59	0.45	0.87	0.59	0.59	0.82	0.57	0.44

Note. This table describes compares three models, the Revised Model, the Implied Structure Model, and the Implied Indicators model. For each model, the composite validity or CV, the predictive validity relative to Beghetto's Creative Self-Efficacy (BCSE) construct or PV—B, and the predictive validity relative to openness to experience or PV—O is calculated for each factor.

Results of the PAF and HCA were used to derive two empirically justified models, the Implied Structure model and the Implied Indicator model. The results of the PAF appear as Table 4.3, and the results of the HCA appear as Figure 4.8. Both the PAF and HCA results imply that fluency and flexibility may not be clearly distinguished factors. In the PAF, all fluency and flexibility items load on one extracted factor, which accounts for 13% of the variance in the data. Likewise, in the HCA, except for three items all fluency and flexibility items are part of the same six-item cluster. Excepting those three outlying items, it is not possible to form a branch of the HCA that incorporates all flexibility items but does not incorporate fluency items. Therefore, the Implied Structure model will model fluency and flexibility as one latent factor.

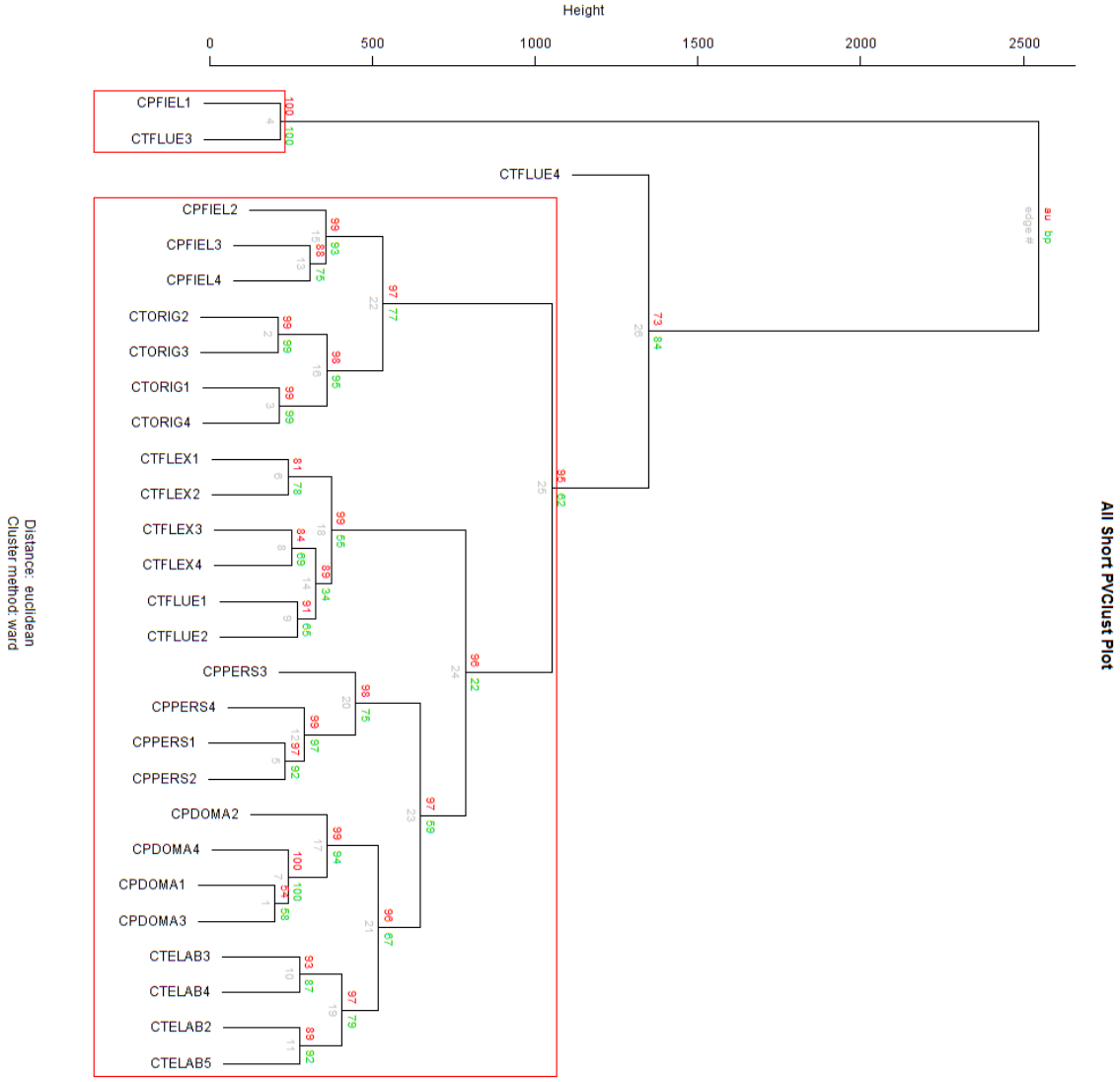
The Implied Indicators model, in contrast, does not alter the theoretical factor structure. It shares with the Implied Structure model, however, a new set of indicators which contained large loadings in the EFA. As with other models, the Implied Indicators and Implied Structure models contain a total of 21 items to indicate the factors of CTSE and CPSE. Unlike other models, however, the Implied Indicators model has four items to estimate flexibility and only two items to estimate fluency. This is because both EFA and HCA showed only two fluency items to load on the same factor and be part of the same cluster as most flexibility items. A visualization of the Revised model, the Implied Structure model, and the Implied Indicators model appears as Figure 4.9.

Table 4.3
Principal Axis Factor Analysis of the CTSE II and CPSE II Inventories

Measure	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
CPDOMA1	0.12	0.06	**0.73**	-0.02	-0.02	0.22	-0.15
CPDOMA2	0.05	-0.02	*0.46*	0.11	0.03	-0.08	0.34
CPDOMA3	-0.02	0.01	**0.93**	0.01	0.02	-0.03	0.02
CPDOMA4	0.03	0.04	**0.67**	0.12	0.05	-0.07	0.11
CPFIEL1	-0.12	*0.38*	0.10	-0.08	0.07	0.04	-0.00
CPFIEL2	0.07	0.23	0.07	0.03	0.05	0.18	**0.57**
CPFIEL3	0.07	0.25	0.09	0.19	0.19	0.04	*0.35*
CPFIEL4	0.07	*0.46*	0.06	0.08	0.06	0.08	0.25
CPPERS1	0.13	**0.80**	0.04	-0.04	0.06	-0.08	0.01
CPPERS2	-0.02	**0.84**	0.07	-0.04	-0.06	0.07	0.09
CPPERS3	-0.07	*0.32*	0.09	0.13	0.29	0.02	-0.04
CPPERS4	-0.03	**0.68**	-0.01	0.18	0.14	0.10	-0.08
CTELAB2	0.01	0.05	0.07	**0.73**	0.09	0.02	-0.15
CTELAB3	*0.35*	0.11	0.03	0.27	0.21	-0.09	0.03
CTELAB4	0.15	0.05	0.08	**0.61**	-0.06	-0.01	0.06
CTELAB5	-0.01	-0.06	0.00	**0.89**	-0.03	0.03	0.07
CTFLEX1	**0.68**	-0.05	0.06	-0.07	0.24	-0.01	0.10
CTFLEX2	**0.83**	-0.07	0.02	-0.01	0.05	0.11	0.10
CTFLEX3	**0.78**	0.05	0.05	0.08	-0.07	-0.00	-0.10
CTFLEX4	**0.77**	0.08	0.04	0.09	0.08	-0.13	-0.07
CTFLUE1	**0.57**	0.23	-0.02	0.04	-0.06	0.07	0.13
CTFLUE2	**0.71**	-0.02	0.02	0.02	0.02	0.12	-0.01
CTFLUE3	*0.34*	0.17	0.02	-0.10	-0.08	0.15	-0.12
CTFLUE4	*0.32*	0.04	0.09	-0.00	-0.04	0.06	-0.01
CTORIG1	0.06	0.03	0.08	0.07	0.13	**0.75**	0.06
CTORIG2	0.06	0.11	-0.03	0.06	**0.73**	0.09	0.01
CTORIG3	0.05	-0.02	0.08	-0.01	**0.87**	0.04	0.01
CTORIG4	0.11	0.17	-0.03	0.11	0.37	*0.44*	0.03

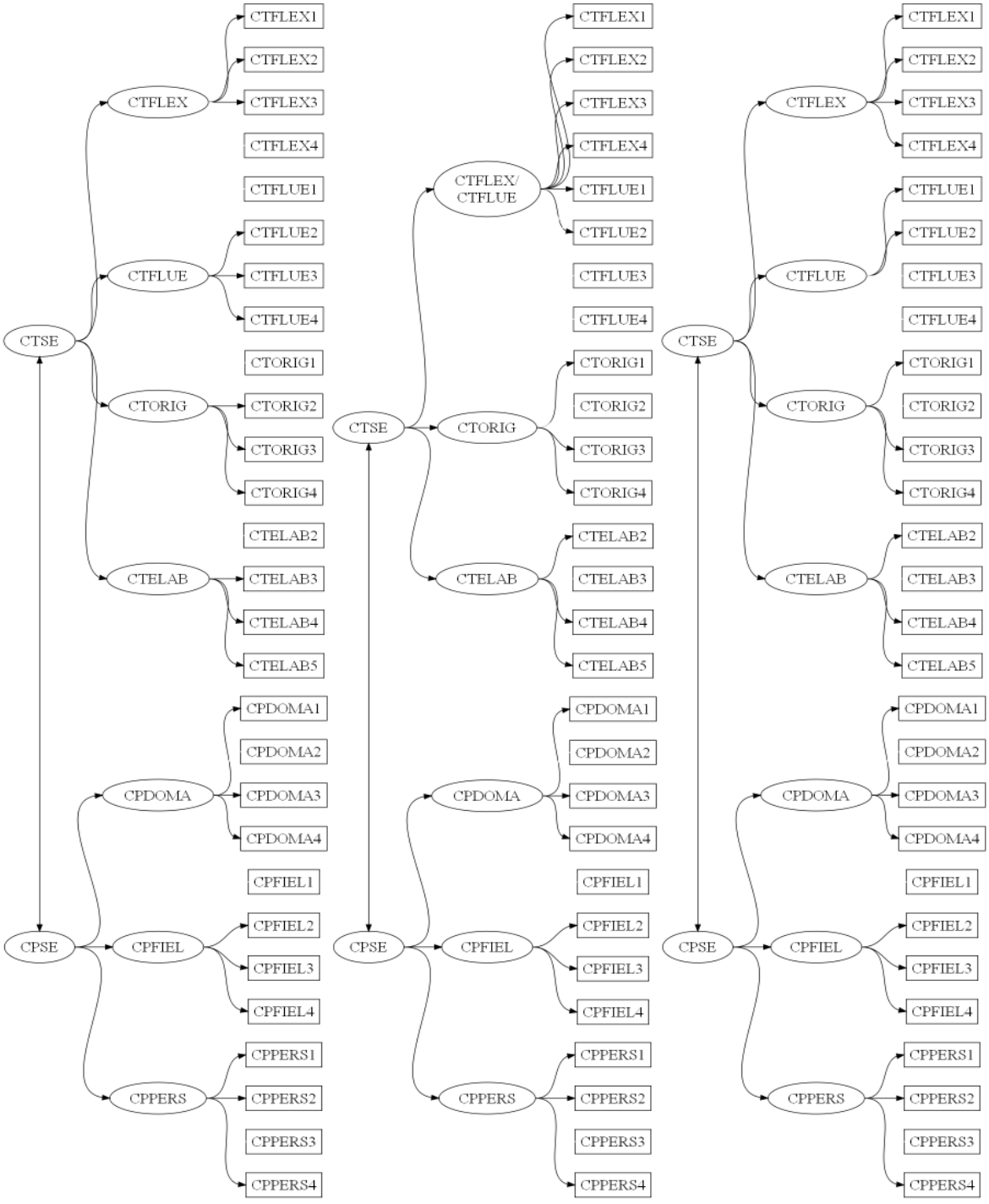
Note. Items in **bold** have a loading > .5. Items in italic load primarily between the indicated measure and factor, but have a loading of < .5. All loadings are rounded. The proportion of the variance explained by the factors is 0.13, 0.09, 0.08, 0.07, 0.06, 0.03, 0.03, respectively. The cumulative proportion of the variance explained by the factors is 0.13, 0.22, 0.30, 0.37, 0.43, 0.47, 0.49, respectively. Domain, Field, and Personality are latent indicators of CPSE. Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE.

Figure 4.8
Hierarchical Cluster Analysis of the CPSE II and CTSE II Inventories



Note. This is a visualization of the hierarchical cluster plot of the CTSE II and CPSE II inventories. Domain, Field, and Personality are latent indicators of CPSE. Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE.

Figure 4.9
Latent Structure of the Revised and Empirically Justified Models

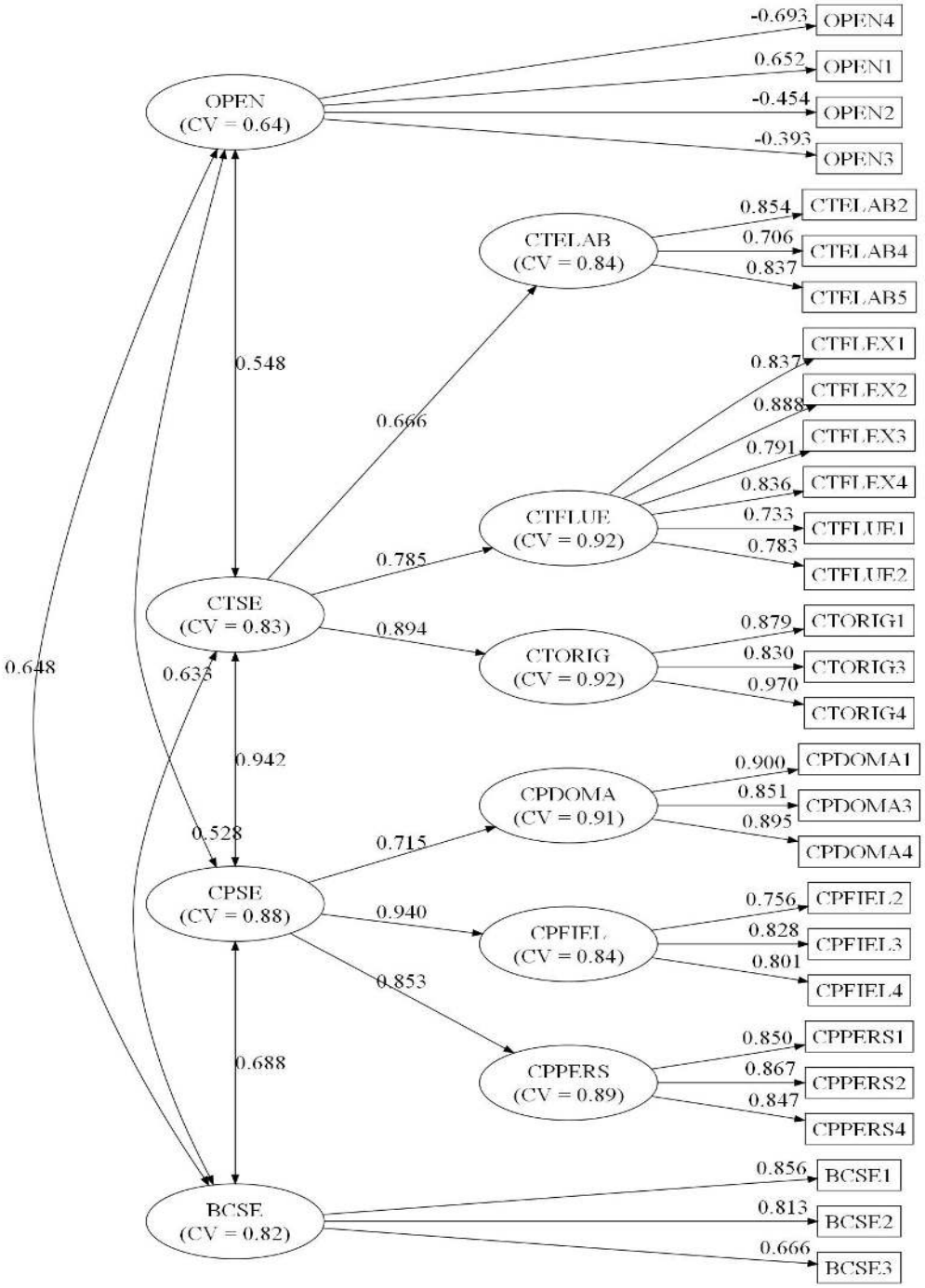


Note. From left to right, this figure shows the theorized latent structure of the CTSE II and CPSE II inventories in the Revised, Implied Structure, and Implied Indicators. The models differ in which items are considered to be indicators of the factors of CTSE and CPSE.

The Revised model reproduces the observed covariance matrix better than either Implied model. The Implied Structure model, in which fluency and flexibility are one factor, passes Hu and Bentler's (1999) criteria, χ^2 (327) = 526.884, $p < .01$, Scaling = 1.357, CFI = .961, RMSEA = .045, SRMR = .049, and AIC = 76503.431. A path diagram of the Implied Structure model appears as Figure 4.10. The AIC in the Implied Structure model compares to an AIC of 76438.957 in the Revised model. Therefore, the Revised model is more parsimonious than the Implied Structure Model. The decrease in parsimony introduced by the Implied Structure model was small, however, as 76503.431 - 76438.957 = 64.474, or a decrease of less than 1%. Therefore, the composite and predictive validity of the factors in the Implied Structure model will be compared against the Revised model to further explore the difference between these models.

The final rival model was the Implied Indicators model. The Implied Indicators model possessed a latent structure that accounts for the same manifest indicators as the Implied Structure model, but maintains flexibility and fluency as distinct models. The Implied Indicators model also passed Hu and Bentler's (1999) criteria, χ^2 (326) = 572.421, $p < .01$, Scaling = 1.363, CFI = .952, RMSEA = .050, SRMR = .054, and AIC = 76570.611. Therefore, the composite and predictive validity of the Implied Indicators model is also explored. The difference in parsimony between the Revised model and the Implied Indicators model is 76570.611 - 76438.957 = 131.65, or nearly twice the difference in parsimony between the Revised model and the Implied Structure model.

Figure 4.10
Path Diagram of the Implied Structure Model



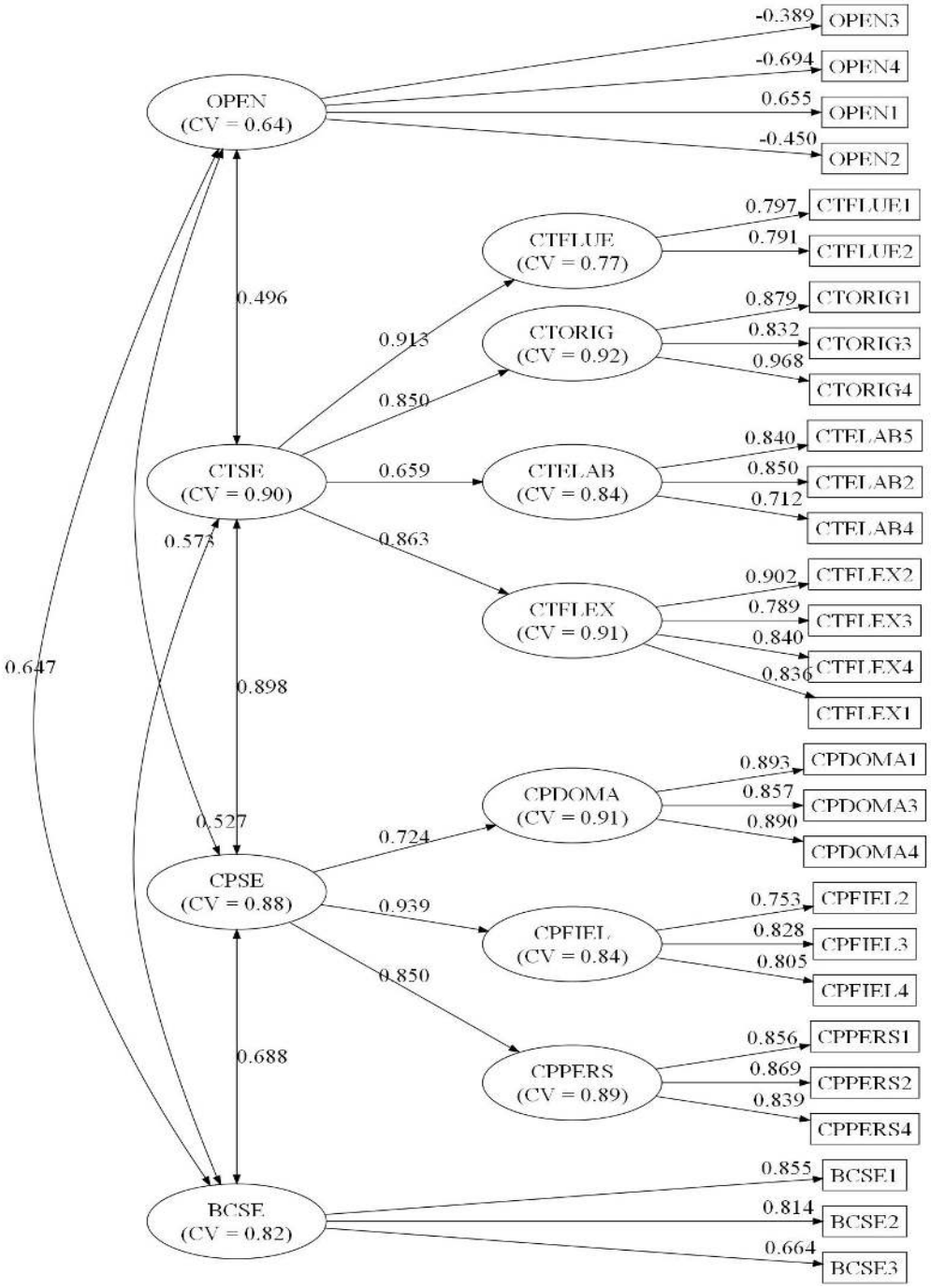
Note. BCSE refers to Beghetto's Creative Self-Efficacy inventory; OPEN refers to Openness to Experience; CPSE refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Correlations between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to composite validity.

Results of the composite and predictive validity tests were mixed, as can be seen in Figures 4.10 and 4.11. To ease the comparisons, a table of the predictive and constructive validity of the factors in the Revised model, the Implied Structure model, and the Implied Indicators model appears as Table 4.4. As demonstrated in the table, composite and predictive validity is generally higher for the Implied models with regards to CTSE factors, and generally similar for all models with regards to CPSE factors. This result is sensible, as the Implied models were both optimized on the basis of the factor extraction techniques of PCA and HFA. Nonetheless, the Implied models pay for this increase in composite and predictive validity with a decrease in parsimony. Therefore, while Implied models may prove useful in providing a direction for future research, they are not preferred over the Revised model, and Hypothesis 6 was judged to be supported.

Summary of Hypothesis Tests

All hypotheses tests were judged to be supported. The data supports the theorized structure of CTSE and CPSE. Hypothesis 1 was judged to be supported, as close fit for the Revised model was achieved. Likewise, Hypothesis 2 was judged to be supported, as a rival alternative model containing a general factor of creative self-efficacy was less parsimonious. The data also supports the external validity of the model. Hypothesis 3 and Hypothesis 4 were both judged to be supported, as all creative self-efficacy constructs correlated with BCSE and openness to experience. Results likewise appear to support the changes made to the model since the quantitative pilot study (Abbott, 2009b). Finally, Hypothesis 5 and Hypothesis 6 were judged to be supported. The Revised model was more parsimonious than any rival alternative model tested.

Figure 4.11
Path Diagram of the Implied Indicators Model



Note. BCSE refers to Beghetto's Creative Self-Efficacy inventory; OPEN refers to Openness to Experience; CPSE refers to Creative Performance Self-Efficacy; CTSE refers to Creative Thinking Self-Efficacy; Domain, Field, and Personality are latent indicators of CPSE; Elaboration, Flexibility, Fluency, and Originality are latent indicators of CTSE. Correlations between manifest indicators, and the presence of saturated correlates, are not displayed for the sake of readability. CV refers to composite validity.

Table 4.4
Composite and Predictive Validity of the Revised and Implied Models

Factor	Model								
	Revised			Implied Structure			Implied Indicators		
	CV	PV—B	PV—O	CV	PV—B	PV—O	CV	PV—B	PV—O
Creative Thinking Self-Efficacy (CTSE)									
Fluency	0.60	0.47	0.4	—	—	—	0.77	0.52	0.45
Flexibility	0.93	0.48	0.41	—	—	—	0.92	0.49	0.43
Fluency/ Flexibility	—	—	—	0.92	0.50	0.43	—	—	—
Elaboration	0.78	0.42	0.35	0.84	0.42	0.37	0.84	0.38	0.33
Originality	0.88	0.46	0.39	0.92	0.57	0.49	0.92	0.49	0.42
Creative Performance Self-Efficacy (CPSE)									
Domain	0.91	0.50	0.38	0.91	0.49	0.38	0.91	0.50	0.38
Field	0.84	0.65	0.49	0.84	0.65	0.5	0.84	0.65	0.5
Personality	0.89	0.59	0.45	0.89	0.59	0.45	0.89	0.5	0.49

Note. This table describes compares three models, the Revised Model, the Implied Structure Model, and the Implied Indicators model. For each model, the composite validity or CV, the predictive validity relative to Beghetto's Creative Self-Efficacy (BCSE) construct or PV—B, and the predictive validity relative to openness to experience or PV—O is calculated for each factor.

The Revised creative self-efficacy inventory passed Hu and Bentler's (1999) criteria, demonstrated external validity, and performed better than any rival alternative model. These results lend provisional support for the use of an instrument that estimates CTSE and CPSE using the Revised model. A visualization of what such an instrument might look like appears as Figure 4.12. Of course, not only the performance of this specific instrument needs to be investigated through future research. Further, the degree to which this study can hint at its potential performance is limited by this study's population, observational design, and the requirement for post-hoc modifications of the model limit the generalizability of this study's findings and the extent to which the use of the Revised model's CTSE and CPSE inventories should be considered to perform validly and reliably.

These caveats emphasize the need for future research and instrument improvement in order to further improve model fit and, ultimately, to engage in substantive research with these inventories. For that purpose, the results of a qualitative, exploratory study are now discussed, in which themes that may be useful in further improving a creative self-efficacy inventory are emphasized. At the conclusion of that discussion, the items from the Revised model are presented with their CFA loadings in the context of the themes that emerged from the interviews.

Figure 4.12
Example Form that Includes the CTSE II and CPSE II Inventories

In the column *Confidence*, rate how confident you are that you can perform each *Task* as of now. Rate your degree of confidence by recording a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Confidence	Task
_____	Come up with many possible solutions to a problem
_____	Arrive at a variety of conclusions given a difficult situation
_____	Think of many answers to a difficult problem or situation
_____	Come up with different kinds of responses, not just different responses?
_____	Answer problems in different ways, each of which are unique and special?
_____	Think of many types of ideas while considering a problem?
_____	Think of ways to defend a 'crazy' thought, by thinking back on what you already know?
_____	Talk to your friends about wild ideas, and make them sound reasonable?
_____	Tell stories based on dreams you had, even if you need to fill in answers?
_____	Be the first in a group to come up with an original suggestion?
_____	Arrive at a novel solution before other people?
_____	Beat other people in imagining a brand new idea first?
_____	Make sense of something you want to learn to do?
_____	Start to learn to do something, even if there are obstacles to doing so?
_____	Teach yourself how to do something new?
_____	Create a novelty that people will choose, over other novelties available?
_____	Find an audience that is well-connected to others in society?
_____	Network with people to convince them that what you made is the best?
_____	Be motivated to come up with new ideas?
_____	Have fun coming up with new ideas, after having learned from others?
_____	Sustain wonder about something, even after working with it for years or decades?

Note. A key to these 21 indicators appears as Table 3.2. The performance of this inventory in this study appears as Table 4.9.

Qualitative Results

The second phase of this explanatory study was designed to understand the experiences of those high and low in Creative Thinking Self-Efficacy (CTSE) and Creative Performance Self-Efficacy (CPSE). In this section, a method similar to Creswell's (2006) multiple case study approach is used to compare and contrast these four types of individuals who vary in their creative self-efficacy.

As described in the methodology chapter, mean scores of indicators for CTSE and CPSE were calculated for each participant. From these scores, 8 participants were selected so the 4 studied groups–High CTSE, Low CTSE, High CPSE, and Low CTSE–would each have 2 participants for follow-up interviews. This process was complicated by two issues. First, the calculated scores for average CTSE and average CPSE were correlated ($r = .77$, $p < .001$). Thus, the number number of individuals who were notable in one dimension but not another was limited. Secondly, while inducements were used to recruit participants in the quantitative phase, no inducements were used in the qualitative phase. Therefore, the eight participants represented only a 24.2% response rates of the 33 participants approached to be interviewed. A table of each participant interviewed along with a brief description of their history and experiences appears as Table 4.5.

Table 4.5
Brief Description of the Eight Participants

Participant ID	Short Description
137	Participant 137 was a 19 year old female who was taking a 200-level class on adolescent development. She took the online survey in its first day of availability. Selected for a high score in CTSE, she emphasized the performative aspect of internal mental acts. Responding to a follow-up question asking if "listening to music is doing a creative thing," she responded "music is no doubt something creative listening to it is no different, your thinking about it, listening to it in a creative mindset much like looking at a work of art can be a creative outlet."
110	Participant 110 was a 23 year old male who was taking a 400-level class in learning and motivation for pre-service secondary teachers. He took the online survey in its twenty-second day of availability. Selected for high CTSE, he used metaphors of transgressing boundaries in describing the creative process, "There is a barrier that you have to cross where it seems harder, but once you get over the barrier the ideas just kind take off." As he then summarized "It's hard to get a large object moving but once it gets moving, its moving."
48	Participant 48 was a 20 year old female who was taking a 200-level class on child development. She took the online survey in its first day of availability. Selected for low CTSE, she repeatedly emphasized how ideas "just pop" into her head. She described the emotional context of creativity, as well. "Another time that I may do [something creative] is if I would like to do something special for someone. The thing that I really enjoy is writing poems."
80	Participant 80 was a 19 year old male who was taking a 200-level class on child development. He took the online survey in its seventh day of availability. Selected for low CTSE, he emphasized the role of virtue and doing the right thing far more than any other participant. "Human thought takes much, if not all, of its fuel from what we see around us, but our perceptions can be misguided and liberty in thought can lead to abandoning precious values that were established for a purpose."
96	Participant 96 was a 19 year old male who was taking a 200-level class on adolescent development. He took the online survey in its seventh day of availability. Selected for high CPSE, he thought about the subtleties between thinking and performance, and efficacy and control. "Thinking is an ongoing process," he said, "but doing creative things actually requires physically moving which is something you can control."

(table continues)

Participant ID	Short Description
107	Participant 107 was a 21 year old female who was taking a 200-level class on adolescent development. She took the online survey in its second day of availability. Selected for a high score on CPSE, she emphasized, color, design, and poetry throughout the interview. “When I'm having creative thoughts,” she said, “ideas just seem to kind of explode in my head like fireworks and when I think of fireworks I think of colorful, exciting bursts.”
87	Participant 87 was a 19 year old female who was taking a 200-level class in adolescent development. She took the online survey in its first day of availability. Selected for low CPSE, she both practices and studies poetry. Her impressions of thinking creative thoughts was evocative: “I guess it feels like Christmas did when you were a kid and you were so anxious about it all month. You spend so much time thinking about what you're going to get. Finally the day comes and you're so surprised and its the best day ever.”
148	Participant 148 was a 22 year old male who was taking a 400-level class on learning and motivation for pre-service secondary teachers. He took the survey in its eighth day of availability. Selected for low CPSE, he implied that some domains afforded creativity better than others. In “the fine arts and English areas,” he said, “there are no theorems or set answers, or interpretations.” This contrasts to the sciences where “there is always a definitive answer (or so it seems) in those fields.”

Note. Participants are discussed using a unique identifier (Participant ID). The short descriptions are a compilation of information collected in both the quantitative and qualitative phases.

The 8 interview transcripts were then read several times. Following this, several passes of coding were used to disaggregate themes and codes from the texts. In the first pass, important passages from the texts were extracted. Second, in vivo-style codes were used to reduce the passages to their essences. Third, the codes were reproduced on a separate sheet of paper, so that comparisons could be made between then. Fourth, codes that emerged from both participants in a group were grouped together. Fifth, codes that emerged from two different groups were selected. Sixth, one code that was apparent in all but one text was extracted to demonstrate a commonality among participants. The sheets used for coding appear in Appendix L.

In this study, unique themes emerged in each group, a shared theme emerged between each High-Low pair of groups, and a universal theme emerged from all but one participant across all groups. No common themes emerged between other pairs of groups. Following the discussion of the groups and how they are similar and different, the themes that emerged from the groups are discussed. Finally, a glossary of themes that emerged from the qualitative phase appears at the end of this section, and the qualitative results are briefly summarized to provide a context for the quantitative results.

Participants were not informed of this approach, or their own rankings, until after the interviews were conducted. This was done to avoid situations where participants would censor their own remarks to appear to be consistent with their previous answers. This led to rich, contextual responses that might not have been possible otherwise. In Table 4.6, the categorization of each participant is presented with their interview answer to the appropriate self-efficacy prompt. For participants in the High and Low CTSE

groups, the appropriate prompt was “Are you confident in your ability to do things, like think of things no one else has, or come up with many different responses to a problem?” For participants in the High and Low CPSE groups, the appropriate prompt was “Are you confident in your ability to do things like, find an audience for what you do, or impress people who have the power to publicize your work?”

As can be seen in Table 4.6, participants have rich, textured experiences which are not captured by simple self-efficacy survey items. Nonetheless, from within these self-descriptions the themes and commonalities of the four groups began to emerge. The two participants in the High CPSE group tended to answer affirmatively, and noted either a need for an audience (“you may have thought of the best program this campus has ever seen but it won't matter if you don't have anyone there to see or experience it”) or difficulties that would be encountered (“finding an audience is easier than finding someone who have the power to publicize your work”). Participants in the Low CPSE group qualified their answers (“I certainly hope so!” and “I think so.”). Both participants in the High CTSE group emphasized the importance of social situations. Participant 137 stated that “every great idea came from someone who had something else influencing them,” while Participant 110 emphasized the role of educational experience. Finally, the two participants in the Low CTSE group either referred to different skills, such as teaching ability (“If I understand something I am pretty confident that I could think of different ways to explain it to others”), or expressed skepticism of their own abilities (“Honestly, I am more often either unconfident with doing things differently, or find that what I come up with is not really a good idea”).

Table 4.6
Participant ID, Group, and Self-Description

Participant ID	Group	Self-Description
137	High CTSE	Yeah, i do think that the best ideas are from other peoples ideas though, every great idea came from someone who had something else influencing them, great ideas can only be so original, anyone can think different responses to a problem if they want to but to create something no one else has is a pretty big deal but to answer the question yah i think i am capable of both
110	High CTSE	In some areas and disciplines I would agree and say yes I am confident to do things like think of things no one else has, but there are some areas where I would doubt my ability. Math was one of those subjects where I could not find different ways to solve a problem, and I think that is one reason why when I was younger I really enjoyed math and then in high school I started to have a distaste for math.
48	Low CTSE	It depends on the topics that are being discussed … I am pretty confident in my math ability and my ability to explain things to other people that I understand. If I understand something I am pretty confident that I could think of different ways to explain it to others
80	Low CTSE	Honestly I am more often either unconfident with doing things differently, or find that what I come up with is not really a good idea. There are times though that I'm very happy with trying to think up new ideas. ...and suggesting/implementing them.
96	High CPSE	Yes i believe i am, when i am planning an event, I am doing so while thinking specifically about what will bring the residence hall students to these events. Over time, you really start to develop a sense of what works and what doesn't work as far as bringing the students to your events. My adviser puts it well, he said that you may have thought of the best program this campus has ever seen but if it won't matter if you don't have anyone there to see or experience it
107	High CPSE	Although I think finding an audience is easier than finding someone who have the power to publicize work.
87	Low CPSE	Finding an audience, yes. Impressing people with power, I certainly hope so! But I don't really have experience with getting work publicized, so I couldn't say I'm confident in it.
148	Low CPSE	I think so. Especially in the fine arts, there is always a niche of people who find it interesting.

Note. Except where required for clarity, self-descriptions provided by participants were not edited for style, spelling, or grammar.

Creative Thinking Self-Efficacy Themes

Three themes in particular help to explore how creative thinking self-efficacy is experienced. First, the theme of *dark feelings* emerged from both participants in the Low CTSE group. Second, the theme of *training* emerged from both participants in the High CTSE group. Third, the theme of *joy* emerged across both groups. How these themes were experienced are now discussed.

The Theme of Low Creative Thinking Self-Efficacy

Both participants in the Low CTSE group reported *dark feelings*. Specific codes that were combined to form the theme of dark feelings were *mad*, *sad*, *hiding results*, and *rejection* for Participant 48 and *discomfort*, *remorse*, *letting go*, and *disturbing* for Participant 80.

For some individuals, the dark feelings include critical judgments of one's thoughts and works. Participant 80 noted that “Honestly, I am more often either unsure of doing things differently, or find that what I come up with is not really a good idea,” though there are times “that I'm very happy with trying to think up new ideas... and suggesting/implementing them.” Likewise, the development of Participant 48's creative expression may be limited by dark feelings. “I don't really show a lot of people the things I write,” she says, because “I am just scared of people not liking what I do.”

However, Participant 48 noted that dark feelings may be part of the creative process. She says that the feeling of creative thinking “depends on what you are feeling like. If you are mad or sad or happy, they all feel different and make you want to write or draw different ways and things.” For example, “if someone is mad at a person... people

like that to paint or draw would probably have bold colors instead of vibrant." Similarly, Participant 80 also noted the use of these feelings in spurring creativity. "Sometimes, though a creative impulsive comes and I just feel very driven to get it out... If I try to move on to something else, sometimes I just feel a sense of remorse at having let my creative thought go and not having acted upon it."

Disconfirming evidence—that is, observations that provide subtly and texture—for the theme of low creative thinking self-efficacy came from Participant 137 of the High CTSE group, as well as Participant 87 of the Low CPSE group. In particular, the theme of *frustration* emerged from Participation 137, while the theme of *anxious* emerged from Participant 87. Participant 87 said that it "is exciting and frustrating when you can't [think creative thoughts] and need to," while Participant 137 wrote that doing creative things "feels like Christmas did when you were a kid and you were so anxious about it all month." These feelings of frustrating and anxiety, however, were juxtaposed with the very positive terms of "excitement" and "Christmas," and so could be considered terms that express the intensity of the positive emotions of excitement and joy.

The Theme of High Creative Thinking Self-Efficacy

The theme of *training* emerged from both participants in the High CTSE group. Specific codes that were combined to form this theme were *strain*, *individual differences*, *training*, *practice*, and *engagement* for Participant 137 and *exercise*, *experience*, *accolades*, *raw*, *polished*, and *know what to do* for Participant 110.

Both participants considered creative thinking to improve with practice. Early in the interview, Participant 110 was explicit that repeated practice improves thinking: "I

think creativity is a very good thing because it exercises the brain and thought processes in different ways and in turn makes the brain and thinking process more active." He echoed Guilford's (1950) view of creativity as divergent thinking: "In a way, it seems to me that creativity is being more broad as opposed to thinking narrowly." This thought also was expressed by Participant 137. When asked if she believed if people were born creative or become creative, she answered "both." Describing her belief that creativity is a product of both nature and practice, she continued:

> I tend to think a LOT i have been known to overthink things too, so i may be distracted by something on the outside but mostly i would say its the inside and not affected by anything other than the fact that you were born maybe a little less creative

Participant 110 also stated that creative performance was the result of practice. When asked about his creative performance self-efficacy, he used the terms *raw* and *polished* to describe variation in creative ability. When asked to discuss these terms, he explained:

> Being polished would be having the experience and being in the situation enough to know what to do. I think a lot of learning and being able to impress people is based off of the situation. The less uncomfortable you are in a situation the more impressive you come off because you are more confident. I think be polished means that you know what you're doing, you have the experience to do it, and you have been there enough times or are creative enough to adjust on the fly.

Disconfirming evidence for the theme of high creative thinking self-efficacy came from Participant 96 of the High CPSE group who also emphasized practice, Participant 87 of the Low CPSE group who discussed inexperience, and Participant 148 of the Low CPSE group who described improvement. Participant 148 said that "Doing creative things, to me, is always outdoing what I've done in the past. If I handled a problem in a certain manner, there is a better way to handle it." Participant 96, when asked the creative thinking self-efficacy prompt, responded "I believe that this is a particular skill that I have gotten a lot stronger at... Being my second year, I feel like now I am much more confident in kinda stepping outside the box to try out new ideas or events that I have never thought of before." Likewise, Participant 87, in describing impressing people who have the power to publicize her work, said, "I don't really have experience with getting work publicized, so I couldn't say I'm confident about it."

Though this disconfirming evidence provides realism and texture to the interviews, it does not contradict the emergence of this theme. Participants 96 and 87 were describing practicing external actions such as publicizing work or putting on an event. Finally, while Participant 148 was responding to a prompt of "doing creative things," the domain in which Participant 148's creativity is expressed is the fine arts. It is possible that the expression of creative thinking and the expression of creative performance may be not be sufficiently distinguished in a domain such as the fine parts to allow separate themes for creative thinking and creative performance in those domains to emerge.

The Common Theme of Creative Thinking Self-Efficacy

The theme of *joy* emerged from both the Low and High CTSE groups. It even coexisted along with the dark feelings of one participant from the Low CTSE group. Participant 48, who described creative feelings when feeling mad or angry, said that creativity "can sometimes be a stress reliever, and other times it just feels good." The joy of creativity has a physical sensation, "For me it is weight lifting to get things off of my chest and on paper. If I have had a long week of studying I relieve stress by sitting and doodling." Participant 110, of the High CTSE group, said that "Thinking creatively makes things more exciting and interesting, and to me it feels good and makes things fun when I am thinking in a way that is different than most other people." Participant 137, a high CTSE participant, described the joys of creative performance and creative thinking, "Just depends on the mood you're in, if you in a doing or thinking mood, sometimes its more fun to make something and create it other times it most fun to think let your mind run." Participant 80, however, emphasized a quieter joy. While noting that "I feel excited often" to think creatively, he also emphasized that "Creative expression can help us explore and come up with solutions to problems and it can also be healing and cultivating to people." It may be that creativity can be joyful, both in its results and its experience.

Creative Performance Self-Efficacy Themes

As with CTSE, three particular themes emerged to help understand the experience of CPSE. First, the theme of *normal* emerged from the Low CPSE group. Second, the theme of *constraints* emerged from the High CPSE group. Third, the theme of

recognition emerged across both groups. How these themes were experienced is now described.

The Theme of Low Creative Performance Self-Efficacy

The theme of *normal* emerged from the Low CPSE group. Specific codes that combined to form the theme of *normal* were *normal*, *fleeting*, *difficulty*, and *homework* for Participant 87, and *normal*, *feels same*, *identity*, and *change* for Participant 148. Participants in the Low CPSE group referred to a struggle to express creativity in some circumstances, though not in others. While one participant in the High CPSE also spoke about normal thought, the use of the term in that context was different.

Participant 87 emphasized that while creativity was easy to fall into, it was hard to find on purpose. She said that "Creativity feels very spontaneous to me. When I'm in need of creative thoughts, they seem to be the most fleeting, but when I'm doing something really menial like cleaning or running, that's when I have my most creative thoughts." Indeed, to Participant 87 the experience of trying to be creative was particularly frustrating because she perceives creativity to be part of her normal routine. "I think a lot of the time. I don't even recognize my own thoughts as creative because the task I'm doing is so normal." Later in the interview she returned to these thoughts. When I asked her about doing creative things, she responded "Well, it's hard work. Unless, you know, it just kind of comes to you when you're not trying." She continued, "I find it hardest to be creative when it's for an assignment or homework."

While Participant 87 spoke of ease and purpose, Participant 148 brought up the role of identity. He said that thinking creatively "really makes me who I am."

Additionally, creative thinking has been proceduralized for him: “Well, I see it is as a normal process–especially for me. I'm an English/Theatre education major, so thinking creatively is a normal part of my life.” Nonetheless, the automatization of creativity was preceding by a long period where creativity was practiced. It is “something that takes practice to really hone,” practice which was available in high school when “thinking creatively provided a sense of relief from the structure I had [in other parts of life].”

Disconforming evidence for the theme of low creative performance self-efficacy came from Participant 96 of the High CPSE group. The theme *normal* also emerged from his interview. However, upon reexamining the transcripts, the term was used in a different context. As opposed to an emphasis on the normal that emerged from the Low CPSE group, Participant 96 rejected normality: “Now as far as the process of thinking creatively, I believe that it requires more than just your normal everyday thought process. It requires you to think less of what you think will be great, but more so to think about the group you are aiming to serve.”

The Theme of High Creative Performance Self-Efficacy

The theme of *constraints* emerged from the High CPSE group. This theme was indicated by the codes of *the good of the people*, *resilience*, *unexpected problems*, and *constraints* for Participant 96 and the codes of *photograph*, *perfection*, *constraints*, *time*, and *money* for Participant 107.

When he was asked the CPSE prompt, Participant 96 asked for permission to “keep using my residence hall association analogy,” explaining that “it's just something that I know best.” He said, “you sometimes have no idea the unexpected problems you

will encounter." It is thus "always helpful to have several 'backup' plans." Such limitations, which he described in term of residence hall association events, tie directly into what Participant 96 described as "the ability to come up with different solutions to a problem," or what Torrance (2008) would have called flexibility.

Participant 107 brought up concrete constraints. When asked to say a little about doing creative things, she described photography, specifically the aiming "through the screen/viewfinder and position it in the frame, walk around it, move up or down, until it's just right." The boundaries of creativity, the rules within which one must perform, were brought up as criteria in deciding whether an activity would be creativity. I asked her if decorating could be creative in the way photography was. She answered: "I mean, when you're decorating you have a room or a house to work with and those are your confines. In photography you only have the frame to work within so I guess when I put it like that they are similar." She was even more explicit about constraints when I asked what blocked people from being more creative: "I mostly think of challenges externally. Stuff like time and money, not really my internal, personal ability to do things." She concluded, "Occasionally it's internal, but that's mostly just if/when I compare myself to others."

While the theme of constraints emerged from the High CPSE group, however, participants in the Low CPSE group also recognized limitations to creativity. The difference was whether individuals viewed limitations as defining the context of creativity (as constraints did for those in the High CPSE group) or as preventing creativity (as the emphasis on the normal did for those in the Low CPSE group). Thus, the more concrete nature of constraints experienced by High CPSE participants may

reflect extensiveness of involvement in the social and technical aspects of creative performance, as opposed to reflecting a trait-like difference in orientation.

The Common Theme of Creative Performance Self-Efficacy

The theme of *recognition* emerged from both the Low and High CPSE groups. Participant 87, a low CPSE participant who enjoyed writing poetry, said Kooser (2005) wrote that "most successful poets write for their audience rather than themselves." Participant 87 stated that she tried "to think of what my invisible 'audience' would want when I write things." Participant 148, another low CPSE participant, noted that a benefit of the performing arts is that an audience comes naturally, "It's hard to describe, but I think there is always an appreciation for some of the fine arts (in my case, theatre), from like-minded creative thinking people who want to experience something that they might not be terribly familiar with." He also contrasted the feeling of creative performance to creative thinking: "It feels right. It's better than just thinking creatively, because I've actually done it. There's a great sense of pride and accomplishment in it." Participant 107, a high CPSE participant, emphasized the role of family and loved ones in giving social reality to creativity. When I asked her who her audience was, she responded "My friends and family, and some of my professors/teachers–people who support me in whatever my endeavors." Likewise, her comparison of creativity performance and creative thinking elicited perhaps the most heartwarming remark of the whole series of interviews "Doing creative things makes me feel a lot more accomplished than just thinking creative thoughts... But when I actually DO something it is very fulfilling." She continued:

> Like over Thanksgiving break the dining room table was all cleared which influenced me to jump on my idea of making homemade Christmas cards so I got out all the paper and markers and stamps and things and laid them all out on the table and made over half a dozen cards. And then my little sister saw me and sat down and made some too:) *[note: :) is a textual representation of happiness or joy]*

Participant 96, another high CPSE participant, conceptualized creative thinking as being for the audience's benefit: “When you really make an effort to think creatively, its very crucial to think more about the good of the people you are trying to 'impress' with your ideas, as well as creative performance.” Likewise, the ability to generate multiple solutions to a problem (a skill Torrance (2008) termed *fluency*), is a social activity:

> Now as for the ability to come up with different solutions to a problem, I believe that this is another skill that I have developed over the past couple years. My advisers in RHA always tell me that its always helpful to have several of 'backup' plans when coordinating an event. When it comes down to crunch time, you sometimes have no idea the unexpected problems you will encounter, that's why it is critical to have solid problem solving skills.

Individuals in both the High and Low CPSE groups shared a common focus on recognition, on the audience, and how their work comes across.

The Creative Self-Efficacy Theme

Following the analysis, the transcripts were re-examined for other common themes. The re-analysis revealed that in all but one case, all participants answered a

follow-up question in similar ways. The follow-up question was some variation of this question: “What stops you from being creative: issues inside you or issues outside you?” However, disconfirming evidence for this theme emerged from one interview. As described previously, Participant 107 stated:

> Hmmm, I'd probably say I mostly think of challenges externally. Stuff like time and money, not really my internal, personal ability to do things. Occasionally it's internal, but that's mostly just if/when I compare myself to others.

If such a focus on external constraints can be typical of high CPSE, how can it be atypical of creative self-efficacy? Perhaps there was a subtle distinction in the way the questions were asked. As the question was presented as an ad hoc follow-up, and not a scripted question, the form of the question varied slightly between the participants. Table 4.7 reports the Participant ID, the form of the question asked, and the answer provided. (Note that Participant 87 used the psychological term *self-efficacy* in an answer without prompting, so the ad hoc question presented to her incorporated the term).

Table 4.7
Follow-up Questions and Answers to Understand the Source of Blocking

Participant ID	Question Text	Answer Text.
137	When you can't [think creatively]—is it mostly because of something "on the inside," or something "on the outside"?	I dont think i would say there is a feeling really, i've never though about that i guess, it feels good when you think of a great idea though, that is exciting and frustrating when you cant and need to
110	What can stop you from doing something creative? ... or from outdoing yourself?	Apathy. If I'm forced to do something I'm not terribly passionate for, it's a huge struggle for me to think creatively about it.
48	Would you say the things stopping you are mostly things outside of you, or from inside of you?	I think that it would mostly be inside because I have never received negative feedback with [what] I have shared
80	When you feel that something is blocking you from being creative -- do you mostly feel it is something "on the inside," or something "on the outside"?	When it's inside, when I don't feel especially creative, I usually can find something else to do. It's when I really feel creative. … It's when I feel a lot of creativity inside and I feel like I'm being smothered, usually by myself, then its hard. The problem with being blocked on the inside is you can be dulled and might have trouble meeting a need or solving a problem.
96	When you think about things that can stop you from doing creative things or thinking creative thoughts... are those things mostly "on the inside," or "on the outside"?	I say both to some extent but mostly on the inside i believe that the biggest hurdle in thinking creatively is your mind telling you that its not possible. You then start thinking through your head about all the possible things that could go wrong, then you start doubting yourself, and then finally you throw out the idea. I believe that if you are not willing to except the fact that you may fail at something, then you may settle with doing something thats easy or something thats been done before

(table continues)

Participant ID	Question Text	Answer Text.
107	When some people think about challenges to their creativity, they mostly think about challenges from inside themselves. Other people think about challenges outside themselves. How do you think about challenges to creativity?	Hmmm, I'd probably say I mostly think of challenges externally. Stuff like time and money, not really my internal, personal ability to do things. Occasionally it's internal, but that's mostly just if/when I compare myself to others.
87	Let me ask the question in a slightly different way then... are you self-efficacious in your ability to do things, like think of things no one else has, or come up with many different responses to a problem?	Hehe, well I'm gonna kind of ride the fence on this one, too.. It depends on how much I care about the problem at hand... If I don't care, I'll give up whether I think I can do it or not.
148	When something blocks you from being creative– do you feel that that thing is often "inside you," or "outside" you?	Hmmm...Most of the time it does feel like it is something inside me, but I do think outside factors can play a key role. Outside factors like noise, or too many things going on that make it hard to focus do not allow to you to fully tap into your creative resources, so I think in that way outside factors can limit your ability to tap into your inside factors.

Note. Participants are discussed using a unique identifier (Participant ID). The question text was customized for each participant, and opportunistically inserted during the interviews. Except where required for clarity, self-descriptions provided by participants were not edited for style, spelling, or grammar.

As can be seen in Table 4.7, all participants except Participant 87 of the low CPSE group were asked what can "stop" or "block," or prevent creativity. All answers to these questions, as well as Participant 87's response, referred to internal factors. On the other hand, Participant 107 of the high CPSE group was asked about challenges and responded by listing external factors. Future research may benefit from replicating and disentangling these results. Based on these results, it may be that internal obstacles appear to be so formidable to some individuals that those obstacles are seen as capable of preventing creative expression altogether. If this is true, it is possible that external obstacles may merely be perceived as degrading the expression of creative thinking and creative performance until they are overcome.

Reflections on the Themes

The themes that emerged during the qualitative analysis of the interview transcripts appear in Table 4.8. Each theme is presented with a description that is designed to be used by future researchers in determining whether or not such themes are present. In addition, it is hoped that future research can demonstrate the utility of these themes in devising interventions to improve CTSE and CPSE.

Table 4.8
Description of Themes

Theme	Descriptions
Constraints	Do individuals recognize social and physical limits on their work? Do they have plans to work around these limits? Have individuals performed a task analysis to allow them to maximize what they can achieve?
Dark Feelings	Do individuals report anger, sadness, loss, or regret? Do they fail to initiative creative actions out of fear of negative reactions? Have individuals lost opportunities for feedback by hiding their work?
Normal	Do individuals perform well when expectations to be creative are high? Are individuals efficacious for thinking and performing creatively on command? Have individuals allowed routine to deprive them of the sensation of creativity?
Internal Blocking	Do individuals place the locus of control for creativity inside themselves? Do they accept responsibility when they fail to think or perform creatively? Are individuals efficacious of improvement when they experience difficulties in creative thinking or creative performance?
Joy	Are individuals compelled by a sense of wonder, awe, and happiness at being creative? Do individuals experience the sensation of release, relaxation and peace during creative thought? Is the hard work, effort, and sacrifice of creative individuals reinforced by mental thrills?
Recognition	Are individuals audience-focused? Do they primarily consider the desires, interests, and tastes of potential viewers, observers, or customers? Do they strive for approval from others?
Training	Do individuals believe that creative thinking is a skill? Do they believe they can improve their creative thinking ability through practice? Do they identify lack of practice as a reason for failing to think as creatively as they wish?

Note. All themes presented in this table emerged in at least one group in this study. The themes of *joy* and *recognition* emerged in two groups. The theme of *internal blocking* emerged from 7 of out 8 participants.

The Thematic Context of the Latent Structure

While the first three research questions could be answered through an investigation of this study's six hypotheses, answering the fourth research question—*How do the themes that emerged from qualitative interviews provide context for the latent structure of creative self-efficacy?*—required a more contextual approach Specifically, answering the fourth research question required placing the qualitative results in the context of the quantitative results. This study, therefore, examined the structure, the nomothetic span, and parsimony of the Revised model of the CTSE II and CPSE II inventories.

A visualization of the thematic context of the latent structure of creative self-efficacy appears as Table 4.9. This table combines the layers of meaning provided by each research question. The first research question, relating to the latent structure of creative self-efficacy, is described through the manifest indicators, CFA loadings, and composite validity of the latent factors of creative self-efficacy. The second research question, relating to nomothetic span, is described through columns relating the predictive validity of the factors on Beghetto's Creative Self-Efficacy (BCSE) construct and Donnellan et al's (2006) Openness to Experience construct. The third research question, relating to whether the changes made were worthwhile, is reflected through the the model which the table presents—the Revised model with saturated correlates. The fourth research question, relating to the context provided by the themes, is provided by the text of the final column.

Table 4.9
Quantitative and Qualitative Findings

Factor	Item Text	CFA	CV	PV—B	PV—O	Themes
Creative Thinking Self-Efficacy (CTSE)						
Fluency	Come up with many possible solutions to a problem	0.84	0.60	0.47	0.40	• Dark Feelings • Training • Joy • Internal Blocking
	Arrive at a variety of conclusions given a difficult situation	0.43				
	Think of many answers to a difficult problem or situation	0.44				
Flexibility	Come up with different kinds of responses, not just different responses?	0.85	0.93	0.48	0.41	
	Answer problems in different ways, each of which are unique and special?	0.91				
	Think of many types of ideas while considering a problem?	0.76				
Elaboration	Think of ways to defend a 'crazy' thought, by thinking back on what you already know?	0.91	0.78	0.42	0.35	
	Talk to your friends about wild ideas, and make them sound reasonable?	0.73				
	Tell stories based on dreams you had, even if you need to fill in answers?	0.54				
Originality	Be the first in a group to come up with an original suggestion?	0.91	0.88	0.46	0.39	
	Arrive at a novel solution before other people?	0.92				
	Beat other people in imagining a brand new idea first?	0.89				

(table continues)

Factor	Item Text	CFA	CV	PV—B	PV—O	Themes
Creative Performance Self-Efficacy (CPSE)						
Domain	Make sense of something you want to learn to do?	0.89	0.91	0.50	0.38	• Normal • Constraints • Recognition • Internal Blocking
	Start to learn to do something, even if there are obstacles to doing so?	0.86				
	Teach yourself how to do something new?	0.89				
Field	Create a novelty that people will choose, over other novelties available?	0.76	0.84	0.65	0.49	
	Find an audience that is well-connected to others in society?	0.83				
	Network with people to convince them that what you made is the best?	0.80				
Personality	Be motivated to come up with new ideas?	0.86	0.89	0.59	0.45	
	Have fun coming up with new ideas, after having learned from others?	0.87				
	Sustain wonder about something, even after working with it for years or decades?	0.84				

Note. This table displays information from the Revised model with saturated correlates, with passes Hu and Bentler's (1999) criteria, χ^2 (326) = 514.108, $p < .01$, Scaling = 1.261, CFI = .963, RMSEA = .043, SRMR = .054, and AIC = 76438.957. CFA loadings are calculated as the loading of the manifest indicator on the appropriate factor. CV is calculated as the sum of the square of the loadings divided by the sum of the sum of the square of the loadings and the sum of the residual error variances, or $CV = \Sigma\lambda^2 / (\Sigma\lambda^2 + \Sigma\varepsilon)$. PV—B is the predictive validity, or latent r^2 value, of the factor on Beghetto's Creative Self-Efficacy (BCSE) construct. PV—O is the predictive validity, or latent r^2 value, of the factor on Donnellan et al.'s (2006) Openness to Experience construct.

The quantitative and qualitative results of this study provide complementary perspectives to reflect this study's capacity to capture and understand the latent structure of creative self-efficacy. Because this study utilized an explanatory mixed methods design, the quantitative and qualitative dimensions of the results were not expected to agree or converge. Instead, as Creswell and Plano Clark (2007) wrote, the explanatory design can be described as a method used to generate follow-up explanations in a sequential (quantitative first, qualitative second) order which connects data between the phases in order to emphasis the primary, quantitative results. (p. 85). Table 4.9 provides a summary of the connection between the quantitative and qualitative dimension of the results, emphasizing the quantitative findings and using the the themes that emerged in the qualitative phase to provide context to the quantitative results.

The kindness and generosity of these eight participants helped advance understanding of CTSE and CPSE. By sharing private emotions, thoughts, desires, and fears, they added life and texture to this study. While much of this discussion is spent on unique themes in the 4 groups, the common themes of *joy*, *recognition*, and *internal blocking* emerged to help better understand creative self-efficacy. Creativity is not something one has or does not–rather, all individuals have it to varying degrees (Guilford, 1950). Creative self-efficacy may be similarly universal. The examples, analogies, and experiences shared by the participants have the potential not only to provide context for the quantitative phase of this study, but also to help guide future research into creative thinking self-efficacy and creative performance self-efficacy.

CHAPTER V

CONCLUSION

This explanatory mixed methods study evaluated a Revised model of the CTSE II and CPSE II inventories for measuring creative self-efficacy. This was accomplished by a) replicating existing research on creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE), b) examining the composite validity of the factors in the Revised model, c) examining the predictive validity of both CTSE and CPSE and on Beghetto's (2006, 2007) Creative Self-Efficacy (BCSE) construct and Donnellan et al.'s (2006) openness to experience inventory to establish nomothetic span, and d) comparing the Revised model against several alternative rival models. Qualitative analysis identified several themes to provide context for the latent structure of creative self-efficacy which can be used to develop new hypotheses. In this chapter, the quantitative and qualitative results are discussed. Following this discussion, areas of future research are described and some limitations of this study are presented.

Results of the Study

The issue of whether the Revised model captured the hypothesized factors and dimensions of creative self-efficacy in this study's sample was addressed through confirmatory factor analysis (CFA). The quantitative evaluation of the latent structure of creative self-efficacy was then followed by interviews designed to provide a context for that quantitative findings. The discussion of the results of this dissertation is organized around this study's four research questions. Answering the first three research questions

required evaluating two hypotheses per research question. These research questions, and their associated hypotheses stated as predictions, were:

1. What is the latent structure of creative self-efficacy?

   H1: The Revised Model of the CTSE II and CPSE II Inventories is supported by data and provides adequate psychometric evidence

   H2: There is no General Factor of Creative Self-Efficacy

2. What is the relationship between creative self-efficacy and variables known to be related to creativity?

   H3: Beghetto's Creative Self-Efficacy (BCSE) construct is related to Creative Self-Efficacy

   H4: Openness to Experience is related to Creative Self-Efficacy

3. Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?

   H5: The Revised model better reproduces the observed covariance matrix than the two theoretically justified rival alternative models

   H6: The Revised model better reproduces the observed covariance matrix than the two empirically justified rival alternative models

4. How do the themes that emerged from qualitative interviews provide context for the latent structure of creative self-efficacy?

Answering the fourth research question, which framed the quantitative dimensions of the study, required analyzing the themes that emerged from interviews. The six hypotheses, along with the themes that emerged from participant interviews, are

now discussed in the context of answering this study's research questions. Following this, the themes are described, and a hypothesized thematic context for the latent structure of creative self-efficacy is explored.

Research Question 1

The first research question asked, "What is the latent structure of creative self-efficacy?" Answering this question required presenting two hypotheses for testing the Revised model and testing for an absence of a General Factor of creative self-efficacy. The first hypothesis was supported, $\chi^2(178) = 295.571$, $p < .01$, CFI = .954, RMSEA = .046, SRMR = .072, and AIC = 52758.669. The second hypothesis was likewise supported, as the introduction of a General Factor of Creative Self-Efficacy to the Revised model produced results there were uninterpretable and less parsimonious as indicated by AIC, $\chi^2(179) = 319.462$, $p < .01$, CFI = .945, RMSEA = .050, SRMR = .055, and AIC = 52799.519.

The latent structure of creative self-efficacy appears to be described through the use of the Revised model of the CTSE II and CPSE II inventories in this sample. This study lends support to the assertion that self-efficacy exists in at least two dimensions, creative thinking self-efficacy (CTSE) and creative performance self-efficacy (CPSE). The CTSE dimension is in turn indicated by four latent factors, relating to creative thinking self-efficacy for elaboration, flexibility, fluency, and originality. Likewise, the CPSE dimension is in turn indicated by three latent factor, relating to creative performance self-efficacy for domain, field, and personality. Further, the evidence against a general factor of creative self-efficacy makes sense in the context of research into

multiple dimensions of creative self-efficacy. That stream, of which the present study is a part, is composed of work by Riley (1999), Tan et al. (2008), Abbott (2009a, 2009b, 2009c), and Beghetto (2009), who all theorized domain- or dimension- specific constructs of creative self-efficacy. No previous study in this stream also theorized a general factor of creative self-efficacy.

Research Question 2

The second research question asked, "What is the relationship between creative self-efficacy and variables known to be related to creativity?" Answering this question required presenting two hypotheses for testing whether the nomothetic span of creative self-efficacy extended to BCSE and openness to experience. The resulting model passed Hu and Bentler's (1999) criteria, $\chi^2(326) = 514.150$, $p < .01$, CFI = .950, RMSEA = .043, SRMR = .058, and AIC = 59249.02. This study's third and fourth hypotheses were supported after statistically significant correlations were discovered between both BCSE and openness to experience on all latent factors of creative self-efficacy included in the Revised model.

Creative self-efficacy appears to be related to BCSE, which is another measure of creative self-efficacy, and to openness to experience, which is related to creativity. This established a nomothetic span for the Revised model of the CTSE II and CPSE II inventories presented to participants in this study. This study cannot answer, however, whether the nomothetic span of the Revised model of the CTSE II and CPSE II inventories extends to actual measures of creative expression, or even to levels of CTSE and CPSE measured at another time.

Research Question 3

The third research question asked, "Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?" Answering this question required testing two hypotheses to compare the parsimony of the Revised model against two theoretically justified rival alternative models, the All and Held models, and two empirically justified rival alternative models, the Implied Structure and Implied Indicators models. Each of these models included all items from the CTSE II and CPSE II inventories, as well as the items from the BCSE and openness to experience inventories. In each model, items that did not load on a latent factor were treated as saturated correlates. The saturated refinement of the Revised model passed Hu and Bentler's criteria, χ^2 (326) = 514.108, p < .01, CFI = .963, RMSEA = .043, SRMR = .054, and AIC = 76438.957. Of the four rival alternative models tested, only the empirically justified models also passed Hu and Bentler's criteria, the Implied Structure model, χ^2 (327) = 526.884, p < .01, Scaling = 1.357, CFI = .961, RMSEA = .045, SRMR = .049, AIC = 76503.431, and Implied Indicators model, χ^2 (326) = 572.421, p < .01, Scaling = 1.363, CFI = .952, RMSEA = .050, SRMR = .054, AIC = 76570.611. The theoretically justified Revised model, however, was more parsimonious as indicated by AIC than the two empirically justified Implied models.

The hypotheses were judged to be supported. Creative self-efficacy appears to be measured less parsimoniously in the rival alternative models than in the Revised model of the CTSE II and CPSE II inventories. This lends support to the theoretical and empirical

structure of the Revised model of the CTSE II and CPSE II inventories, as well as the methods used to construct the Revised model.

Research Question 4

The fourth research question asked, "Were changes introduced in the methodology section of this dissertation useful in better capturing the latent structure of creative self-efficacy?" Answering this question requires a series of interviews, out of which several themes of creative self-efficacy emerged. The themes that emerged from the interviews, as well as a hypothetical extension of the nomothetic span of creative self-efficacy, are now described.

The Themes of Creative Self-Efficacy

Seven themes emerged from the follow-on, qualitative phase of this study. Two of these themes—*dark feelings* and *normal*—were associated with low levels of CTSE and CPSE, respectively. Likewise, two other themes—*training* and *constraints*—were associated with high levels of CTSE and CPSE, respectively. The theme of *joy* was associated with both high and low levels of CTSE, while the theme of *recognition* was associated with both high and low levels of CPSE. Except for one participant, who received the appropriate in a format that differed from others, the theme of *internal blocking* emerged from all participants. While these qualitative results cannot be generalized to a broader population, they provide a context from eight participants selected for high CTSE, low CTSE, high CPSE, or low CPSE within which the quantitative results can be considered.

Dark Feelings. The interviews revealed that the theme of *dark feelings* was common to participants in the Low CTSE group. This study did not attempt to determine causality, or whether these dark feelings prevented creative thinking, were the results of low creative thinking, both, or neither. This theme presents a poignant counterweight of Abbott's (2009a) study of creative self-efficacy among bloggers, in which the theme of *joy*, but not the theme of *dark feelings*, emerged.

Training. The theme of *training* emerged from the High CTSE group. Of all themes, this may be the strongest indication that creative expression might be improved with practice. This implies not only that high CTSE individuals are self-efficacious, which helps validate the quantitative inventory, but also they have an internal locus of control for creativity, a theme that emerged in Abbott (2009a). In that study, individuals reported high self-efficacy but external locus-of-control for creative thinking. That is, it appears that some individuals believe themselves able to express creative thinking, but do do believe themselves to be in control of that expression. The reason for these seemingly discordant findings needs to be investigated.

Joy. The theme of *joy* emerged across the Low and High CTSE groups. This theme contrasted with the emergence of dark feelings in the Low CTSE group but compared well with Abbott's (2009a) observation of joy among creative bloggers. Presuming these results are comparable, it may imply that joy is a source of drive for individuals who strive for creative thinking. Through experience in reaching for this joy, some individuals perceive themselves to be efficacious, and some individuals perceive deficiencies in their ability to harness enough resources to reach this goal. Thus, it may be

that the a keen sense of the real or potential joy of creative thinking is shared by individuals who are high or low in CTSE, but not by other individuals. Csikszentmihalyi (1996) similarly observed the importance of maintaining a sense of wonder in developing and maintaining creativity. As creative performance is partially predicted by creative thinking (Plucker, 1999), it seems possible that Csikszentmihalyi's observation of joy among individuals who express creative performance was made possible by the high CTSE of those individuals. This possibility, however, requires further investigation.

Normal. The theme of *normal* emerged from the Low CPSE group. These participants reported that creativity was a normal process, and one that could not be forced. The negative associations of this perspective on creativity recalls research that criticized common myths about creativity (Lemons, 2006, 2009). Interestingly, these participants appear to echo the theme of external locus of control that was typical of creative bloggers (Abbott, 2009a). By not believing creativity is something they control, low CTSE individuals may forfeit important opportunities for practice which might lead to the experiences that could make them more self-efficacious and creative.

Constraints. The theme of *constraints* emerged from the High CPSE group. This finding was originally counter-intuitive, because it implied more experiences with limitations and failure. Experience with constraints may imply more experience in a domain of practice, as well as more resilience in the face of constraints. Existing lines of research into experience and creativity, however, have not converged. Further research should be conducted to determine the relationship between experience, constraints, creativity, and creative self-efficacy.

Recognition. The theme of *recognition* emerged across the Low and High CPSE groups. As with joy, which was common to the Low and High CTSE groups, recognition may provide a thrill or drive that compels the expression of creative performance. Also much like the attainment of joy, it may be that efforts to obtain recognition may be initially successful or unsuccessful, and so increase or decrease CPSE.

Internal Blocking. With the exception of one participant, who was presented with a prompt that differed in wording from others, the theme of *internal blocking* was common to all interviewed participants. In order to understand this theme, it is important to know whether it is a common human experience, or one that is unique to individuals who are high or low in some dimension of creative self-efficacy. If internal blocking is common to all, then it is simply part of the human experience, and not unique to the understanding of creativity. If it is a theme which emerges from those who differ from the norm in some aspect of creative self-efficacy, however, internal blocking may be similar to joy or recognition in that it is a source of initial inspiration. Thus, it may be that individuals who attribute initial weakness in creativity to external factors simply do not practice at all, and believe themselves to be average in creativity efficacy. Individuals who initially perceive the obstacles to be within themselves may practice more, however, and from this practice construct an understanding of themselves that is largely efficacious or non-efficacious.

The Thematic Context of Creative Self-Efficacy

The fourth research question asked, “How do the themes that emerged from qualitative interviews provide context for the latent structure of creative self-efficacy?”

The answer appears to be that themes may provide the latent structure of creative self-efficacy with another layer of meaning. That is, while the two dimensions of creative self-efficacy included the Revised model are indicated by latent factors, the dimensions also relate to the experience of the participants in this study. For instance, CTSE is expressed by the latent factors of creative thinking self-efficacy for elaboration, flexibility, fluency, and originality. High CTSE participants in this study, however, experienced the theme of *training* while Low CTSE participants experienced the theme of *dark feelings*. Likewise, while CPSE is expressed by the latent factors of creative performance self-efficacy for domain, field, and personality, High CPSE participants experienced the theme of *constraints*, though Low CPSE participants experienced theme of *normal*.

These findings are limited by the tools used to uncover them. In particular, the use of qualitative interviews necessarily prevents generalization of these findings to any larger population. The theme of *dark feelings*, for instance, may be the result, the cause, co-morbid, or not related in any statistical way to low levels of CTSE in the general population. These qualitative findings are thus even more limited in some aspects than the quantitative findings, which can at least be generalized to the population of pre-service teachers from which the sample was drawn. Nonetheless, the open-ended use of the researcher as data gathering instrument allows more meaning and context to be provided by the addition of the qualitative follow-up phase than in the quantitative primary phase alone.

The context provided by the themes can be presented through a description of the testable hypotheses that might to derived from the quantitative and qualitative findings. That is, while quantitative data are not reevaluated or reexamined following the results of the qualitative phase in an explanatory mixed methods design (Creswell and Plano Clark, 2007), the results can be used to construct hypotheses which could be tested and, if supported, then generalized. In the context of a structural model, in which the nomothetic span of the CTSE and CPSE constructs is described, replication hypotheses and new hypotheses derived from the quantitative and qualitative phases of this study might be presented. Replication hypotheses, which would be expected based on the generalizable findings of the quantitative phase of this mixed methods dissertation, might include predictions related to the latent structure of creative self-efficacy:

Hypotheses A: CTSE is related to CPSE

Hypotheses B: CTSE is indicated by the latent factors of Elaboration, Flexibility, Fluency, and Originality

Hypothesis C: CPSE is indicated by the latent factors of Domain, Field, and Personality

Additionally, replication hypotheses might also be added that predict that the nomothetic span of creative self-efficacy includes BCSE and openness to experience:

Hypothesis D: CTSE and CPSE both predict BCSE

Hypothesis E: CTSE and CPSE both predict Openness to Experience

Further, new hypothesis, which could be posed based on the meaning provided by the participants in the qualitative phase of this mixed methods dissertation, might include:

Hypothesis F: High levels of CTSE predict training-seeking behaviors

Hypothesis G: Low levels of CTSE predict moods related to dark feelings

Hypothesis H: High levels of CPSE predict constraints-seeking behaviors

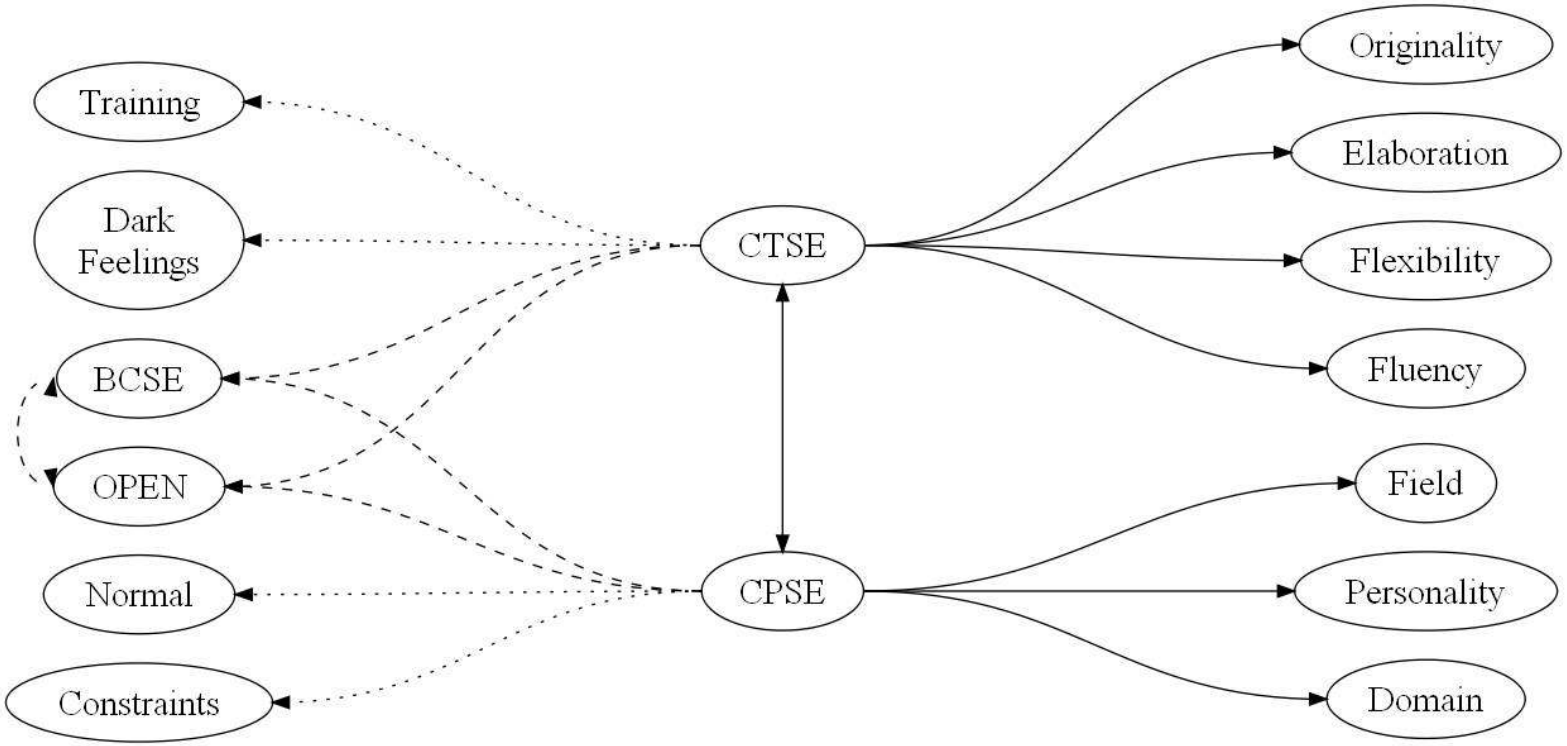
Hypothesis I: Low levels of CPSE predict self-reported normalcy

These hypotheses can be simultaneously tested through a structural model, which would avoid problems introduced by multiplicity. A visualization of such a structural model appears as Figure 5.1. Of course, the operationalization of these hypotheses would require appropriate measures to be selected to indicate the latent constructs. While this study lends support to the use of the Revised model of the CTSE II and CPSE II inventories for measuring CTSE and CPSE, respectively, suggestions for the operationalization of the constructs derived from the qualitative themes are beyond the scope of this dissertation.

Implications of the Study

To help people better express creativity, a need exists to capture and understand creative self-efficacy through a combination of quantitative and qualitative methods. It was for these reasons that the four research questions were asked, addressed, and answered. The answers to these research questions led to two sets of implications, one for each of the intended audiences of this study. The first set of implications is for other researchers and concerns the findings of this study. The second set of implications is for all individuals who wish to improve their own creative self-efficacy, or the creative self-efficacy of others.

Figure 5.1
Hypothetical Nomothetic Span for CTSE and CPSE



Note. This model presents a hypothetical latent factor model, or nomothetic network, which incorporates both the latent indicators of CTSE and CPSE, as well as potential relationships implied by the quantitative findings. This, the hypothesized model incorporates both the predictive validity of CTSE and CPSE on BCSE and openness to experience, which was identified in this study, as well the CTSE-related themes of *training* and *dark feelings*, and the CPSE-related themes of *normal* and *constraints*. CTSE refers to creative thinking self-efficacy, CPSE refers to creative performance self-efficacy, BCSE refers to Beghetto's Creative Self-Efficacy construct, OPEN refers to openness to experience. Solid lines refer to latent correlations expected as part of the creative self-efficacy measurement model. Dashed line refers to latent correlations expected as part of the nomothetic span of creative self-efficacy and observed in this study. Dotted lines refer to latent correlations implied by the thematic context provided by this study, but which have not yet been observed.

Implications for Researchers

This study's four research questions cumulatively address the needs of this study. The answer to the first research question, that the latent structure of creative self-efficacy is presented through the Revised model, allows the Revised model of the CTSE II and CPSE II inventories to serve as a structure around which the themes can be organized, as in Table 4.9. Likewise, the answer to the second research question, that the Revised model is related to BCSE and openness to experience, provides a beginning to a nomothetic span which may eventually be expanded to include constructs related to the themes. That is, the visualizations that appear in Table 4.9 and Figure 5.1 may serve as scaffolding for future research, which may (or may not) extend the nomothetic span of creative self-efficacy to include *constraints*, *normal*, *training*, and so on. Finally, the answer to the third research question, that changes introduced in the methodology section of this dissertation were useful in better capturing the factors and dimensions of creative self-efficacy, provide a trajectory for future research that incorporates such a hypothesize nomothetic span.

This study provides researchers with new findings regarding creative self-efficacy. Abbott's (2009b) findings of a factor structure for two dimensions of creative self-efficacy, CTSE and CPSE, were replicated. Likewise, a Revised model for measuring the latent structure of creative self-efficacy was developed and evidence was found in support of the reliability and validity of the use of this model in this study's population. Finally, this study discovered several themes that emerged from follow-up interviews which may eventually be used in designing an experimental program to improve creative

self-efficacy. For instance, it is possible that the theme of *constraints* that emerged in the qualitative discussion may be useful in constructing a program aimed at encouraging individuals to have a positive view of constraints with the aim of promoting creative self-efficacy and creative expression. As all themes emerged from a qualitative follow-up, however, it is also possible that they are related to creative self-efficacy in some other way, or perhaps not related at all.

Implications for Educators and Students

Another audience of this study is composed of individuals who wish to be more creative. Implications for this audience center around how the quantitative and qualitative findings of this study imply ways of improving creative self-efficacy and, through that, creative expression. Just as all scientific conclusions are subject to change, however, the implications that will now be shared are tentative. The Revised model has not been directly validated against a measure of creativity. Thus, the implications of this dissertation may be resting on shaky foundations. It may be that attempts to raise CTSE and CPSE could do exactly that, for instance, but without generating a meaningful improvement in either creative thinking or creative performance.

To the extent that CTSE and CPSE are important for creative expression, the results can be used to help individuals can improve their creative self-efficacy. The themes that emerged from the qualitative, follow-up analysis provide guidance for those who wish to be more creative. Generally, Bandura (1977a) emphasized the importance of mastery experience, vicarious experiences, persuasion, and physiological excitement as media through which self-efficacy can be improved. In the context of creativity, this

would imply the need to expose individuals to areas where they can observe themselves being creative, observe others being creative (both peers or experts), be told that they can be creative, and have the ability to experience the excitement (whether from *joy* or *recognition*) of being creative. Likewise, care should be taken to manage the negative affect (such as *dark feelings*) or potentially dysfunctional attributions (such as that creative expression is a *normal* process) which can discourage individuals from putting forth the effort needed to think or perform creatively. To improve their skill and self-efficacy, individuals need opportunities to practice completing these tasks in order to better expressive their creativity.

Future Research

This study is part of a research program centering on creative self-efficacy. The conclusions of the study lead naturally into two avenues of future research. The first of these, measurement research, focuses on improving the instruments used to measure creative self-efficacy. The second of these, substantive research, would use these instruments to understand, predict, and control the development of creative self-efficacy.

Measurement Research

The area of measurement research centers on ways that creative self-efficacy may be better measured. The most obvious next step is to move toward a new revision of the CTSE and CPSE inventories. It may also be wise to create short scales to measure CTSE and CPSE as unidimensional constructs. Finally, it may be useful to apply conjoint analysis, or a measurement technique based on forced-choice items instead of Likert-type items, to the study of creative self-efficacy.

Toward a new version of the CTSE and CPSE Inventories

It is possible to further improve the performance of the CTSE and CPSE inventories discussed in this dissertation. Improved versions of these inventories can be constructed in a manner similar to the way this study built on the results of the quantitative pilot study (Abbott, 2009b). This process could require removing the items with the weakest loadings on the relevant factors, and creating new items that better load on those factors. Additionally, it may be wise for new CTSE and CPSE inventories to include domain-specific formulations along the line's of Beghetto's (2009) recent research. This may lead to even better parsimony or else imply different factors and dimensions for creative self-efficacy across different domains.

A CTSE Short Form and CPSE Short Form?

In general, the practicality of a measure increases as its length, and the number of participants required to complete it, decrease. Two scales used in this study, BCSE and the openness to experience inventory, demonstrate what such a short form could look like. BCSE has only 3 items, while the openness to experience scale has only 4. While there are only 3 indicators for each factor in the Revised model (for example, CTSE elaboration), this adds up to 21 items to measure what to most researchers would be only two meaningful concepts: CTSE and CPSE. Future research, perhaps conducted alongside the development of a new version of the CTSE and CPSE inventories, could determine a small subset of indicators that indicate the CTSE and CPSE factors themselves when simply averaged together. This would allow creative self-efficacy to be

examined in studies even when it is not the primary focus of the inquiry and when latent factor analysis is not employed.

Conjoint Analysis

While Likert-type analysis asks individuals to rate one item at a time, conjoint measurement is a family of analysis that asks participants to response to forced choice prompts (Carrol & Green, 1995; Gustafsson, Herrmann, & Huber, 2002; Luce & Tukey, 1964). Such an approach would present participants with a series of forced choice items, such as asking a participant if he or she believed that he or she had a very high CTSE of 80, or else a high CPSE. Using a full factorial design, main effects for levels of creative self-efficacy could then be determined. There is reason to believe that conjoint analysis may be appropriate for use in measuring creative self-efficacy. For instance, it is well known that the use of an interval scale implicitly assumes that a plot of the response probability against scale magnitude should have a cumulative normal distribution (Gescheider, 1997; Thurstone, 1928). The performance of response scales of different lengths can be difficult to predict (e.g., Pajares et al., 2001; Smith et al., 2003). The forced-choice nature of conjoint measurement was developed as an alternative to the problems introduced by this implicit assumption of Likert-type measures.

Substantive Research on Creative Self-Efficacy

The purpose of instrument construction is to use those instruments in substantive research. Little has been done, however, to determine the extent to which creative self-efficacy precedes creativity, or how to improve creative self-efficacy in controlled environments. It is expected that the state-like constructs of CTSE and CPSE mediate the

expression of creativity into creative thinking and creative performance, as self-efficacy is an important mediator of the "initiation, attainment, and maintenance" of the expression of an ability (Bandura, 2007, p, 642). In order to show creative self-efficacy actually mediates creative expression, however, it must be demonstrated that changes creative self-efficacy precede change in creativity.

Future substantive research, therefore, might proceed by longitudinally observing the creativity and creative self-efficacy of individuals. Special attention should be given to creating a standardized experimental program which increases the creativity of individuals through an increase in their creative self-efficacy, achieved via manipulation of performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal, as recommended by Bandura (1977a). Both potential studies below are extensions of Gist's (1989) experimental study of creative self-efficacy.

Longitudinal Research on Creative Self-Efficacy

Even if creative self-efficacy statistically were to predict creative expression, the question of whether creative self-efficacy precedes creative expression can only be answered through a longitudinal study. This might be done by taking the pre- and post-test approach to measuring creative expression and creative self-efficacy, as described by Gist (1989), and extending it over a longer period of time. For instance, undergraduates at a college of education could have their creative expression and creative self-efficacy measured. Specifically, this could involve regular measurements of CTSE, CPSE, creative thinking as measured by a Torrance-style test, and creative performance in the academic domain of teacher education. As self-efficacy for an ability generally mediates

the expression of that ability (Bandura, 2007), it would be hypothesized that increases in CTSE or CPSE would precede any changes in creative thinking or creative performance.

Experimental-Based Programs to Improve Creative Self-Efficacy

Arguably, the "gold standard" of all scientific research is the randomized, controlled trial. An intervention could be conducted that compares a control group, a second group receiving a behavioral model expressing creative thinking, and a third group receiving a cognitive model expressing creative thinking. It would be expected that exposure to the models would increase creative self-efficacy, and that the change in creative self-efficacy would mediate a change in creative expression. A second study could also be conducted, in which modeling of creative performance is presented near the beginning the academic year. In the second study, observations of the expression of creative performance in a domain would be taken at the beginning and end of the academic year. It would be hypothesized that creative self-efficacy would increase in the presence of effective models, and that this would mediate an improvement in creative performance.

Bandura (1977a) wrote that experimental programs to change self-efficacy can be drawn from four main sources: performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Performance accomplishments are raised by success and lowered by repeated failures. Modes of performance accomplishment include participant modeling, performance desensitization, performance exposure, and self-instructed performance. Vicarious experience occurs when learners see others perform activities in some context. Both live modeling and symbolic modeling are modes of

vicarious experience. Verbal persuasion occurs when learners are led through language to believe they can successful perform tasks that they had previously believed would overwhelm them. Verbal persuasion can occur through suggestion, exhortation, self-instruction, or interpretive treatments. Lastly, emotional arousal can occur through physiologically intense experiences that generate stress, fear, hope, or other emotional states. Emotional arousal can be induced to alter self-efficacy beliefs through attribution, relaxation, biofeedback, symbolic desensitization, and symbolic exposure. Bandura's (1977a) recommendations, combined with the results of this dissertation, hint at mediating and moderating variables that may be appropriate targets for any experimental programs to improve creative self-efficacy.

The Purpose of Future Research on Creative Self-Efficacy

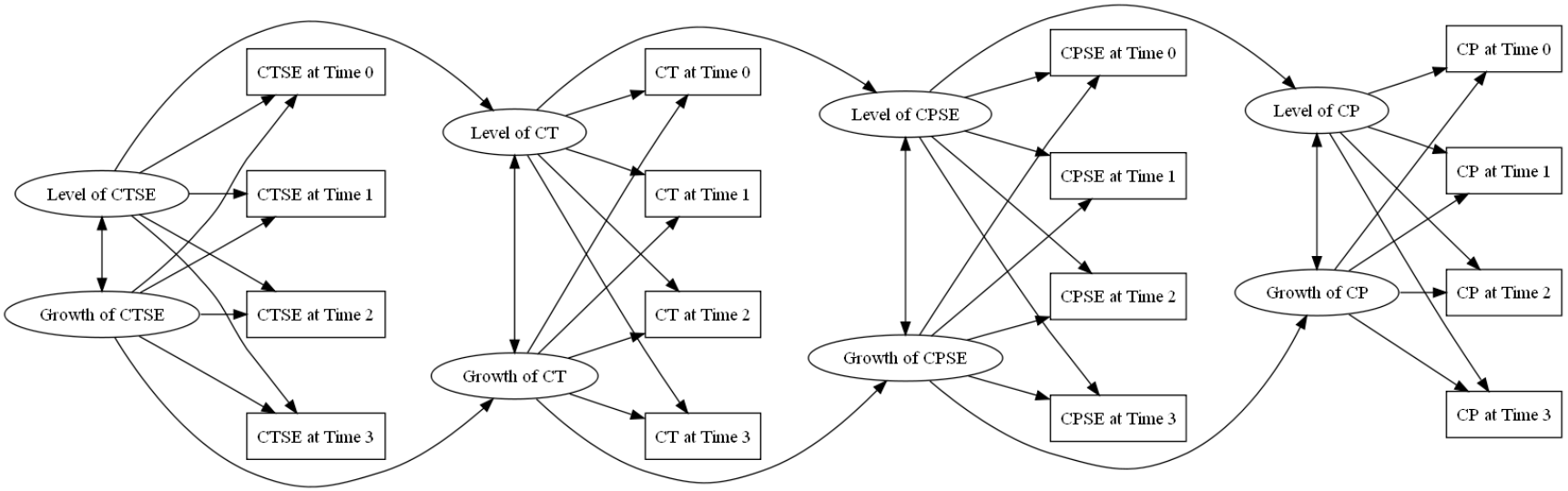
This dissertation is part of a broader program of research. The answers to the research questions, the implications of the study, and the areas outlined for future research reflect this program. The animating idea behind this program of research is that an increase in creative self-efficacy leads to an increase in creative expression (Bandura, 2006) and that an increase in the expression of creative thinking can in turn lead to an increase in creative performance (Plucker, 1999; Silvia, 2008). Further, it may be that the experience of internal expression of creative thinking motivates creative performance over time. As one participant wrote in the qualitative pilot study (Abbott, 2009a), “Thinking is easy. Express[ing] that creative thought is a little more difficult and time-consuming, but it's still a very straightforward task. Implementing something creative

takes more... DOING something creative... requires much more—depending on what it is you're doing" (pp. 30-31).

It may be that change in self-efficacy over time can be modeled. An experimental program to increase self-efficacy might be devised that improves the level of CTSE, perhaps through manipulation of elements of the nomothetic span of creative self-efficacy that mediate or moderate creative self-efficacy, and thus in turn lead to increases in creative thinking and creative performance. Consider a hypothetical conditional associative latent growth model of creative self-efficacy, where changes in the rate of growth in one construct can predict changes in the rates of growth of others (Bovaird & Kupzyk, 2007). For instance, if a program can be found that improves creative self-efficacy, manipulation of joy or dark feelings at the start of the program may increase the rate at which creative thinking self-efficacy increases over time, thus in turn influencing the rate of improvement for creative thinking, creative performance self-efficacy, and creative performance. A visualization of such a model appears as Figure 5.2.

While the uncertainty of such a hypothetical model of creative expression must be emphasized, the implications of such a model may be profound. If the use of such a model can be validated, and experimental programs can be developed to improve CTSE and CPSE, learners will become better able to express creative performance. That is, the result of such experimental programs will be for learners to be better able to master a domain, pass the gatekeepers of the field, and maintain a creative personality. As a consequence, learners might therefore be more influential across the domains in which they operate.

Figure 5.2
Hypothesized Latent Growth Model of Creative Self-Efficacy



Note. This model presents a conditional associative latent growth model of creative self-efficacy. In this level, an increase in creative thinking self-efficacy (CTSE) is hypothesized to lead to an increase in the expression of creative thinking (CT). In turn, this is hypothesized to lead to an increase in creative performance self-efficacy (CPSE), which in turn may lead to an increase in the expression of creative performance (CP).

The consequences of such a tool of empowering individuals extends far beyond classroom settings. They have the potential—again, if the use of such a model can be validated and appropriate experimental programs devised—of reshaping markets, industries, and institutions. As one example, consider the effort that goes into targeting educational and professional software for intended users. Currently, a variety of techniques are employed in an effort to detect *personas*, or latent types of users of software products (Abbott, 2010b; Chapman, Love, Milham, & ElRif, 2008; Cooper, 1999). In the absence of careful analysis, mistakes can be made which force users to relearn conventions and lead to decreases in productivity (Abbott, 2009d). It would be more convenient, more pluralistic, and more empowering if users were able to effectively shape this process themselves. That is, instead of being passive recipients of the tools they use, educators and learners might be able to actively participate in the construction of those tools. Such mastery of the domain of the software the use, access to the field of gatekeepers of those who create such software, and maintenance of the creative personality necessary to express such views may lead to richer online and virtual environments.

The empowerment that might come from expression of creative performance may be applicable to any area of potentially creative endeavor. The factors that comprise the expression of creative performance—expertise in a domain, acceptance by a field, and the maintenance of a creative personality—are the sort of skills required to operate inside the mental conceptions of others and so help shape the social reality (Abbott, 2008a, 2008; Osinga, 2007). The rise of computers and the Internet may mean that many forms of

work are gone, but it also gives workers new ways of gaining expertise in a domain, access fields, and expressing a creative personality. Many tasks in these fields that were once vital to success may be performed more quickly and less expensively by computers, but this means that the relative value of human labor and human ingenuity is increasing. Individuals who can better express creativity may be more successful in a world where creative thought cannot be automated and creative solutions to problems are at a premium.

Limitations of the Study

This study helped to replicate, extend, and explain earlier research on creative thinking self-efficacy and creative performance self-efficacy, However, limitations specific to quantitative, qualitative and the explanatory mixed methods aspects of study potential could have affected the study's findings and impacted the interpretatability and generalizability of these findings.

Quantitative Limitations

Several problems in the study's design limit the generalizability of its quantitative phase. First, the study utilized an observational design, which implies requires caution when attempting to draw causal inferences. For instance, although CTSE and CPSE were correlated with openness to experience, these results do not demonstrate if development of CTSE and CPSE is encouraged by the trait of openness to experience. It may be, instead, that a state of openness to creative experiences is a result of creative self-efficacy. Second, this study is not generalizable outside its range of observation, who are predominately pre-service teachers attending classes at one particular university with a

narrow age range (M = 20.69, SD = 1.93), this presents a substantial problem. Third, the study did not validate the use of the Revised model against any measures of creative thinking or creative performance. Fourth, all quantitative data were gathered through Google Docs (Google, 2009). The psychometric properties of this tool have not been studied, and it may lead to systematic, non-ignorable distortions in the data.

Qualitative Limitations

Likewise, several cautions are in order about this study's qualitative phase. First, while the participants in the qualitative phase were drawn from the participants in the quantitative phase, a different incentive mechanism was used to recruit participants in the second phase. Participants in the quantitative phase were induced to participate either through the offer of extra credit or a course requirement to engage in research, while participants in the qualitative phase contributed without such extrinsic incentives. Given that the response rate was low (24.2%), self-election of participants into the qualitative phase may be results in participants who were systematically more interested in pro-social, scientific activities than the general sample. Second, while Internet Instant Messaging was used to increase the accessibility of the interviews and make participation more appealing, this necessarily removed the ability of the researcher to observe body language, vocal intonations, and so on. Third, all interviews were conducted by a male doctoral student who also had teaching duties. This may have influenced the participants willingness to disclose information that might be considered unwise to share with an authority figure. Fourth, while the protocol is a shortened version of the protocol used in the qualitative pilot study (Abbott, 2009a), there was not a standard form for the follow-

up question relating to the internal or external source of obstacles that block creative expression. Therefore, the answers to this question may not be comparable across participants.

Explanatory Mixed Methods Limitations

The central limitation of this study's explanatory mixed method design is the relatively limited integration of the quantitative and qualitative phases. That is, as the qualitative phase was explicitly designed to shed light on the latent structure of creative self-efficacy, the interview protocol was constructed and approved before item-level results were analyzed. This is in keeping with Creswell and Plano Clark's (2007) recommendations, as the explanatory mixed methods design is used when there is enough theory to design the second phase before knowing the results of the first. Further, the focus of the qualitative results was on providing context for the latent structure of the quantitative results, as opposed to context for the manifest indicators themselves. For this reason, the themes are associated at the conceptual factor level in both the results (Table 4.9) and discussion (Figure 5.1) chapters. Of course, the conceptual focus of this study's design limits the ability of this study to present item-level meaning. Such an item-level approach could have been conducted through generating the qualitative protocol after the quantitative analysis had been conducted.

Final Thoughts

With apologies to Guilford (1950), a native Nebraskan who saw the future clearly, let me paraphrase a portion of his APA Presidential Address and end with this coda:

We hear much these days about new technologies, such as Internet-accessible computers and new accountability standards. We are told these technologies can be made to take over much of the routine thinking of education and instruction. We are told that this entails a revolution which will make the Industrial Revolution fade into insignificance. The first one made our muscles relatively useless—the second threatens to do the same to our brains. Eventually about the only educational or instructional value of brains left would be the expression of creative thinking and creative performance.

REFERENCES

Abbott, D.H. (2007). [Creativity, attitudes, and cooperation among bloggers and blog readers]. Unpublished raw data.

Abbott, D.H. (2008a). *A dual-processing theory of learning: Introducing the Observe-Orient-Decide-Act Loop to Educational Psychology*. Unpublished manuscript.

Abbott, D.H. (2008b). A History of the OODA Loop. In M. Safranski (Ed.), *The John Boyd Roundtable: Debating Science, Strategy, and War*. Ann Arbor, MI: Nimble Books.

Abbott, D.H. (2009a). *Experiencing creative self-efficacies: A case study of Coming Anarchy*. Unpublished manuscript.

Abbott, D.H. (2009b). *The dimensions of creative self-efficacy: Latent factor analysis of a multidimensional creative self-efficacy survey*. Unpublished manuscript.

Abbott, D.H. (2009c). *The myth of the creatives: Problematizing the presence of latent types of self-efficacious individuals*. Unpublished manuscript.

Abbott, D.H. (2009d). *The real use of telemetry in User Experience Research (UXR)*. Unpublished manuscript.

Abbott, D.H. (2010a). *Self-efficacy for creative thinking: A structural equations reanalysis of Gist (1989)*. Paper to be presented at the American Educational Research Association annual conference, Denver, CO.

Abbott, D.H. (2010b). *Personas as latent profiles and latent classes*. Unpublished manuscript.

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principal. In B.B. Petrov and F. Csaki (Eds.), *Second International Symposium on Information Theory* (pp. 267-281). Akademiai Kiado: Budapest.

Amabile, T.M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology, 45*(2), 357-276.

Amabile, T.M. (2001). Beyond talent: John Irving and the Passionate Craft of Creativity. *American Psychologist, 56*(4), 333-336.

American Psychological Association. (2002). *Ethical standards for psychologists*. Retrieved July 16, 2009, from http://www.nova.edu/library/dils/lessons/apa/.

Audia, P.G. & Goncalo, J.A. (2007). Past success and creativity over time: A study of inventors int eh hard disk drive industry. *Management Science, 53*(1), 1-15.

Averill, J.R. (1999). Individual differences in emotional creativity: Structure and correlates. *Journal of Personality, 67*(2), 331-371.

Baas, M., De Dreu, C. K. W., & Nijstad, B.A. (2008). A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus? *Psychological Bulletin, 134*(6), 779-806.

Baer, J. (1997). Gender differences in the effects of anticipated evaluation of creativity. *Creativity Research Journal, 10*(1), 25-31.

Bandura, A. (1963). The role of imitation in personality development. *The Journal of Nursery Education, 18*(3).

Bandura, A. (1977a). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1977b). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychology, 37*, 122-147.

Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1999). A sociocognitive analysis of substance abuse: An agentic perspective. *Psychological Science, 10*, 214-217.

Bandura, A. (2003). *Self-efficacy: The exercise of control, 6th Ed.*. New York: Freeman.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. Urdan (Eds.). *Self-efficacy beliefs of adolescents, 5*, pp. 307-337. Greenwich, CT: Information Age Publishing.

Bandura, A. (2007). Much ado over a faulty conception of perceived self-efficacy grounded in faulty experimentation. *Journal of Social and Clinical Psychology, 26*(6), 641-658.

Bandura, A., Ross, D. & Ross, S.A. (1961) Transmission of aggression through imitation of aggressive models. *Journal of Abnormal and Social Psychology, 63*, 575-82.

Batey, M. & Furnham, A. (2006). Creativity, intelligence, and personality: A critical review of the scattered literature. *Genetic, Social,and General Psychological Monographs, 132*(4), 355-429.

Baumann, C. (1999). Adoptive fathers and birthfathers: A study of attitudes. *Child and Adolescent Social Work Journal, 16*(5), 373-391.

Beghetto, R.A. (2006). Creative self-efficacy: Correlates in middle and secondary students. *Creativity Research Journal, 18*(4), 447-457.

Beghetto, R.A. (2007). Factors associated with middle and secondary students' perceived science competence. *Journal of Research in Science Teaching, 44*(6), 800-814.

Beghetto, R.A. (2009). Correlates of intellectual risk taking in elementary school science. *Journal of Research in Science Teaching, 46*(2), 210-223.

Bernaards, C.A. & Jennrich, R.I. (2005). Gradient projection algorithms and software for arbitrary rotation criteria in factor analysis. *Educational and Psychological Measurement, 65*, 676-696.

Bogdan, R. & Biklen, S.K. (2003). *Qualitative research for education: An introduction to theory and methods* (4th ed.) Boston: Allyn and Bacon.

Bonesteel, M. (2000). *Henry Darger: Art and Selected Writings*. New York: Rizzoli.

Bovaird, J.A. & Kupzyk, K.A. (2007). *Latent variables approaches to fitting growth curves*. CYFS Research Methodology Series.

Brown, RT (1989). Creativity: What are we to measure? In JA Glover, RR Ronning, & CR Reynolds (Eds.), *Handbook of creativity* (pp. 3—32). New York: Plenum Press.

Browne, M.W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing structural equation models* (pp. 136-162), Newbury Park, CA: Sage.

Burch, G. St. J., Pavelis, C., & Port, R.L. (2008). Selecting for creativity and innovation: The relationship between the innovation potential indicator and the team selection inventory. *International Journal of Selection and Assessment, 16*(2), 177-181.

Campbell, D.T. & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56*, 81-105.

Carroll, J.B. (1993). *Human cognitive abilities: A survey of factor-analytical studies*. New York: Cambridge University Press.

Carroll, J.D. & Green, P.E. (1995) Psychometirc methods in m-arketing research: Part I, Conjoint Analysis. *Journal of Marketing Research 32*, 385-391.

Carson, S., Peterson, J.B., & Higgins, D.M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal, 17*(1), 37-50.

Cattell, R.B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*, 245-76.

Cattell, R.B. (1966). The scree test for the number of factors. Multivariate Behavioral Research, 1(2), 245-276.

Cattell, R.B. & Scheier, I.H. (1963). *Handbook for the IPAT Anxiety Scale Questionnaire*. Champaign, IL: Institute for Personality and Ability Testing.

Chapman, C.N., Love, E., Milham, R.P., ElRif, P., & Alford, J.L. (2008). Quantitative evaluation of personas as information. *Proceedings of the Human Factors and Ergonomics Society.* 52nd Annual Meeting, New York, NY, September 2008, pp. 1107-1111.

Charyton, C. & Snelbecker, G.E. (2007b). General, artistic, and scientific creativity attributes of engineering and music students. *Creativity Research Journal, 19*, 213-225.

Charyton, C., Jagacinski, R.J., & Merrill, J.A. (2008). CEDA: A research instrument for creative engineering design assessment. *Psychology of Aesthetics, Creativity, and the Arts, 2*(3), 147-154.

Cheek, J.M. & Stahl, S.S. (1986). Shyness and verbal creativity. *Journal of Research in Personality, 20*(1), 55-61.

Chen, Greene, P.G., & Crick, A. (1998). Does entrepreneurial self-efficacy distinguish entrepreneurs from managers? *Journal of Business Venturing, 13*, 295-316.

Choi, J.N. (2004). Individual and contextual predictors of creative performance: The mediating role of psychological processes. *Creativity Research Journal, 16*(2 & 3), 187-199.

Christensen, P. R., & Guilford, J. P. (1957a). *Associational Fluency I, Form A*. Beverly Hills, CA: Sheridan Supply.

Christensen, P. R., & Guilford, J. P. (1957b). *Ideational Fluency I. Form A*. Beverly Hills, CA: Sheridan Supply.

Christensen, P. R., & Guilford, J. P. (1958b). *Word Fluency, Form A*. Beverly Hills, CA: Sheridan Supply.

Christensen, P. R., & Guilford, J. P. (I958a). *Expressional Fluency, Form A*. Beverly Hills, CA: Sheridan Supply.

Christensen, P.R., Merrifield, P.R., & Guilford, J.P. (1958). *Consequences, Form A-II*. Beverly Hills, CA: Sheridan Supply.

Cohen, J., Cohen, P., West, S.G. & Aiken, L.S. (2003). *Applied multiple regression/correlation analysis in the behavioral sciences* (3rd ed.).Mahwah, NJ: Lawrence Erlbaum Associates.

Cole, M.S., Walter, F., & Bruch, H. (2008). Affective mechanisms linking dysfunctional behavior to performance in work teams: A moderated mediation study. *Journal of Applied Psychology, 93*(5), 945-958.

Cook, R.D. (1977). Detection of influential observations in linear regression. *Technometrics, 19*, 15-18.

Cooper, A. (1999). *The inmates are running the asylum*. New York: Macmillian.

Costa, P.T., JR. & McCrae, R.R. (1985). *The NEO Personality Inventory manual*. Odessa, FL: Psychological Assessment Resources.

Coutinho, S. (2008). Self-efficacy, metacognition, and performance. *North American Journal of Psychology, 10*(1), 165-172.

Creswell, J.W. (2006). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage.

Creswell, J.W. (2008). *Research design: Qualitative, quantitative, and mixed methods approaches (3rd edition)*. Thousand Oaks, CA: Sage.

Creswell, J.W. & Plano-Clark, V. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.

Cronbach, L.J. (1951). Coefficient alpha dn the internal structure of tests. *Psychometrika, 16*, 297-334.

Cronbach, L.J. & Meehl, P.E. (1955). Construct validity in psychological tests. *Psychological Bulletin, 52*, 281-302.

Csikszentmihalyi, M. (1994). The domain of creativity. In D.H. Feldman, M. Csikszentmihalyi, & H. Gardner (Eds.) *Changing the world: A framework for the study of creativity*. Westport, CT: Praeger Publishers.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. New York, NY: HarperCollins.

De Dreu, C.K.W. & Nijstad, B.A. (2008). Mental set and creative thought in social conflict: Threat rigidity versus motivated focus. *Journal of Personality and Social Psychology, 95*(3), 648-661.

Dearborn, G.V. (1898). A study of imagination. *American Journal of Psychology, 9*, 183-190.

DeCarlo, L.T. (1997). On the meaning and use of kurtosis. *Psychological Methods, 2*(3), 292-307.

Deci, E.L. & Ryan, R.M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology, 49*(1), 14-23.

Deci, E.L. & Ryan, RM. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum.

Dewey, J. (1899). *The school and society.* Chicago: University of Chicago Press.

Dewey, J. & Dewey, E. (1915). *Schools of to-morrow.* New York: E.P. Dutton & Company.

Diakidoy, I-.A. N. & Constantinou, C.P. (2001). Creativity in physics: Response fluency and task specificity. *Creativity Research Journal, 13*(3 & 4), 401-420.

Dillman, D.A. (2007). *Mail and internet surveys: The tailored design method. (2nd ed.)*. New York: Wiley and Sons.

Donnellan, M.B., Oswald, F.L., Baird, B.M., Lucas, R.E. (2006). The mini-IPI scales: Tiny-yet-effective measures of the big five factors of personality. *Psychological Assessment, 18*(2), 192-203.

Eisenberger, R. & Cameron, J. (1996). Determinantal effect of reward: Reality or myth? *American Psychology, 51*(11), 1153-1166.

Eisenberger, R. & Shanock, L. (2003). Rewards, intrinsic motivation, and creativity: A case study of conceptual and methodological isolation. *Creativity Research Journal, 15*(2 & 3), 121-130.

Embretson (Whitely), S. (1983). Construct validity: Construct representation versus nomothetic span. *Psychological Bulletin, 93*, 179-197.

Enders, C. (n.d.). This SAS program implements the test for missing completely at random (MCAR) missing data outlined in Little's (1998) JASA article. Retrieved from http://psychology.clas.asu.edu/files/LittlesTestofMCARMissingData.sas.

Feist, G.J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality & Social Psychology Review, 2*(4), 290-310.

Fox, J. (2009). *car: Companion to Applied Regression*. [Computer manual]. Retrieved from http://CRAN.R-project.org/package=car.

Fromkin, H.L. (1970). Effects of experimentally aroused feelings of undistinctiveness upon valuation of scarce and novel experiences. *Journal of Personality and Social Psychology, 16*(3), 521-529.

Garaigordobil, M. (2006). Intervention in creativity with children aged 10 and 11 years: Impact of a play program on verbal and graphic-figural creativity. *Creativity Research Journal, 18*(3), 329-345.

Gardner, H. (1993). *Creating Minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*. New York: Basic Books.

Gardner, H. (2004). *Changing minds*. Boston, MA: Harvard Business School Press.

George, J.M. & Zhou, J. (2001). When openness to experience and conscientiousness and related to creative behavior: An interactional approach. *Journal of Applied Psychology, 86*(3), 513-526.

Gescheider, G.A. (1997). *Psychophysics: The fundamentals.* Mahwah, NJ: Lawrence Erlbaum Associates.

Gibbs, S.R.. (2009). Exploring the influence of task-specific self-efficacy on opportunity recognition perspectives and behaviors. *Frontiers of Entrepreneurship Research, 29*(6). Retrieved from http://digitalknowledge.babson.edu/cgi/viewcontent.cgi?article=1510&context=fer.

Gist, M.E. (1989). The influence of training method on self-efficacy and idea generation among managers. *Personnel Psychology, 42*(4), 787-805.

Glover, J.A., Ronning, R.R., & Reynolds, C.R. (1989). Preface. In J.A. Glover, R.R. Ronning, and C.R. Reynolds (Eds.), *Handbook of Creativity*, xi - xiii. New York: Plenum Press.

Goldberg, L.R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I Mervielde, I Deary, F De Fruyt, & F Ostendorf (Eds.), *Personality Psychology in Europe 7*, pp. 7-28. Tilburg, The Netherlands: Tilburg University Press.

Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., & Gough, H. C. (2006). The International Personality Item Pool and the future of public-domain personality measures. *Journal of Research in Personality, 40*, 84-96.

Gong, Y., Huang, J.-C., & Farh, J.-L. (2009). Employee learning orientation, transformational leadership, and employee creativity: The mediating role of employee creative self-efficacy. *Academy of Management Journal, 52*(4), 765-778.

Gosling, S.D., Rentfrow, P.J., & Swann, W.B., Jr. (2003). A very brief measure of the big five personality domains. *Journal of Research in Personality, 37*, 504-528.

Gough, H. (1979). A creative personality scale for the Adjective Check List. *Journal of Personality and Social Psychology, 37*, 1398-1407.

Graham, J.W. (2003). Adding missing-data-relevant variables to FIML-based structural equation models. *Structural Equation Modeling, 10*(1), 80-100.

Griskevicius, V., Cialdini, R.B., & Kenrick, D.T. (2005). Peacocks, Picasso, and parental investment: The effects of romantic motives on creativity. *Journal of Personality and Social Psychology, 91*(1), 63-76.

Gruber, H.E. & Wallace, D.B. (2001). Creative work: The case of Charles Darwin. *American Psychologist, 56*(4), 346-349.

Guilford, J.P. (1950). Creativity. *American Psychologist, 5*(9), 444-454.

Guilford, J.P. (1967). Creativity: Yesterday, today, and tomorrow. *Journal of Creative Behavior, 1*, 3-14.

Gustafsson, Herrmann, & Huber. (2002).*Conjoint Measurement: Methods and Applications (2nd Ed.)*. Springer: New York.

Haggbloom S.J., Warnick, R., Warnick, J.E., Jones, V.K., Yarbrough, G.L., Russell, T.M., Borecky, C.M., McGahhey, R., Powell, J.L. III, Beavers, J., & Monte, E. (2002). The 100 most eminent psychologists of the 20th century. *Review of General Psychology, 6*(2), 139-152.

Hannemann, B.T. (2005). Creativity with dementia patients: Can creativity and art stimulate dementia patients positively? *Gerontology, 52*, 59-65.

Hatch, J.A. (2001). *Doing qualitative research in educational settings*. Albany, NY: State University of New York Press.

Hayduk, J.A. & Glaser, D.N. (2000). Jiving the four-step, waltzing around factor analysis, and other serious fun. *Structural Equation Modeling, 7*(1), 1-35.

Hennesey, B.A. & Amabile, T.M. (1999). Reward, intrinsic motivation, and creativity. *American Psychologist, 53*(6), 674-675.

Hennessey, B.A. (2000). Self-determination theory and the social psychology of creativity. *Psychological Inquiry, 11*(4), 293-298.

Hirsch, J.B. & Peterson, J.B. (2008). Predicting creativity and academic success with a "fake-proof" measure of the Big Five. *Journal of Research in Personality, 42*, 1323-1333.

Houtz, J.C. & Krug, D. (1995). Preface to special issue on the educational psychology of creativity: Toward an educational psychology of creativity? *Educational Psychology Review, 7*(2), 137-139.

Hu, L, -T., & Bentler, P.M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Hu, L.-T.,& Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modelin*g (pp. 76-99). Thousand Oaks, CA: Sage.

Humpreys, L.G. & Montanelli, R.G. (1975). An examination of the parallel analysis criterion for determining the number of common factors. *Multivariate Behavioral Research, 10*, 193-206.

Hutcheson, G, & Sofroniou, N. (1999). *The multivariate social scientist: Introductory statistics using generalized linear models*. Thousand Oaks, CA: Sage Publications.

Jaussi, K.S., Randel, A.E., & Dionne, S.D. (2007). I am, I think I can, I do: The role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. *Creativity Research Journal, 19*(2 & 3), 247-258.

Jöreskog K. & Sörbom, D. (1981). *LISREL V: Analysis of linear structure relationships by the method of maximum likelihood*. Chicago: National Educational Resources.

Joy, S. (2004). Innovation motivation: The need to be different. *Creativity Research Journal, 16*(2 & 3), 313-330.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*, 141-151.

Kaiser, H.F. (1970). A second-generation Little Jiffy. *Psychometrika*, 35, 401-415.

Kaiser, H.F. (1974). An index of factorial simplicity. *Psychometrika*, 39, 31-36.

Khatena, J. & Torrance, E.P. (1976). *Khatena-Torrance creative perception inventory.* Chicago: Stoelting.

Kim, K.H. (2008). Commentary: The torrance tests of creative thinking already overcome many of the perceived weaknesses that Silvia et al.'s (2008) methods are intended to correct. *Psychology of Aesthetics, Creativity, and the Arts, 2*(2), 97-99.

King, L. & Gurland, S.T. (2007).Creativity and experience of a creative task: Person and environmental effects. *Journal of Research in Personality, 41*, 1252-1259.

King, L.A., Walker, L.M., & Broyles, S.J. (1996). Creativity and the five-factor model. *Journal of Research in Personality, 30*(2), 189-203.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford Press

Kooser, T. (2005). *The poetry home repair manual: Practical advice for beginning poets*. Lincoln, NE: University of Nebraska Press.

Kray, L.J., Galinsky, A.D., & Wong, E.M. (2006). Thinking within the box: The relational processing style elicited by counterfactual mind-sets. *Journal of Personality and Social Psychology, 91*(1), 33-48.

Kuder, G.F. & Richardson, M.W. (1937). The theory of estimation of test reliability. *Psychometrika, 2*, 151-160.

Langfelder, P., Zhang, B., & Horvath, S. (2008). Defining clusters from a hierarchical cluster tree: the Dynamic Tree Cut package for R. *Bioinformatics, 24*(5), 719-720.

Laweshe, C.H. & Harris, D.H. (1960). *Purdue Creativity Test*. West. Lafayette, IN: Purdue Research Foundation

Laws, J. (2003). *Self-efficacy beliefs and creative performance in adults: A phenomenological investigation*. (Doctoral dissertation, University of Ottawa, 2003).

Lemons, G.K. (2006). *A qualitative investigation of college students' creative self-efficacy*.(Doctoral dissertation, University of Northern Colorado, 2006).

Lemons, G.K. (2009). *Diverse perspectives of creativity testing: Controversial issues when used for inclusion into gifted programs*. Paper presented at the American Educational Research Association annual conference, San Diego, CA.

Little, R.J.A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*, 1198-1202.

Locke, E.A., Frederick, E., Lee, C., Bobko, P. (1984). Effect of self-efficacy, goals, and task strategies on task performance. *Journal of Applied Psychology, 69*(2), 241–251.

Luce, R.D. & Tukey, J.W. (1964). Simultaneous conjoint measurement: a new scale type of fundamental measurement. *Journal of Mathematical Psychology*, *1*, 1–27.

Mardia, K.V. (1970). Measures of multivariate skew and kurtosis with applications. *Biometrika, 57*, 519-530.

Mardia, K.V., Kent, J.T., & Bibby, J.M. (1979). *Multivariate analysis*. London: Academic Press.

Marsh, H. & O'Neill, R. (1984). Self-Description Questionnaire III: The construct validity of multidimensional self-concept ratings by late adolescents. *Journal of Education Measurement, 21*, 153-174.

Martindale, C. (2001). Oscillations and analogies: Thomas Young, MD, FRS, Genius. *American Psychologist, 56*(4), 342-345.

Mathisen, G.E. & Bronnick, K.S. (2009). *Creative self-efficacy: An intervention study. International Journal of Educational Research, 48*, 21-29.

McCrae, R.R. (1987). Creativity, divergent thinking, and openness to experiences. *Journal of Personality and Social Psychology, 52*(6), 1258-1265.

McCrae, R.R., & John, O.P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality: 60*, 175–215.

Messick, S. (1989). Validity. In R. Linn (Ed.), *Educational measurement*, (3rd ed.). Washington, D.C.: American Council on Education

Morse, J.M. & Richards, L. (2002). *Readme first for a user's guide to qualitative methods*. Thousand Oaks, CA: Sage.

Muthén, B.O. (1998-2004). Mplus Technical Appendices. Los Angeles, CA: Muthén & Muthén.

Muthén, B.O. (2006, February 20.) The asymptotics of the test fails to kick in. Message posted to http://www.statmodel.com/discussion/messages/9/352.html.

Muthén, B.O. (2008, May 16.) Tech13 was primarily developed for mixture models to see if the estimated model would capture the skewness and kurtosis in the data. Message posted to http://www.statmodel.com/discussion/messages/9/189.html?1265389765.

Muthén, L.K. (2008, February 6). Tech 13 does not provide tests of multivariate skewness and kurtosis. Message posted to http://www.statmodel.com/discussion/messages/9/352.html.

Muthén, L.K, & Muthén, B.O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling, 9*(4), 599-620.

Muthén, L.K. & Muthén, B.O. (2006). *Mplus user's guide*. Los Angels, CA: Muthén & Muthén.

Nakamura, J. & Csikszentmihalyi, M. (2001). Catalytic creativity: The case of Linus Pauling. *American Psychologist, 56*(4), 337-341.

Nyulund, K.L. Asparouhov, T. & Muthén, B.O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling, 14*(4), 535-569.

OpenOffice.org. (2009). *OpenOffice.org 3 Writer Guide* [Computer software manual]. Available from http://documentation.openoffice.org/manuals/userguide3/0200WG3-WriterGuide.pdf.

Oral, G., Kaufman, J.C., & Agars, M.D. (2007). Examining creativity in Turkey: Do Western findings apply? *High Ability Studies, 18*(2), 235-246.

Osigna, F.P.B. (2007). *Science, strategy, and war: The strategic theory of John Boyd*. New York: Routledge.

Owens, W.A. (1960). *The Owens' Creativity Test: Examiner's manual*. Ames, IA: Iowa State University Press.

Pajares, F., Hartley, J., & Valiante, G. (2001). Response format in writing self-effi-cacy assessment: Greater discrimination increases prediction. *Measurement and Evaluation in Counseling and Development, 33*, 214-221.

Pannells, T.C. & Claxton, A.F. (2008). Happiness, creative ideation, and locus of control. *Creativity Research Journal, 20*(1), 67-71.

Patterson, F. (2000). *The Innovation Potential Indicator: Test manual and user's guide*. Oxford: Oxford Psychologists Press.

Phelan, S.G. (2001). *Developing creative competence at work: The reciprocal effects of creative thinking, self-efficacy, and organizational culture on creative performance*. (Doctoral dissertation, California School of Professional Psychology, 2001).

Plucker, J.A. (1999). Is the proof in the pudding? Reanalysis of Torrance's (1958 to present) longitudinal data. *Creativity Research Journal, 12*, 1103-1114.

Plucker, J.A. (2001). Introduction to the special issue: Commemorating Guilford's 1950 presidential address. *Creativity Research Journal, 13*(3 & 4), 247.

Plucker, J.A., Beghetto, R.A., & Dow, G.T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist, 39*, 83-96.

Plucker, J.A., Runco, M.A., & Lim, .W. (2008). Predicting ideational behavior from divergent thinking and discretionary time on task. *Creativity Research Journal, 18*(1), 55-63.

Popper, K. (1963). Science: Conjectures and Refutations. In *Conjectures and Refutations* (pp. 33 - 59). New York, NY: Routledge.

Prabhu, V., Sutton, C., & Sauser, W. (2008). Creativity and certain personality traits: Understanding the mediating effect of intrinsic motivation. *Creativity Research Journal, 20*(1), 53-66.

R Development Core Team. (2009). *R: A language and environment for statistical computing* [Computer software manual]. Vienna, Austria. Available from http://www.R-project.org.

Raiche, G., Riopel, M. and Blais, J.-G. (2006). *Non graphical solutions for the Cattell's scree test*. Paper presented at the International Annual meeting of the Psychometric Society, Montreal. [http://www.er.uqam.ca/nobel/r17165/RECHERCHE/COMMUNICATIONS/]

Ranpura, A. (2005). [R] KMO sampling adequacy and SPSS–partial solution. *R mailing lists archive*. December 8, 2005. Retrieved May 14, 2009, from http://tolstoy.newcastle.edu.au/R/help/05/12/17235.html.

Raykov, T. & Shrout, P.E. (2002). Reliability of scales with general structure: point and interval estimation using a structural equations modeling approach. *Structural Equations Modelings, 9*(2), 195-212.

Raykov, T. (2004). Behavioral scale reliability and measurement invariance evaluation using latent variable modeling. *Behavior Therapy, 35*, 299-331.

Renner, V. (1970). Effects of modification of cognitive style on creative behavior. *Journal of Personality and Social Psychology, 14*(3), 257-262.

Rietzschel, E.F., DeDreu, C.KW., & Nijstad, B.A. (2007). Personal need for structure and creative performance: The moderating influence of fear of invalidity. *Personality and Social Psychology Bulletin, 33*(6), 855-866.

Riley, K. (1999). *Adult creative self-efficacy and intrinsic leisure motivation in recreation art and exercise environments*. (Doctoral dissertation, University of Oregon, 1999).

Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs, 80*, 1-28.

Rotter, J.B. (1990). Internal versus external control of reinforcement: A case history of a variable. *American Psychologist, 45*(4), 489-493.

Runco, M.A. (2001). Introduction to the special issue: Commemorating Guilford's 1950 presidential address. *Creativity Research Journal, 13*(3 & 4), 245.

Runco, M.A. (2008). Commentary: Divergent thinking is not synonymous with creativity. *Psychology of Aesthetics, Creativity, and the Arts, 2*(2), 93-96.

Runco, M.A., Plucker, J.A., & Lim, .W. (2001). Development and psychometric integrity of a measure of ideational behavior. *Creativity Research Journal, 13*(3 & 4), 393-400.

Russ, S.W. (2003). Play and creativity: Developmental issues. *Scandinavian Journal of Educational Research, 47*(3), 291-303.

SAS Institute, Inc. (2008). *SAS 9.1.3 Help and Documentation*. Cary, NC: SAS Institute, Inc.

Satorra, A. (2000). Scaled and adjusted restricted tests in multi-sample analysis of moment structures. In R.D.H. Heijmans, D.S.G. Pollock, & A. Satorra (Eds.), *Innovations in multivariate statistical analysis. A Festschrift for Heinz Neudecker* (pp.233-247). London: Kluwer Academic Publishers.

Satorra, A. & Bentler, P.M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika 66*(4), 507-514.

Schack, G. (1989). Self-efficacy as a mediator in the creative productivity of children. *Journal for the Education of the Gifted, 12*(3), 231-249.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston (Eds.), *Causal and control beliefs* (pp. 35-37). Windsor, England: NFER-NELSON

Schwert, P.M. (2007). Using sentence and picture clues to solve verbal insight problems. *Creativity Research Journal, 19*(2 & 3), 293-306.

Sheldon, K.M. (1995). Creativity and self-determination in personality. *Creativity Research Journal 8*(1), 25-36.

Sijtsma, K. (2009). On the use, the misuse, and the very limited usefulness of Cronbach's Alpha. *Psychometrika, 74*(1), 107-120.

Silvia, P.J. (2008). Creativity and intelligence revisited: A latent variable analysis of Wallach and Kogan (1965). *Creativity Research Journal, 20*(1), 34-39.

Silvia, P.J., Winterstein, B.P., & Willse, J.T. (2008). Rejoinder: The madness to our method: Some thoughts on divergent thinking. *Psychology of Aesthetics, Creativity, and the Arts, 2*(2), 109-114.

Silvia, P.J., Winterstein, B.P., Willse, J.T., Barona, C.M., Cram, J.T., Hess, K.I., Martinez, J.L., & Richard, C.A. (2008). Assessing creativity with divergent thinking tasks: Exploring the reliability and validity of new subjective scoring methods. *Psychology of Aesthetics, Creativity, and the Arts, 2*(2), 68-85.

Smith, E.V. Jr., Wakeyl, M.B., de Kruif, R.E.L., & Swartz, C.W. (2003). Optimizing rating scales for self-efficacy (and other) research. *Educational and Psychological Measurement, 63*(3), 369-391.

Stanley, J.C. (1956). The riddle of creativity. *Peabody Journal of Education, 34*(2), 79-81.

Sternberg, R.J. (1999). Preface. In R.J. Sternberg (Ed.), *Handbook of Creativity*, xi. New York: Cambridge University Press.

Sternberg, R.J. (2006a). Creating a vision of creativity: The first 25 years. *Psychology of Aesthetics, Creativity, and the Arts, S*(1), 2-12.

Sternberg, R.J. (2006b). The nature of creativity. *Creativity Research Journal 18*(1), 87-98.

Sternberg, R.J. & Dess, N.K. (2001). Creativity for the new millennium. *American Psychologist, 56*(4), 332.

Sternberg, R.J. & Lubart, T.I. (1992). Buy low and sell high: An investment approach to creativity. *Current Directions in Psychological Science, 1*, 1-5

Sternberg, R.J. & Lubart, T.I. (1993). Investing in creativity. *Psychological Inquiry, 51*(7), 677-688.

Sternberg, R.J. & Lubart, T.I. (1996). Investing in creativity. *American Psychologist, 51*(7), 677-688.

Sternberg, R.J. & Lubart, T.I. (1999). The concept of creativity: Prospects and paradigms. In R.J. Sternberg (Ed.), *Handbook of Creativity*, 3- 15. New York: Cambridge University Press.

Stevens, J.P. (1984). Outliers and influential data points in regression analysis. *Psychological Bulletin, 95*(2), 334-344.

Stokes, P.D. (2001b). Variability, constraints, and creativity: Shedding light on Charles Monet. *American Psychologist, 56*(4), 355-359.

Suzuki, R. & Shimodaira, H. (2006). Pvclust: an R package for assessing the uncertainty in hierarchical clustering. *Bioinformatics, 22*(12), 1540-1542.

Suzuki, R. & Shimodaira, H. (2009). *pvclust: Hierarchical Clustering with p-values via multiscale bootstrap resampling* [Computer manual]. Retrieved from http://www.is.titech.ac.jp/~shimo/prog/pvclust/.

Tan, A.G. (2007). *Development of creativity efficacy scales*. Unpublished manuscript. Singapore: National Institute of Education.

Tan, A.-G., Ho, V., Ho., E., Ow, S. (2008). *The International Journal of Creativity and Problem Solving, 18*(2), 115-126.

Tabachnick, B.G. & Fidell, L.S. (2006). *Using multivariate statistics*. (5th ed.). Boston, MA: Allyn & Bacon.

Thurstone, L.L. (1928). The phi gamma hypothesis. *Journal of Experimental Psychology, 11*, 293-305.

Thurstone, L.L. (1934). The vectors of the mind. *Psychological Review, 41*, 1-32.

Tierney, P., Farmer, S.M., & Graen, C.B. (1999). An examination of leadership and employee creativity: The relevance of traits and relationships. *Personal Psychology, 52*, 591-620.

Tierney, P.A. & Farmer, S.M. (2002). Creative self-efficacy: its potential antecedents and relationship to creative performance. *Academy of Management Journal, 45*(6), 1137-1148.

Tierney, P.A. & Farmer, S.M. (2004). The Pygmalion process and employee creativity. *Journal of Management, 30*(3), 413-432.

Tomas, V. (1964). *Creativity in the arts*. Englewood Cliffs, NJ: Prentice-Hall.

Torrance, E.P. (1966). *Torrance tests of creative thinking: Norms. Technical manual*. Princeton, NJ: Personnel Press.

Torrance, E.P. (1972). Career patterns and peak creative achievement of creative high school students twelve years later. *Gifted Child Quarterly, 16*, 75-88.

Torrance, E.P. (1990). *Torrance tests of creative thinking. Norms-technical manual* (Figural streamlined Forms A & B). Bensenville, IL: Scholastic Testing Services, Inc.

Torrance, E.P. (2004). Great expectations: Creative achievements of the sociometric stars in a 30-years survey. *Journal of Secondary Gifted Education, 16*(1), 5-13.

Torrance, E.P. (2008). *Torrance Tests of Creative Thinking: Norms-technical manual, verbal forms A and B*. Bensenville, IL: Scholastic Testing Service.

Tsao, Y.-L. (200). Using guided play to enhance children's conversation, creativity and competence in literacy. *Education, 128*(3), 515-520.

Tufis, C.D. (2008). Multiple imputation as a solution to the missing data problem in the social sciences. *Calitatea Vietii, 19*, 199-212.

Upmanyu, V.V., Bhardwaj, S., & Singh, S. (1996). Word-association emotional indicators: Associations with anxiety, psychoticism, neuroticism, extraversion, and creativity. The *Journal of Social Psychology, 136*(4), 521-529.

Venables, W. N., & Ripley, B. D. (2002). *Modern applied statistics with s* (4th ed.). New York: Springer. Available from http://www.stats.ox.ac.uk/pub/MASS4 (ISBN 0-387-95457-0).

Vygostky, L. (1990). Imagination and creativity in childhood. *Soviet Psychology, 28*, 84-96. Original work published 1930).

Wallach, M.A. & Kogan, N. (1965). *Modes of thinking in young children: A study of the creativity-intelligence distinction*. New York: Holt, Rinehart, & Winston.

Ward, T.B. (2001). Creative cognition, conceptual combination, and the creative writing of Stephen R. Donaldson. *American Psychologist, 56*(4), 350-354.

Way, N., Stauber, H.Y., Kakkula, M.J., & London, P. (1994). Depression and substance use in two divergent high school cultures: A quantitative and qualitative analysis. *Journal of Youth and Adolescence, 23*(3), 331-357.

Wilson, R.C., Guilford, J.P. & Christensen, P.R. (1953). The measurement of individual differences in originality. *Psychology Bulletin, 50*, 362-370.

Worthington, R. L. & Whittaker, T.A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist, 34*(6), 806-838.

Wothke, W. (2000). Longitudinal and multi-group modeling with missing data, in T. Little, K. Schnabel, & J. Baumert, (Eds)., *Modeling longitudinal and multilevel data: Practical issues, applied approaches, and specific examples*. Mahwah, NJ: Lawrence Erlbaum Associates, 2000.

Yang, H.-L. & Cheng, H-H. (2009). Creative self-efficacy and its factors: An empirical study of information systems analysts and programmers. *Computers in Human Behavior, 25*(2), 429-438.

Yuan, K.-H. & Bentler, P.M. (2000). Three likelihood-based methods for mean and covariance structure analysis with nonnormal missing data. *Sociological Methodology, 30*, 165-200.

Zhou, J. & George, J.M. (2001). When job dissatisfaction leads to creativity: Encouraging the expression of voice. *Academy of Management Journal, 44*(4), 682-696.

APPENDIX A. VERBAL SCRIPT FOR QUANTITATIVE PHASE

Hello.

I have been asked to share a research opportunity with you.

Two-researchers in this department are conducting a study on motivation and creativity. They have asked me to pass this along. I will be sending out an electronic mail to this class that includes a link to an "Informed Consent" document online. If you are 19 years of age or older, and you decide to grant "Informed Consent," you will then be able to participate in the study. The study will be conducted online.

[If the class has a research participation requirement.]
Participating in this study will fulfill one of your "research participation" requirements, as mentioned in the syllabus. If you are not 19 years of age or older or decide not to grant informed consent, an alternative activity will be made available to you. After you have finished participating in the study, or alternatively have finished participating in the alternative activity, please reply to my electronic mail, so I can give you credit for research participation. In any case, your answers will be completely anonymous.

[If the class does not have a research participation requirement.]
Participating in this study is completely voluntary. Doing so will help further the scientific study of creativity and motivation. However, there is no requirement that you participate. Participation is anonymous, and I will not know who participates and who does not.

I will be sending out an electronic mail repeating this information after class.

Thank you.

APPENDIX B. EMAIL SCRIPT FOR QUANTITATIVE PHASE

Hello.

I have been asked to share a research opportunity with you.

Two-researchers in this department are conducting a study on motivation and creativity. They have asked me to pass this along. If you are 19 years of age or older, and you decide to grant "Informed Consent," you will then be able to participate in the study. The study will be conducted online.

[If the class has a research participation requirement.]
Participating in this study will fulfill one of your "research participation" requirements, as mentioned in the syllabus. If you are not 19 years of age or older or decide not to grant informed consent, an alternative activity will be made available to you. To receive the alternative email, please request it from the researcher at danhabbott@gmail.com. After you have finished participating in the study, or alternatively have finished participating in the alternative activity, please reply to this electronic mail, so I can give you credit for research participation. In any case, your answers will be completely anonymous.

[If the class does not have a research participation requirement.]
Participating in this study is completely voluntary. Doing so will help further the scientific study of creativity and motivation. However, there is no requirement that you participate. Participation is anonymous, and I will not know who participates and who does not.

To participate in this survey, please read the Informed Consent to better understand your rights as participants.

[SECURE HTTP LINK GOES HERE]

If you decide to grant informed consent, please click the appropriate link in the Informed Consent document.

If you have any questions about the form, please contact the principal investigator, Daniel H. Abbott, at danhabbott@gmail.com. You may also contact the supervising investigator, Dr. Roger H. Bruning, at rbruning@unl.edu. If you have any concerns about your rights as a participant, please contact the UNL Institutional Review Board, at (402) 472-6965.

Thank you.

APPENDIX C. EMAIL SCRIPT FOR QUALITATIVE PHASE

Hello.

I am writing this email to you because of your participation in an online survey, conducted [DATE]. Your responses were valuable!

Of all the hundreds of participants, you were selected to be one of only 12 whose voices will be heard for a second stage of the study. You are invited to participate in an online interview that will be conducted through an instant messaging application, to better understand your views.

If you agree to participate, this will take about 30 minutes.

You do not have to participate. No one will know if you do not. But if you do agree, the opinions that contribute will become part of the scientific literature on creativity. Your ideas can help influence the ideas of others.

Interested? Please review the Informed Consent document believe, which emphasizes your rights as a participant. If you will volunteer your time, please contact Daniel Abbott at danhabbott@gmail.com, and he will set up a time that is convenient for you. And of course you are able to withdraw at any time.

If you do not want to participate, please email danhabbott@gmail.com anyway, so we can take you off the list. If we don't hear from you in a week, we will assume you decline to participate. That is OK. However, it would be a shame for us to miss out on hearing your views.

Daniel H. Abbott, M.A.
Department of Educational Psychology
University of Nebraska–Lincoln
Email: danhabbott@gmail.com

APPENDIX D. ONLINE FORM FOR QUANTITATIVE PHASE

Constructing a Creative Self-Efficacy Inventory - Quantitative Phase
The attached form lists different activities. In the column Confidence, rate how confident you are that you can do them as of now. Rate your degree of confidence by recording a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.
* Required

Get a large number of different ideas or responses? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Come up with many possible solutions to a situation. Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Arrive at a variety of conclusions given a difficult situation. Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Think of many answers to a difficult problem or situation. Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Come up with different kinds of responses, not just different responses? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Answer problems in different ways, each of which are unique and special? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Think of many types of ideas while considering a problem? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Answer problems in different forms or styles? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Think of ways to defend a 'crazy' thought, by thinking back on what you already know? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Talk to your friends about wild ideas, and make them sound reasonable? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Tell stories based on dreams you had, even if you need to fill in answers? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Connect day-dreams or new ideas to things you have already learned? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Be the first in a group to come up with an original suggestion? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Arrive at a novel solution before other people? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Beat other people in imagining a brand new idea first? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Think of ideas no one else has? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Make sense of something you want to learn to do? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Start to learn to do something, even if there are obstacles to doing so? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Teach yourself how to do something new? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Choose do something that is more important within your culture? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Create a novelty that people will choose, over other novelties available? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Find an audience that is well-connected to others in society? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Network with people to convince them that what you made is the best? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Convince others that you have made a valuable contribution? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Be motivated to come up with new ideas? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Have fun coming up with new ideas, after having learned from others? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Wake up feeling like you can come up with new ideas if you want to? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Sustain wonder about something, even after working with it for years or decades? Please enter a number from 0 to 100. 0 means Not at All Confident. 100 Means highly certain that you can do the task.

Extraverted, enthusiastic. *
Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I have a lot of good ideas *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I am good at coming up with new ideas *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I have a good imagination *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I have a vivid imagination *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I am not interested in abstract ideas *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I have difficulty understanding abstract ideas *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

I do not have a good imagination *

1 2 3 4 5 6 7

Very strongly disagree — Very strongly agree

What is your sex?

Male

Female

What is your age?

May we contact you later?We may want to interview you to learn more. If this is acceptable, please enter an email address or phone number

APPENDIX E. INTERVIEW PROTOCOL FOR QUALITATIVE PHASE

Interview Protocol

Interview Protocol: Constructing a Creative Self-Efficacy Inventory–Qualitative Phase

Interviewer: _____
Date: _____
Time: _____
Participant #: _____

Introduction,

Hello _____. Thank you for taking the time to talk to me today. Before we begin, I want to remind you that I am "logging" our conversation today. Do I have your permission to make a textual recording?

[Note response]

I want to assure you that your identity will be kept confidential. I will be asking you a number of questions so feel free to discuss your ideas and views. I have a protocol of questions that I will ask. This interview should take between 30 and 45 minutes, but I do ask that you not work on other matters during it. Are you ready to begin?

[Note response]

1. First, Could you tell me a little about thinking creative thoughts? => *Are you confident in your ability to do things, like think of things no one else have, or come up with many different responses to a problem?* => *What does thinking creative thoughts feel like?*	
2. Great. Could you tell me a little about doing creative things? => *Are you confident in your ability to do things like, find an audience for what you do, or impress people who have the power to publicize your work?* => *What does doing creative things feel like?*	

Thank you for your time. Your responses are very helpful. Can I answer any questions you may have?

APPENDIX F. INFORMED CONSENT FOR QUANTITATIVE PHASE

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

INFORMED CONSENT FORM

Identification of Project:
Constructing a Creative Self-Efficacy Inventory–Qualitative Phase–Quantitative Phase

Purpose of the Research:
This is a research project to study the factor structure of different measures of creativity. You must be 19 years of age or older to participate. You are invited to participate in this study because you are a student in an Educational Psychology (EDPS) course at the University of Nebraska–Lincoln.

Procedures:
First you will take a survey containing around 26 multiple-choice questions, including demographic questions, motivational questions, and a short personality inventory.

Risks and/or Discomforts:
There are no known risks or discomforts associated with this research. In the event of problems resulting from participation in the study, psychological treatment is available at the University Health Center Counseling and Psychological Services on a sliding fee scale, telephone (402) 472-5000.

Benefits:
Some students may have to participate in a research opportunity as part of their class requirements. this is only true if your professor notified you of this, and it is included in your class syllabus. If so, you will receive research participation whether you grant informed consent and participate, or if you do not grant informed consent, and engage in another, non-research activity. There are no other direct benefits from participating in the study.

Confidentiality:
Any information obtained during this study that could identify you will be kept strictly confidential. The data will be stored in password-protected folders on computers in the locked offices of the principal and secondary investigators and will only be seen by the investigators during the study and for three years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings, but the data will be reported as aggregated data.

When you begin the Internet survey, a “cookie” will be automatically placed on your computer. This will allow you to continue the survey if your computer crashes or your web browser closes. Your “cookie” information will not be shared.

Compensation:
You will receive no compensation for participating in this project, aside from credit for participating in one research opportunity (if applicable).

Opportunity to Ask Questions:
You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may call the investigator at any time, personal phone, (402) 304-9540. If you have questions concerning your rights as a research subject that have not been answered by the

investigator or to report any concerns about the study, you many contact the University of Nebraska-Lincoln Institutional Review Board, telephone (402) 472-6965.

Freedom to Withdraw:
You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the investigators or the University of Nebraska-Lincoln**.** If you withdraw, an alternative activity will be presented to you which will allow you to earn your research participation credit.

Consent, Right to Receive a Copy:
You are voluntarily making a decision whether or not to participate in this research study. Clicking "accept" certifies that you have decided to participate having read and understood the information presented. You may print out a copy of this informed consent form to keep.

Name and Phone number of investigator(s)

Daniel H. Abbott, M.A., Primary Investigator — Department Phone: (402) 304-9540
Roger H. Bruning, Ph.D., Project Supervisor — Office Phone: (402) 472-2225

APPENDIX G. INFORMED CONSENT FOR QUALITATIVE PHASE

University of Nebraska Lincoln
DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

INFORMED CONSENT FORM

Identification of Project:
Constructing a Creative Self-Efficacy Inventory–Qualitative Phase

Purpose of the Research:
This is a research project to study the process of creativity and motivation among pre-service teachers. You must be 19 years of age or older to participate. You are invited to participate in this study because you participated in the quantitative phase of this research, and have been selected as a voice that should be heard..

Procedures:
You will be asked four interview questions, not including prompts or queues for more information. This process should take approximately 30 to 45 minutes.

Risks and/or Discomforts:
There are no known risks or discomforts associated with this research. In the event of problems resulting from participation in the study, psychological treatment is available at the University Health Center Counseling and Psychological Services on a sliding fee scale, telephone (402) 472-5000.

Benefits:
There are no direct benefits from participating in the study, other than the knowledge that you are assisting in the scientific study of creativity.

Confidentiality:
Any information obtained during this study that could identify you will be kept strictly confidential. The data will be stored in password-protected folders on computers in the locked offices of the principal and secondary investigators and will only be seen by the investigators during the study and for three years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings, but the data will be reported as aggregated data.

Compensation:
You will receive no compensation for participating in this project.

Opportunity to Ask Questions:
You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may call the investigator at any time, personal phone, (402) 304-9540. If you have questions concerning your rights as a research subject that have not been answered by the investigator or to report any concerns about the study, you many contact the University of Nebraska-Lincoln Institutional Review Board, telephone (402) 472-6965.

Freedom to Withdraw:
You are free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the investigators or the University of Nebraska-Lincoln.

Consent, Right to Receive a Copy:
You are voluntarily making a decision whether or not to participate in this research study. Saying "I grant informed consent" certifies that you have decided to participate having read and understood the information presented. You may print out a copy of this informed consent form to keep.

Name and Phone number of investigator(s)

Daniel H. Abbott, M.A., Primary Investigator — Department Phone: (402) 304-9540
Roger H. Bruning, Ph.D., Project Supervisor — Office Phone: (402) 472-2225

APPENDIX H. ALTERNATIVE ACTIVITY

Constructing a Creative Self-Efficacy Inventory: A Quantitative and Qualitative Inquiry
ALTERNATIVE ACTIVITY

Please read the following passages from "Creativity," by J.P. Guilford. The article was published in 1950 in the scientific journal, *The American Psychologist*. After you have read the passage, please answer *2 (TWO)* of the following 4 questions below. Your responses will not be graded and will not be used for research purposes.

> In its narrow sense, creativity refers to the abilities that are most characteristic of creative people. Creative abilities determine whether the individual has the power to exhibit creative behavior to a noteworthy degree. Whether or not the individual who has the requisite abilities will actually produce results of a creative nature will depend upon his motivational and temperamental traits. To the psychologist, the problem is as broad as the qualities that contribute significantly to creative productivity. In other words, the psychologist's problem is that of creative personality.
>
> …
>
> Creative personality is then a matter of those patterns of traits that are characteristic of creative persons. A creative pattern is manifest in creative behavior, which includes such activities as inventing, designing, contriving, composing, and planning. People who exhibit these types of behavior to a marked degree are recognized as being creative.

Now please answer *2 (TWO)* of the following 4 questions in the space provided. Your response will not be graded and will not be used for research purposes.

1. How does J.P. Guilford define creativity? That is, what does creativity mean to him?

2. How would *you* define creativity? That is, what does creativity mean to you?

3. How does J.P. Guilford plan on 'measuring' creativity in people?

4. How would *you* measure creativity in people? Or do you think that creativity cannot be measured?

APPENDIX I. EMPIRICAL POWER ANALYSIS

```
Monte Carlo demonstrating that n=200 should be sufficient

SUMMARY OF ANALYSIS

Number of groups       1
Number of observations      200

Number of replications
 Requested      10000
 Completed      10000
Value of seed       0

Number of dependent variables     21
Number of independent variables     0
Number of continuous latent variables    9

Observed dependent variables

 Continuous
 CTFLU_1 CTFLU_2 CTFLU_3 CTFLEX_1 CTFLEX_2 CTFLEX_3
 CTELAB_1 CTELAB_8 CTELAB_9 CTORIG_1 CTORIG_2 CTORIG_3
 CPDOMA_1 CPDOMA_2 CPDOMA_3 CPFIEL_1 CPFIEL_2 CPFIEL_3
 CPPERS_1 CPPERS_2 CPPERS_3

Continuous latent variables
 CTFLU CTFLEX CTELAB CTORIG CPDOMA CPFIEL
 CPPERS CT  CP


    ESTIMATES  S. E. M. S. E. 95% % Sig
  Population Average Std. Dev. Average  Cover Coeff
 CTFLU BY
 CTFLU_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
 CTFLU_2  1.430 1.4329 0.0986 0.0964 0.0097 0.945 1.000
 CTFLU_3  1.430 1.4327 0.0985 0.0964 0.0097 0.944 1.000

 CTFLEX BY
 CTFLEX_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
 CTFLEX_2  1.090 1.0917 0.0676 0.0669 0.0046 0.946 1.000
 CTFLEX_3  1.090 1.0921 0.0676 0.0669 0.0046 0.949 1.000

 CTELAB BY
 CTELAB_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
 CTELAB_8  0.890 0.8942 0.0689 0.0677 0.0048 0.950 1.000
 CTELAB_9  0.890 0.8934 0.0681 0.0677 0.0047 0.950 1.000

 CTORIG BY
 CTORIG_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
 CTORIG_2  0.940 0.9409 0.0623 0.0608 0.0039 0.946 1.000
 CTORIG_3  0.940 0.9405 0.0612 0.0608 0.0037 0.948 1.000

 CPDOMA BY
```

```
CPDOMA_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
CPDOMA_2  0.660 0.6647 0.0927 0.0911 0.0086 0.952 1.000
CPDOMA_3  0.660 0.6640 0.0931 0.0911 0.0087 0.949 1.000

CPFIEL BY
CPFIEL_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
CPFIEL_2  0.960 0.9633 0.0876 0.0852 0.0077 0.946 1.000
CPFIEL_3  0.960 0.9627 0.0872 0.0853 0.0076 0.947 1.000

CPPERS BY
CPPERS_1  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
CPPERS_2  0.810 0.8153 0.0987 0.0966 0.0098 0.947 1.000
CPPERS_3  0.810 0.8161 0.0983 0.0966 0.0097 0.946 1.000

CT BY
CTFLU  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
CTFLEX  1.414 1.4261 0.1865 0.1832 0.0349 0.947 1.000
CTELAB  1.277 1.2865 0.1735 0.1711 0.0302 0.946 1.000
CTORIG  1.487 1.5020 0.1954 0.1911 0.0384 0.947 1.000

CP BY
CPDOMA  1.000 1.0000 0.0000 0.0000 0.0000 1.000 0.000
CPFIEL  1.254 1.2643 0.1330 0.1303 0.0178 0.948 1.000
CPPERS  1.017 1.0235 0.1131 0.1112 0.0128 0.948 1.000

CP WITH
CT  0.000 -0.0012 0.0833 0.0814 0.0069 0.955 0.045

Variances
CT  1.000 1.0092 0.2275 0.2221 0.0518 0.937 1.000
CP  1.000 0.9997 0.1818 0.1815 0.0331 0.939 1.000
```

APPENDIX J. MPLUS MODEL CODE

```
!! Hypothesis 1 - The Revised Model without Refinements!!
TITLE: CommandCode_revised-Short-flat GENERATED BY COMMANDMPLUS.PL;
DATA:
FILE IS
"C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE
Cohort GroupName TimeStamp CTFLUE1 CTFLUE2 CTFLUE3 CTFLUE4 CTFLEX1
CTFLEX2 CTFLEX3 CTFLEX4 CTELAB1 CTELAB2 CTELAB3 CTELAB4 CTELAB5 CTORIG1
CTORIG2 CTORIG3 CTORIG4 CPDOMA1 CPDOMA2 CPDOMA3 CPDOMA4 CPFIEL1 CPFIEL2
CPFIEL3 CPFIEL4 CPPERS1 CPPERS2 CPPERS3 CPPERS4 BCSE1 BCSE2 BCSE3 BCSE4
BCSE5 BCSE6 P1Open P1Cons P1Extr P1Agre P1Stab Open1 Open2 Open3 Open4
S_MaleFemale A_Years Email;
USEVARIABLES ARE CPDOMA1 CPDOMA3 CPDOMA4 CPFIEL2 CPFIEL3 CPFIEL4
CPPERS1 CPPERS2 CPPERS4 CTELAB3 CTELAB4 CTELAB5 CTFLEX1 CTFLEX2 CTFLEX3
CTFLUE2 CTFLUE3 CTFLUE4 CTORIG2 CTORIG3 CTORIG4; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE2@1 CTFLUE3*.296 CTFLUE4*1.487; CTFLEX BY
CTFLEX1@1 CTFLEX2*1.025 CTFLEX3*.784; CTORIG BY CTORIG2@1 CTORIG3*.993
CTORIG4*.992; CTELAB BY CTELAB3@1 CTELAB4*.751 CTELAB5*.639; CPDOMA BY
CPDOMA1@1 CPDOMA3*1.006 CPDOMA4*1.046; CPFIEL BY CPFIEL2@1 CPFIEL3*.054
CPFIEL4*1.082; CPPERS BY CPPERS1@1 CPPERS2*.992 CPPERS4*1.069; CTSE BY
CTFLUE CTFLEX CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS; CTSE WITH
CPSE;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypothesis 1 - The Revised Model with Refinements!!
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 2:41 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_revised-Short-flat GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4,
S_MaleFemale A_Years Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3,
CPDOMA4, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB3,
CTELAB4, CTELAB5, CTFLEX1, CTFLEX2, CTFLEX3, CTFLUE2, CTFLUE3, CTFLUE4,
CTORIG2, CTORIG3, CTORIG4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE2@1 CTFLUE3*.296 CTFLUE4*1.487; CTFLEX BY
CTFLEX1@1 CTFLEX2*1.025 CTFLEX3*.784; CTORIG BY CTORIG2@1 CTORIG3*.993
CTORIG4*.992; CTELAB BY CTELAB3@1 CTELAB4*.751 CTELAB5*.639; CPDOMA BY
CPDOMA1@1 CPDOMA3*1.006 CPDOMA4*1.046; CPFIEL BY CPFIEL2@1 CPFIEL3*.054
CPFIEL4*1.082; CPPERS BY CPPERS1@1 CPPERS2*.992 CPPERS4*1.069;\
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; CTSE
BY CTFLUE CTFLEX CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypothesis 2 - The General Factor Model !!
Mplus VERSION 5.2
```

```
MUTHEN & MUTHEN
04/12/2010 12:50 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_revised-Short-steep GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3, CPDOMA4, CPFIEL2,
CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB3, CTELAB4, CTELAB5,
CTFLEX1, CTFLEX2, CTFLEX3, CTFLUE2, CTFLUE3, CTFLUE4, CTORIG2, CTORIG3,
CTORIG4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL:
CTFLUE BY CTFLUE2@1 CTFLUE3 CTFLUE4; CTFLEX BY CTFLEX1@1 CTFLEX2
CTFLEX3; CTORIG BY CTORIG2@1 CTORIG3 CTORIG4; CTELAB BY CTELAB3@1
CTELAB4 CTELAB5; CPDOMA BY CPDOMA1@1 CPDOMA3 CPDOMA4; CPFIEL BY
CPFIEL2@1 CPFIEL3 CPFIEL4; CPPERS BY CPPERS1@1 CPPERS2 CPPERS4;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; CTSE
BY CTFLUE* CTFLEX CTORIG CTELAB; CPSE BY CPDOMA* CPFIEL CPPERS; CTSE@1;
CPSE@1; CTSE WITH CPSE@1;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
H3 & H4: Revised Long Flat
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 2:46 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_revised-Long-flat GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3, CPDOMA4, CPFIEL2,
CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB3, CTELAB4, CTELAB5,
CTFLEX1, CTFLEX2, CTFLEX3, CTFLUE2, CTFLUE3, CTFLUE4, CTORIG2, CTORIG3,
CTORIG4, BCSE1, BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE2@1 CTFLUE3*.296 CTFLUE4*1.487; CTFLEX BY
CTFLEX1@1 CTFLEX2*1.025 CTFLEX3*.784; CTORIG BY CTORIG2@1 CTORIG3*.993
CTORIG4*.992; CTELAB BY CTELAB3@1 CTELAB4*.751 CTELAB5*.639; CPDOMA BY
CPDOMA1@1 CPDOMA3*1.006 CPDOMA4*1.046; CPFIEL BY CPFIEL2@1 CPFIEL3*.054
CPFIEL4*1.082; CPPERS BY CPPERS1@1 CPPERS2*.992 CPPERS4*1.069;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; BCSE1
with BCSE3; BCSE3 WITH CPFIEL4; OPEN1 with BCSE1; OPEN1 with BCSE3;
OPEN2 with OPEN1; OPEN3 with OPEN2; OPEN4 with BCSE2; OPEN4 with BCSE3;
CTSE BY CTFLUE CTFLEX CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS; BCSE
BY BCSE1 BCSE2 BCSE3; OPEN BY Open1 Open2 Open3 Open4; CTSE WITH CPSE
BCSE; CPSE WITH BCSE; OPEN WITH CTSE CPSE BCSE;
```

```
OUTPUT: Standardized,Tech3,Tech4, ModIndices(All);
!! Hypotheses 3 and 4 - The Revised Model (with BCSE and Openness) !!
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 2:52 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_revised-Long-flat GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6
P1Open P1Cons P1Extr P1Agre P1Stab Open1, Open2, Open3, Open4, Sex Age
Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3, CPDOMA4, CPFIEL2, CPFIEL3,
CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB3, CTELAB4, CTELAB5, CTFLEX1,
CTFLEX2, CTFLEX3, CTFLUE2, CTFLUE3, CTFLUE4, CTORIG2, CTORIG3, CTORIG4,
CTFLUE1, CTFLEX4, CTORIG1, CTELAB2, CPDOMA2, CPFIEL1, CPPERS3, BCSE1,
BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE2@1 CTFLUE3*.296 CTFLUE4*1.487; CTFLEX BY
CTFLEX1@1 CTFLEX2*1.025 CTFLEX3*.784; CTORIG BY CTORIG2@1 CTORIG3*.993
CTORIG4*.992; CTELAB BY CTELAB3@1 CTELAB4*.751 CTELAB5*.639; CPDOMA BY
CPDOMA1@1 CPDOMA3*1.006 CPDOMA4*1.046; CPFIEL BY CPFIEL2@1 CPFIEL3*.054
CPFIEL4*1.082; CPPERS BY CPPERS1@1 CPPERS2*.992 CPPERS4*1.069; CTSE BY
CTFLUE CTFLEX CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS;
CTFLUE1 WITH CTFLEX4, CTORIG1, CTELAB2, CPDOMA2, CPFIEL1, CPPERS3,
CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3
CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2
CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2
Open3 Open4;
CTFLEX4 WITH CTORIG1, CTELAB2, CPDOMA2, CPFIEL1, CPPERS3, CTFLUE2
CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3 CTORIG4,
CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3
CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3
Open4;
CTORIG1 WITH CTELAB2, CPDOMA2, CPFIEL1, CPPERS3, CTFLUE2 CTFLUE3
CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3 CTORIG4, CTELAB3
CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4,
CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CTELAB2 WITH CPDOMA2, CPFIEL1, CPPERS3, CTFLUE2 CTFLUE3 CTFLUE4,
CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3 CTORIG4, CTELAB3 CTELAB4
CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1
CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPDOMA2 WITH CPFIEL1, CPPERS3, CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2
CTFLEX3, CTORIG2 CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1
CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1
BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPFIEL1 WITH CPPERS3, CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3,
CTORIG2 CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3
CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2
BCSE3 Open1 Open2 Open3 Open4;
CPPERS3 WITH CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2
CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4,
```

```
CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3
Open1 Open2 Open3 Open4; BCSE BY BCSE1 BCSE2 BCSE3; OPEN BY Open1 Open2
Open3 Open4; CTSE WITH CPSE BCSE; CPSE WITH BCSE; OPEN WITH CTSE CPSE
BCSE;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; BCSE1
with BCSE3; BCSE3 WITH CPFIEL4; OPEN1 with BCSE1; OPEN1 with BCSE3;
OPEN2 with OPEN1; OPEN3 with OPEN2; OPEN4 with BCSE2; OPEN4 with BCSE3;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypotheses 5 - The Revised Model (with Saturated Correlates) !!
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 3:12 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_revised-Long-flat GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3, CPDOMA4, CPFIEL2,
CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB3, CTELAB4, CTELAB5,
CTFLEX1, CTFLEX2, CTFLEX3, CTFLUE2, CTFLUE3, CTFLUE4, CTORIG2, CTORIG3,
CTORIG4, CTFLUE1, CTFLEX4, CTORIG1, CTELAB2, CPDOMA2, CPFIEL1, CPPERS3,
BCSE1, BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE2@1 CTFLUE3*.296 CTFLUE4*1.487; CTFLEX BY
CTFLEX1@1 CTFLEX2*1.025 CTFLEX3*.784; CTORIG BY CTORIG2@1 CTORIG3*.993
CTORIG4*.992; CTELAB BY CTELAB3@1 CTELAB4*.751 CTELAB5*.639; CPDOMA BY
CPDOMA1@1 CPDOMA3*1.006 CPDOMA4*1.046; CPFIEL BY CPFIEL2@1 CPFIEL3*.054
CPFIEL4*1.082; CPPERS BY CPPERS1@1 CPPERS2*.992 CPPERS4*1.069;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; BCSE1
with BCSE3; BCSE3 WITH CPFIEL4; OPEN1 with BCSE1; OPEN1 with BCSE3;
OPEN2 with OPEN1; OPEN3 with OPEN2; OPEN4 with BCSE2; OPEN4 with BCSE3;
CTSE BY CTFLUE CTFLEX CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS;
CTFLUE1 WITH CTFLEX4, CTORIG1, CTELAB2, CPDOMA2, CPFIEL1, CPPERS3
CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3
CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2
CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2
Open3 Open4;
CTFLEX4 WITH CTORIG1, CTELAB2, CPDOMA2, CPFIEL1, CPPERS3 CTFLUE2
CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3 CTORIG4,
CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3
CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3
Open4;
CTORIG1 WITH CTELAB2, CPDOMA2, CPFIEL1, CPPERS3 CTFLUE2 CTFLUE3
CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2 CTORIG3 CTORIG4, CTELAB3
CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4,
CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CTELAB2 WITH CPDOMA2, CPFIEL1, CPPERS3 CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1
CTFLEX2 CTFLEX3, CTORIG2 CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5,
CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2
CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
```

```
CPDOMA2 WITH CPFIEL1, CPPERS3 CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2
CTFLEX3, CTORIG2 CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1
CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1
BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPFIEL1 WITH CPPERS3 CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3,
CTORIG2 CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3
CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2
BCSE3 Open1 Open2 Open3 Open4;
CPPERS3 WITH CTFLUE2 CTFLUE3 CTFLUE4, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG2
CTORIG3 CTORIG4, CTELAB3 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4,
CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3
Open1 Open2 Open3 Open4; BCSE BY BCSE1 BCSE2 BCSE3; OPEN BY Open1 Open2
Open3 Open4; CTSE WITH CPSE BCSE; CPSE WITH BCSE; OPEN WITH CTSE CPSE
BCSE;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypothesis 5 - The All Model !!
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 2:48 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_all-Long-flat GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA2, CPDOMA3, CPDOMA4,
CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS3, CPPERS4,
CTELAB2, CTELAB3, CTELAB4, CTELAB5, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4,
CTFLUE1, CTFLUE2, CTFLUE3, CTFLUE4, CTORIG1, CTORIG2, CTORIG3, CTORIG4,
BCSE1, BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE1 CTFLUE2 CTFLUE3 CTFLUE4; CTFLEX BY CTFLEX1
CTFLEX2 CTFLEX3 CTFLEX4; CTORIG BY CTORIG1 CTORIG2 CTORIG3 CTORIG4;
CTELAB BY CTELAB2 CTELAB3 CTELAB4 CTELAB5; CPDOMA BY CPDOMA1 CPDOMA2
CPDOMA3 CPDOMA4; CPFIEL BY CPFIEL1 CPFIEL2 CPFIEL3 CPFIEL4; CPPERS BY
CPPERS1 CPPERS2 CPPERS3 CPPERS4; CTSE BY CTFLUE CTFLEX CTORIG CTELAB;
CPSE BY CPDOMA CPFIEL CPPERS; BCSE BY BCSE1 BCSE2 BCSE3; OPEN BY Open1
Open2 Open3 Open4; CTSE WITH CPSE BCSE; CPSE WITH BCSE; OPEN WITH CTSE
CPSE BCSE;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; BCSE1
with BCSE3; BCSE3 WITH CPFIEL4; OPEN1 with BCSE1; OPEN1 with BCSE3;
OPEN2 with OPEN1; OPEN3 with OPEN2; OPEN4 with BCSE2; OPEN4 with BCSE3;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypothesis 5 - The Held Model !!
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 3:02 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_held-Long-flat GENERATED BY COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
```

```
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA2, CPDOMA3, CPFIEL1,
CPFIEL2, CPFIEL3, CPPERS1, CPPERS2, CPPERS3, CTELAB2, CTELAB3, CTFLEX1,
CTFLEX2, CTFLEX3, CTFLUE1, CTFLUE2, CTFLUE3, CTORIG1, CTORIG2, CTORIG3,
CTFLUE4, CTFLEX4, CTORIG4, CTELAB4, CTELAB5, CPDOMA4, CPFIEL4, CPPERS4,
BCSE1, BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE1 CTFLUE2 CTFLUE3; CTFLEX BY CTFLEX1 CTFLEX2
CTFLEX3; CTORIG BY CTORIG1 CTORIG2 CTORIG3; CTELAB BY CTELAB2 CTELAB3;
CPDOMA BY CPDOMA1 CPDOMA2 CPDOMA3; CPFIEL BY CPFIEL1 CPFIEL2 CPFIEL3;
CPPERS BY CPPERS1 CPPERS2 CPPERS3; CTSE BY CTFLUE CTFLEX CTORIG CTELAB;
CPSE BY CPDOMA CPFIEL CPPERS;
CTFLUE4 WITH CTFLEX4, CTORIG4, CTELAB4, CTELAB5, CPDOMA4, CPFIEL4,
CPPERS4 CTFLUE1 CTFLUE2 CTFLUE3, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG1
CTORIG2 CTORIG3, CTELAB2 CTELAB3, CPDOMA1 CPDOMA2 CPDOMA3, CPFIEL1
CPFIEL2 CPFIEL3, CPPERS1 CPPERS2 CPPERS3 BCSE1 BCSE2 BCSE3 Open1 Open2
Open3 Open4;
CTFLEX4 WITH CTORIG4, CTELAB4, CTELAB5, CPDOMA4, CPFIEL4, CPPERS4
CTFLUE1 CTFLUE2 CTFLUE3, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG1 CTORIG2
CTORIG3, CTELAB2 CTELAB3, CPDOMA1 CPDOMA2 CPDOMA3, CPFIEL1 CPFIEL2
CPFIEL3, CPPERS1 CPPERS2 CPPERS3 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3
Open4;
CTORIG4 WITH CTELAB4, CTELAB5, CPDOMA4, CPFIEL4, CPPERS4 CTFLUE1
CTFLUE2 CTFLUE3, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG1 CTORIG2 CTORIG3,
CTELAB2 CTELAB3, CPDOMA1 CPDOMA2 CPDOMA3, CPFIEL1 CPFIEL2 CPFIEL3,
CPPERS1 CPPERS2 CPPERS3 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CTELAB4 WITH CTELAB5, CPDOMA4, CPFIEL4, CPPERS4 CTFLUE1 CTFLUE2
CTFLUE3, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG1 CTORIG2 CTORIG3, CTELAB2
CTELAB3, CPDOMA1 CPDOMA2 CPDOMA3, CPFIEL1 CPFIEL2 CPFIEL3, CPPERS1
CPPERS2 CPPERS3 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CTELAB5 WITH CPDOMA4, CPFIEL4, CPPERS4 CTFLUE1 CTFLUE2 CTFLUE3, CTFLEX1
CTFLEX2 CTFLEX3, CTORIG1 CTORIG2 CTORIG3, CTELAB2 CTELAB3, CPDOMA1
CPDOMA2 CPDOMA3, CPFIEL1 CPFIEL2 CPFIEL3, CPPERS1 CPPERS2 CPPERS3 BCSE1
BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPDOMA4 WITH CPFIEL4, CPPERS4 CTFLUE1 CTFLUE2 CTFLUE3, CTFLEX1 CTFLEX2
CTFLEX3, CTORIG1 CTORIG2 CTORIG3, CTELAB2 CTELAB3, CPDOMA1 CPDOMA2
CPDOMA3, CPFIEL1 CPFIEL2 CPFIEL3, CPPERS1 CPPERS2 CPPERS3 BCSE1 BCSE2
BCSE3 Open1 Open2 Open3 Open4;
CPFIEL4 WITH CPPERS4 CTFLUE1 CTFLUE2 CTFLUE3, CTFLEX1 CTFLEX2 CTFLEX3,
CTORIG1 CTORIG2 CTORIG3, CTELAB2 CTELAB3, CPDOMA1 CPDOMA2 CPDOMA3,
CPFIEL1 CPFIEL2 CPFIEL3, CPPERS1 CPPERS2 CPPERS3 BCSE1 BCSE2 BCSE3
Open1 Open2 Open3 Open4;
CPPERS4 WITH CTFLUE1 CTFLUE2 CTFLUE3, CTFLEX1 CTFLEX2 CTFLEX3, CTORIG1
CTORIG2 CTORIG3, CTELAB2 CTELAB3, CPDOMA1 CPDOMA2 CPDOMA3, CPFIEL1
CPFIEL2 CPFIEL3, CPPERS1 CPPERS2 CPPERS3 BCSE1 BCSE2 BCSE3 Open1 Open2
Open3 Open4; BCSE BY BCSE1 BCSE2 BCSE3; OPEN BY Open1 Open2 Open3
Open4; CTSE WITH CPSE BCSE; CPSE WITH BCSE; OPEN WITH CTSE CPSE BCSE;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypothesis 5 - The Implied Structure Model !!
```

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 3:07 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_implied_7_factors-Long-flat GENERATED BY
COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3, CPDOMA4, CPFIEL2,
CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB2, CTELAB4, CTELAB5,
CTFLUE1, CTFLUE2, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTORIG1, CTORIG3,
CTORIG4, CTFLUE3, CTFLUE4, CTORIG2, CTELAB3, CPDOMA2, CPFIEL1, CPPERS3,
BCSE1, BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE1 CTFLUE2 CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4;
CTORIG BY CTORIG1 CTORIG3 CTORIG4; CTELAB BY CTELAB2 CTELAB4 CTELAB5;
CPDOMA BY CPDOMA1 CPDOMA3 CPDOMA4; CPFIEL BY CPFIEL2 CPFIEL3 CPFIEL4;
CPPERS BY CPPERS1 CPPERS2 CPPERS4;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; BCSE1
with BCSE3; BCSE3 WITH CPFIEL4; OPEN1 with BCSE1; OPEN1 with BCSE3;
OPEN2 with OPEN1; OPEN3 with OPEN2; OPEN4 with BCSE2; OPEN4 with BCSE3;
CTSE BY CTFLUE CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS;
CTFLUE3 WITH CTFLUE4, CTORIG2, CTELAB3, CPDOMA2, CPFIEL1, CPPERS3
CTFLUE1 CTFLUE2 CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1 CTORIG3
CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2
CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2
Open3 Open4;
CTFLUE4 WITH CTORIG2, CTELAB3, CPDOMA2, CPFIEL1, CPPERS3 CTFLUE1
CTFLUE2 CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1 CTORIG3 CTORIG4,
CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3
CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3
Open4;
CTORIG2 WITH CTELAB3, CPDOMA2, CPFIEL1, CPPERS3 CTFLUE1 CTFLUE2 CTFLEX1
CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4
CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1
CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CTELAB3 WITH CPDOMA2, CPFIEL1, CPPERS3 CTFLUE1 CTFLUE2 CTFLEX1 CTFLEX2
CTFLEX3 CTFLEX4, CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5,
CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2
CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPDOMA2 WITH CPFIEL1, CPPERS3 CTFLUE1 CTFLUE2 CTFLEX1 CTFLEX2 CTFLEX3
CTFLEX4, CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1
CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1
BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPFIEL1 WITH CPPERS3 CTFLUE1 CTFLUE2 CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4,
CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3
CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2
BCSE3 Open1 Open2 Open3 Open4;
```

```
CPPERS3 WITH CTFLUE1 CTFLUE2 CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1
CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4,
CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3
Open1 Open2 Open3 Open4; BCSE BY BCSE1 BCSE2 BCSE3; OPEN BY Open1 Open2
Open3 Open4; CTSE WITH CPSE BCSE; CPSE WITH BCSE; OPEN WITH CTSE CPSE
BCSE;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
!! Hypothesis 6 - The Implied Indicators Model !!
Mplus VERSION 5.2
MUTHEN & MUTHEN
04/09/2010 3:10 PM
INPUT INSTRUCTIONS
TITLE: CommandCode_implied_8_factors-Long-flat GENERATED BY
COMMANDMPLUS.PL;
DATA: FILE IS "C:\Users\Dan\Desktop\Sync\CohortsTwo.dat";
VARIABLE: NAMES ARE Cohort GroupName TimeStamp CTFLUE1, CTFLUE2,
CTFLUE3, CTFLUE4, CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTELAB1, CTELAB2,
CTELAB3, CTELAB4, CTELAB5, CTORIG1, CTORIG2, CTORIG3, CTORIG4, CPDOMA1,
CPDOMA2, CPDOMA3, CPDOMA4, CPFIEL1, CPFIEL2, CPFIEL3, CPFIEL4, CPPERS1,
CPPERS2, CPPERS3, CPPERS4, BCSE1, BCSE2, BCSE3, BCSE4, BCSE5, BCSE6,
P1Open, P1Cons, P1Extr, P1Agre, P1Stab Open1, Open2, Open3, Open4, Sex
Age Email ; USEVARIABLES ARE CPDOMA1, CPDOMA3, CPDOMA4, CPFIEL2,
CPFIEL3, CPFIEL4, CPPERS1, CPPERS2, CPPERS4, CTELAB2, CTELAB4, CTELAB5,
CTFLEX1, CTFLEX2, CTFLEX3, CTFLEX4, CTFLUE1, CTFLUE2, CTORIG1, CTORIG3,
CTORIG4, CTFLUE3, CTFLUE4, CTORIG2, CTELAB3, CPDOMA2, CPFIEL1, CPPERS3,
BCSE1, BCSE2, BCSE3, Open1, Open2, Open3, Open4, ; MISSING = .;
ANALYSIS: ESTIMATOR = MLR;
MODEL: CTFLUE BY CTFLUE1 CTFLUE2; CTFLEX BY CTFLEX1 CTFLEX2 CTFLEX3
CTFLEX4; CTORIG BY CTORIG1 CTORIG3 CTORIG4; CTELAB BY CTELAB2 CTELAB4
CTELAB5; CPDOMA BY CPDOMA1 CPDOMA3 CPDOMA4; CPFIEL BY CPFIEL2 CPFIEL3
CPFIEL4; CPPERS BY CPPERS1 CPPERS2 CPPERS4; CTSE BY CTFLUE CTFLEX
CTORIG CTELAB; CPSE BY CPDOMA CPFIEL CPPERS;
CTELAB4 WITH CTELAB5; CPDOMA1 WITH CPDOMA4; CPPERS2 WITH CPFIEL2; BCSE1
with BCSE3; BCSE3 WITH CPFIEL4; OPEN1 with BCSE1; OPEN1 with BCSE3;
OPEN2 with OPEN1; OPEN3 with OPEN2; OPEN4 with BCSE2; OPEN4 with BCSE3;
CTFLUE3 WITH CTFLUE4, CTORIG2, CTELAB3, CPDOMA2, CPFIEL1, CPPERS3
CTFLUE1 CTFLUE2, CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1 CTORIG3
CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2
CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2
Open3 Open4;
CTFLUE4 WITH CTORIG2, CTELAB3, CPDOMA2, CPFIEL1, CPPERS3 CTFLUE1
CTFLUE2, CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1 CTORIG3 CTORIG4,
CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3
CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3
Open4;
CTORIG2 WITH CTELAB3, CPDOMA2, CPFIEL1, CPPERS3 CTFLUE1 CTFLUE2,
CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1 CTORIG3 CTORIG4, CTELAB2
CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4,
CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CTELAB3 WITH CPDOMA2, CPFIEL1, CPPERS3 CTFLUE1 CTFLUE2, CTFLEX1 CTFLEX2
CTFLEX3 CTFLEX4, CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5,
CPDOMA1 CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2
CPPERS4 BCSE1 BCSE2 BCSE3 Open1 Open2 Open3 Open4;
```

```
CPDOMA2 WITH CPFIEL1, CPPERS3 CTFLUE1 CTFLUE2, CTFLEX1 CTFLEX2 CTFLEX3
CTFLEX4, CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1
CPDOMA3 CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1
BCSE2 BCSE3 Open1 Open2 Open3 Open4;
CPFIEL1 WITH CPPERS3 CTFLUE1 CTFLUE2, CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4,
CTORIG1 CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3
CPDOMA4, CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2
BCSE3 Open1 Open2 Open3 Open4;
CPPERS3 WITH CTFLUE1 CTFLUE2, CTFLEX1 CTFLEX2 CTFLEX3 CTFLEX4, CTORIG1
CTORIG3 CTORIG4, CTELAB2 CTELAB4 CTELAB5, CPDOMA1 CPDOMA3 CPDOMA4,
CPFIEL2 CPFIEL3 CPFIEL4, CPPERS1 CPPERS2 CPPERS4 BCSE1 BCSE2 BCSE3
Open1 Open2 Open3 Open4; BCSE BY BCSE1 BCSE2 BCSE3; OPEN BY Open1 Open2
Open3 Open4; CTSE WITH CPSE BCSE; CPSE WITH BCSE; OPEN WITH CTSE CPSE
BCSE;
OUTPUT: Standardized,Tech3,Tech4, ModIndices;
```

APPENDIX K. IRB DOCUMENT

University of Nebraska-Lincoln
Institutional Review Board (IRB)
312 N. 14th St., 209 Alex West
Lincoln, NE 68588-0408(402) 472-6965
Fax (402) 472-6048
irb@unl.edu
FOR OFFICE USE ONLY
IRB #:
IRB Decision Date:
Date Received: 09/17/2009
Code #:
IRB Project ID: 10096
Form ID: 10096
Status: Submitted to Expedited IRB Reviewer(s)
IRB New Protocol Submission
Project Title: Constructing a Creative Self-Efficacy Inventory: A Quantitative and Qualitative Inquiry
Investigator Information:
Principal
Investigator:
Daniel Abbott Secondary
Investigator:
Roger Bruning
Department: Department of Educational
Psychology
Department: Department of Educational
Psychology
Contact Phone: Contact Phone: (402)472-2225
Contact Address: Contact Address: 209C TEAC UNL
68588-0384
Email Address: Email Address: rbruning@unlserve.unl.edu
* Student theses or dissertations must be submitted with a faculty member listed as Secondary
Investigator or Project Supervisor
Principal Investigator Is: Graduate Student
Type of Project: Research
Does the research involve an outside institution/agency other than UNL? No
If yes, please list the institutions/agencies:
Where will participation take place? (e.g., UNL, at home, in a community building, etc)
* Note: Research can only begin at each institution after the IRB receives the institutional approval letter
Page 1
Generated On 09/29/2009
Project Information:
Present/Proposed Funding Source: Minimial Costs are Self-Funded
Project Start Date: 10/15/2009
Project End Date: 12/17/2009
1. Does the research involve prisoners?
No
2. Will the research only be conducted in schools or educational settings?
No
Does the research study involve only normal education practices (such as research on regular and special education instructional strategies, or research on effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.)?
N/A (or no answer)
3. Does the research involve only the use of educational tests, survey procedures, interview procedures, or observation of public behavior? (The use of pre-existing data does not fall into this category.)
Yes
Does the research involve children (under 19 years of age)?
No

Does the research only involve the observation of public behavior where the investigator does not intervene or interact in the activities being observed?
N/A (or no answer)
Is the information recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects?
Yes
Could any disclosure of the human subjects' responses outside the research reasonably place the subjects at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation?
No
Are the subjects elected or appointed public officials (e.g. senior officials, such as mayor or school superintendent, rather than a police officer or teacher)
N/A (or no answer)
Page 2
Generated On 09/29/2009
Does any Federal statute require without exception that the confidentiality of personally identifiable information will be maintained throughout the research and thereafter?
N/A (or no answer)
4. Does the research involve only the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens?
No
Are these sources publicly available?
N/A (or no answer)
Will the information be recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects?
N/A (or no answer)
5. Does the research involve only studying, evaluating or examining public benefit or service programs?
No
Is the research or demonstration project conducted or approved by the Department or Agency Head?
N/A (or no answer)
Does the research or demonstration project involve only the study, evaluation, or examination of:
Public benefit or service programs:
N/A (or no answer)
Procedures for obtaining benefits or services under public benefit or service programs:
N/A (or no answer)
Possible changes in or alternatives to public benefit or service programs or to procedures for obtaining benefits or services under public benefit or service programs:
N/A (or no answer)
Possible changes in methods or levels of payment for benefits or services under those public benefit or service programs:
N/A (or no answer)
Does the research or demonstration project involve only the study, evaluation, or examination of the
Page 3
Generated On 09/29/2009
previous 4 categories?
N/A (or no answer)
6. Does the research involve only a taste and food quality evaluation or food consumer acceptance study?
No
Are wholesome foods without additives consumed?
N/A (or no answer)
Is food consumed that contains a food ingredient, agricultural chemical, or environmental containment at or below the level found to be safe by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture?
N/A (or no answer)
7. Does the research present more than minimal risk to human subjects?
N/A (or no answer)
For each category, please mark if it is a part of the project:

1) Clinical studies of drugs and/or medical devices?
N/A (or no answer)
2) Collection of blood samples by finger stick, heel stick, ear stick, or venipuncture?
N/A (or no answer)
3) Prospective collection of biological specimens for research purposes by noninvasive means?
N/A (or no answer)
4) Collection of data through noninvasive procedures routinely employed in clinical practice, excluding procedures involving x-rays or microwaves?
N/A (or no answer)
5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for non-research purposes (such as medical treatment or diagnosis)?
N/A (or no answer)
Page 4
Generated On 09/29/2009
6) Collection of data from voice, video, digital, or image recordings made for research purposes?
N/A (or no answer)
7) Research on individual or group characteristics or behavior (including but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior)?
N/A (or no answer)
8) Research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies?
N/A (or no answer)
Does the research involve only procedures included in the previous 8 categories?
N/A (or no answer)
Could identification of subjects put them at risk of criminal or civil liability, or be socially or economically damaging?
N/A (or no answer)
8. Does the research involve clinical studies of drugs and medical devices?
N/A (or no answer)
Is FDA required?
N/A (or no answer)
9. Does the research involve collection of blood samples by finger stick, heel stick, ear stick, or venipuncture?
N/A (or no answer)
from healthy, nonpregnant adults who weight at least 110 pounds? (amounts drawn may not exceed 550 ml in an 8 week period and collection may not occur more frequently than 2 times per week)
N/A (or no answer)
from other adults and children considering the age, weight, and health of the subjects, the collection procedure, the amount of blood to be collected, and the frequency with which it will be collected. For these subjects, the amount drawn may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week period and collection may not occur more frequently than 2 times per week.
N/A (or no answer)
Page 5
Generated On 09/29/2009
Description of Subjects:
Total number of participants (include 'controls'): 200
Will participants of both sexes/genders be recruited? Yes
Will participation be limited to certain racial or ethnic groups? No
What are the participants' characteristics?
The sample frame consists of all students who are taking cognition, learning, or development (CLD) coursework in Educational Psychology in the Fall 2009 semester. All available students from the appropriate classrooms will be polled, though in keeping with ethical guidelines, all students will be treated with respect, and will participate only if they grant and continue to grant informed consent throughout the quantitative phase.
Type of Participant: (check all appropriate blanks for participant population)
Adults, Non Students Pregnant Women Persons with Psychological Impairment
X

UNL Students Fetuses Persons with Neurological
Impairment
Minors (under age 19) Persons with Limited Civil
Freedom
Persons with Mental
Retardation
Adults with Legal
Representatives
Persons with HIV/AIDS
Other (Explain):

Unique Research Methodology or Data Sources

Will your project involve audio taping? No
Is this project web-based research? Yes
For web-based studies, how will the data be handled? Will the data be sent to a secure server? Will the data be encrypted while in transit? Will you be collecting IP addresses?
This research occurs in two phases.
The quantitative phase of this research follows the pattern of "Creativity and Blogging," (Project ID: 8197, IRB Approval #: 2007118197) and "Factor Analysis of Self-Reported Measures of Creativity" (Project ID: 9701, IRB Approval #: 2009039701)and will use similar web-based data collection procedures. The "Form" option from "Google Docs & Spreadsheets" will be used to handle the secure transmission, storage, and retrieval of participant
responses.
No IP addresses will be connected. Data will be collected on a secure server, using the "https" protocol.

The qualitative phase of this research follows the pattern of "Case Study of Creative Bloggers," (Project ID: 9714, IRB Approval #: 2009039714). It will be conducted through internet instant messaging clients in the form of interviews.
Is this study utilizing Protected Health Information (PHI; e.g., information obtained from a hospital, clinic, or treatment facility)? No
Does this project involve genetic data/sampling/analysis, illegal drug use, or criminal activity that places the participant at risk for legal action? No
Does this project involve photography? No
Does this project involve videotaping? No
Does this project involve archival or secondary data analysis? No
Does this project involve biological samples? No

Project Personnel List:

Please list the names of all personnel working on this project, starting with the principal investigator and the secondary investigator/project advisor. Research assistants, students, data entry staff and other research project staff should also be included. For a complete explanation of training and project staff please go to http://www.unl.edu/research/orr/index.shtml.

Name Role UNL Status Is Involved In
Design/Supervision
Is Involved In Data
Collection
Daniel Abbott PI Graduate Student Yes Yes
Roger Bruning Second PI / Project
Advisor
Faculty Yes No

Project Description

1. Describe the research purpose of the project.
What is the purpose of the study? (Please provide a brief 1-2 paragraph explanation in lay terms, to include a brief literature justification.)
This study address creative self-efficacy. An explanatory mixed-methods design is used that first collects and analyzes quantitative data, and expands on that data in a qualitative phase. First, in the quantitative phase, self-report measures from undergraduate students at a large midwestern research university (UNL) are collected, including their responses to various creative self-efficacy instruments. The purpose of this phase is to further develop a new, multidimensional instrument for measuring creative

self-efficacies. Second, in the qualitative phase, participants who vary in creative self-efficacy are

selected for interviews. In this qualitative follow-up to the quantitative phase, the phenomenon of creative self-efficacy is explored with a subset of the original participants. The reason for this follow-up is to identify areas for improvement in the new creative self-efficacy inventory.

2. Description of the Methods and Procedures.

Describe the data collection procedures and what participants will have to do.

This study occurs in two phases.

In the quantitative phase, data will be collected online through Google docs (Google, 2009), using the form included in the appendix. In Google Docs, data entered into the form is automatically stored in a spreadsheet, which can be downloaded into Microsoft Excel, plain text, or other formats for data analysis. While internet-based surveys mean that the quality of an individual student's computer may vary, it is unrealistic to expect that all students in a classroom environment are equally ready to participate in research. Further, classroom-based surveying introduce a group-level bias of classroom environment. While residual effects of classroom environment may well still appear, they are unlikely to be as large when the survey is conducted asynchronously anywhere the student has an internet connection than if conducted at the same time in the same classroom.

In the qualitative phase, Interview transcripts will be automatically recorded by an internet instant messaging application that will be used to conduct the interviews. This means of conducting and recording the interviews is chosen to maximize the amount of useful data collected during the interview, shield participant privacy, and encourage increased participation. Internet instant messaging programs are conducted in text, which makes the transcription completely reliable and also provide information on the timing of specific comments. Additionally, Internet instant messaging applications provide increased privacy for participants. Participants do not have to worry about involuntary or potentially embarrassing postures, positions, and body language, as in face-to-face interviews. Further, Internet instant messaging makes research participation more accessible. While university research can be biased in favor of undergraduates under 23 years of age who live on campus, interviews conducted by distance allow physically challenged, older, professional, and nontraditional students to easily participate. Internet instant messaging has already been used with an expanded version of this study's research protocol in a qualitative study of the creative self-efficacy of bloggers.

How long will this take participants to complete?

The approximately 250 participants of the qualitative phase will complete an online survey that will take approximate 20-30 minutes to complete.

The approximately 12 participants of the qualitative phase will be interviewed using a protocol that will take approximately 30-45 minutes to complete.

Will follow-ups or reminders be sent?

Yes

If so, explain.

The sample of the qualitative phase will be drawn from the quantitative phase. Creswell and Plano Clark (2007) recommend purposeful sampling, or sampling whereby participants are selected because of a special experience with the phenomenon of interest being explored (p. 112). Many forms of purposeful

sampling exist in qualitative research, including confirming or disconfirming sampling,critical sampling, extreme case sampling, homogeneous sampling, opportunistic sampling, snowball sampling, theory or concept sampling, and typical sampling (Creswell, 2008). A form of extreme case sampling will be used, where individuals who are high or low in CTSE and CPSE are asked to participate. This will enable post-hoc analysis of students who excel or fall behind in CTSE and CPSE, which will in turn lead to greater understanding of how the instrument may be improved in the future.

Participant Selection. Creswell and Plano Clark address the issue of whether participants in the qualitative phase should be selected from participants in the quantitative phase. Though the authors note that there is no universal agreement on this problem, they warn that sampling “different individuals will introduce personal characteristics that might confound the comparison” (p. 119). Further, Creswell and Plano Clark cite two examples of explanatory designs that used a subset of the quantitative participants for qualitative participants (Way, Stauber, Nakkula, & London, 1994; Baumann, 1999). Therefore, following both the authors recommendations and cited examples, participants for the qualitative section will be chosen from the quantitative section.

3. Description of Recruiting Procedures

How will the names and contact information for participants be obtained?
Access to the sample frame is controlled by professors at the department where the research will be conducted. Therefore, these professors must be individually approached and, if permission is given, a time to conduct research that it is convenient for the professors must be agreed upon As the quantitative portion of this research will be conducted online using the form in the appendix, little classtime will be spent on research-related matters. However, a method for tracking students who choose to participate either in research or in an alternative class activity must be agreed upon, that meets both the desire of the professors to expose students to the methods of psychology while at the same time guaranteeing the students' right to anonymity and freedom to withdraw.
How will participants be approached about participating in the study?
In the quantitative phase, participants will be approached both in class and through class email to inform them of the ability to participate in a research project. In many cases, this will also involve an offer of extra credit for students who participate. This will be done through the instructor script in the appendix, as well as the email script that appears in the appendix. Upon clicking the appropriate link, students in classes for which there is extra credit will submit their names, and choose to conduct either the research or an alternative activity. This choice will be anonymous and no student will be compelled to participate in the research.
In the qualitative phase, participants will first be selected for inclusion in the qualitative survey if they meet three criteria: they fit into either a high or low CPSE or CTSE group, they have included their email address and/or phone number in the quantitative survey form, and they indicated willingness to participate in a follow-on qualitative survey. If so, participates will be emailed using the script in the appendix, or called using the script in the appendix. If the participant agrees, a mutually convenient time will be scheduled for a follow-up interview. If not, the participant will be thanked and another participant will be contacted instead.
4. Description of Benefits and Risks
Explain the benefits to participants or to others.
Some participants will receive in-class extra credit, for either participating or for engaging in an

alternative activity.
Broadly put, this study has two different audiences. The first and more traditional audience are academics. Creativity has been studied for sixty years, and this is the twenty-fifth anniversary of Locke, Frederick, Lee, and Bobko's (1984) study of creative self-efficacy. A more comprehensive instrument that is better at capturing creative self-efficacy continues the intellectual tradition of this area, and will help other researchers devise more sophisticated studies in the future. However, as educational psychologists, we are also concerned about the teachers and students we help train. Technology, the Internet, and Guilford's thinking machines are rapidly changing an educational system that is already under pressure from budget cuts and No Child Left Behind. Teachers and students without creative self-efficacy, who do not think or perform creatively, will be left behind in their careers and their intellectual lives. Our intellectual study of creative self-efficacy does not exist solely for its own sake, but also so that its findings may be reproduced and applied in real classrooms in our schools, colleges, and universities.
Explain the risks to participants. What will be done to minimize the risks? If there are no known risks, this should be stated.
There are no known risks
5. Description of Compensation
Will compensation (including money, gift certificates, extra credit, etc.) be provided to participants?
Yes
If Yes, please describe the amount and type of compensation.
Participants will be approached both in class and through class email to inform them of the ability to participate in a research project. In many cases, this will also involve an offer of extra credit for students who participate.
6. Informed Consent Process
In certain cases for children over the age of 14, such as UNL students who are 17 or 18, waivers of informed consent can be granted.
Would you like to request a waiver of consent?
No
How will informed consent/assent be obtained?
Informed consent for the quantitative portion of project will involve first presenting the participant with an

"Informed Consent" document, which explains the research and provides the participant with the opportunity to participate or else engage in an alternate activity. The quantitative phase of the study cannot be accessed without affirmatively granting informed consent.
Informed consent for the qualitative phase of the project will involve providing the participant with an informed consent document before the beginning of the interview. The interview will proceed only if the participant understands the form and affirmatively grants informed consent.
7. Description of How Confidentiality will be Maintained
Page 10
Generated On 09/29/2009
How will confidentiality of records be maintained?
Records will be kept in the locked office of the principle investigator.
Will individuals be identified?
Yes
Will the participants be identifiable during data collection? How long will individuals be identifiable? At what point will the identities be removed (if ever)?
Participants in the quantitative may, if they choose, submit an email address or phone number to be considered for inclusion in the second, qualitative phase of the study. Once the qualitative phase is complete, this personally identifiable information will be removed and replaced with an arbitrary ID number.
If the data is coded, will there be a list linking names and codes? If so, how long will this list be kept and where?
Pseudonyms will be used during coding.
How long will records be kept?
3 years
Where will records be stored?
In the locked office of the primary investigator
Who has access to the records/data?
The primary and co-primary researchers.
How will data be reported?
Anonymously, without information that would uniquely identify the participant.
8. Copies of Questionnaires, Survey, or Testing Instruments
Please list all questionnaires, surveys, and/or assessment instruments/measures used in the project.
The attached document includes the following sections of the dissertation proposal that this research is part of.

9. Uploaded Attachments
EDPS Dissertation IRB Forms.pdf - 317250 Bytes - application/pdf
Page 11
Generated On 09/29/2009
Comments:
PI Comments
URC Comments
ORR Comments
Page 12
Generated On 09/29/2009

APPENDIX L. THE CODING PROCESS

Note: These two pages contain the codes that emerged from the interviews, organized by group. In the second page, common themes are extracted.