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Stephen J. Worst
Western Michigan University

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VYGOTSKY'S THEORY OF THE CREATIVE IMAGINATION: A STUDY OF THE INFLUENCES ON PRESERVICE TEACHERS' CREATIVE THINKING CAPACITIES

by

Stephen J. Worst

A Dissertation
Submitted to the
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Dr. Andrea Beach, Advisor

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This study investigated the effect of formal instruction in the use of creative thinking skills on preservice teachers’ capacities for increased creative activity. It emerged from Vygotsky’s theory of the creative imagination. Emphasizing the impact of formal schooling on the growth of creative activity, he implied that individuals who are continually adding to accumulation of knowledge develop an abundant imagination from which creativity flows.

This quantitative study used a quasi-experimental design and attempted to test Vygotsky’s assumptions within a sample population of 113 preservice teachers. Torrance Tests of Creative Thinking served as the pre- and post-tests that measured the creative capacities of the participants who were assigned to one of three sample groups. Group 1 (n₁ = 30) received three one-hour sessions of training in the use of creative thinking skills; Group 2 (n₂ = 42) received three one-hour sessions of training in general thinking strategies; and Group 3 (n₃ = 41) served as the control. Pre- and post-study questionnaires were used to measure participants’ attitudes toward creative activity.
The study showed Group 1 to have a 12.45 point spread between pre- and post tests, while Groups 2 and 3 had 1.32 and 1.29 point spreads on the creativity index scale developed for the Torrance tests. The results showed that Group 1 had a significant difference among the three groups when the raw score differences between pre- and post-test raw scores were compared to the national percentiles established from the norming sample.

The study’s results provided strong support for Vygotsky’s claim that formal instruction increases learners’ creative capabilities. Through specific instruction, preservice teachers increased their ability to engage in creative activity. Their attitudes toward creativity-related experiences and their own preparedness to teach students about creative thinking were affected by their participation in the study. They viewed the creative process as being more complex than they did initially. The study’s results confirmed the need for replication in similar contexts and over longer periods of time.
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My heartfelt gratitude for making this project so very rich goes to many individuals. I must first thank the Creator of the Cosmos whose creative power is beyond my understanding and whose universe spills over with amazing gifts, all of which have been generously entrusted to me and the entire human family. Soli Deo gloria!

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Stephen J. Worst
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CHAPTER I

INTRODUCTION

[Creative activity] arises not at once, but very slowly and gradually, developing from more elementary and simple forms to more complex forms at each age level of childhood...Moreover, it does not appear by itself in the behavior of the child, but emerges in direct dependence on other forms of activity and in part from the accumulation of experience...in everyone around us, creativity is a necessary force of existence...creativity [is] the rule...rather than the exception. (Vygotsky, 1930/1967, p. 88)

Lev S. Vygotsky, the Russian psychologist whose body of work was largely written during the 1930s, challenged popular notions about creativity by asserting that creativity was a developmental process. "Up until this time there has been an opinion that the child has more imagination than the adult," he declared, after which he proceeded to put forth a proposition fundamentally contrary to conventional opinion (Vygotsky, 1930/1967, p. 91). What Vygotsky was advancing in his theory of creativity and imagination was that creativity existed in all individuals and was a cognitive process that developed along with other cognitive processes over the human life-span (Smolucha, 1992).

Vygotsky's notion of creativity focused on the use of cognitive tools of the imagination (Gajdamaschko, 1999). Gajdamaschko, a Vygotskian psychologist, is among those scholars who has explained Vygotsky's ideas regarding the development of the imagination but assumed, as other creativity researchers typically have, that Vygotsky's definition of creativity was consistent with the early 20th Century understanding of
creativity (Lowenfeld & Brittain, 1970). That common definition included fluency of thought, novelty of ideas, elaboration of basic concepts, and flexibility of object and idea function (Guilford, 1967). Although E. Paul Torrance, whose work is discussed in the second chapter, regarded creativity as a cognitive process that involved the same qualities, both of these men (whose concepts are central to this study) were interested in aspects of creativity other than its definition. Vygotsky was intrigued with the development of the imagination from which creativity emerged (Vygotsky, 1930/1967). Torrance was interested throughout his entire career in the measurement of creativity (Torrance, 1966). Their respective ideas of what constituted creative activity were, however, consistent with the common definition of the early to mid-1900s. This understanding of creativity materialized from the new study of psychology that began in the late 1800s (Smolucha, 1984; Torrance, 1966).

In addition to being a cognitive process, Vygotsky theorized that the growth of creativity was shaped primarily by the amount and variety of a person’s knowledge and life experiences (Vygotsky, 1930/1967). He stated that because adults often see the fascinating creations of a child’s imagination as being much more interesting than those of most adults, the conclusion often follows that children have a greater capacity than adults have to engage in producing these amazingly fantastic concepts. Vygotsky, a theorist who appreciated scientific examination, claimed that this conclusion was not supported by science research. What is known, he maintained, is that children’s experiences are less rich than those of adults; it is known that children’s interests are “simple, more elementary, poorer in quality” (Vygotsky, 1930/1967, pp. 91-92). But
more importantly, it was known that a child’s relation to the world does not possess the “complexity and diversity that distinguishes that of the adult and that are important in the work of the imagination” (Vgotsky 1930/1967, p. 91). Vygotsky concluded that this was a clear demonstration of how the imaginations of children were not richer, but poorer than adults’ imaginations. “In the process of child development, the imagination also develops, reaching its maturity only in the adult” (Vygotsky, 1930/1967, p. 92). Even though individuals might consider creative activity to be most recognizable in adults like Tolstoy, Edison, and Darwin, every adult has the capacity to be creative and to increase that capacity for creative activity (Smolucha, 1992).

One of the major concepts in Vygotsky’s work on creativity is his view about the emergent nature of creativity. It is developing throughout the human life-span and is not mature until adulthood (Vygotsky, 1930/1967). Creativity is not an event that occurs at a certain time on a specific day. Creativity evolves. It is for this reason that creativity is addressed in this study from the perspective of its potential for growth within individuals. As a result, the term capacity is used in this study; capacity refers to the potential amount of growth that creativity can achieve within an individual.

Csikszentmihalyi presents this emergent nature of creativity as a theoretical shift. He explains it this way: rather than asking the classical question “What is creativity?” the more important question is “Where is creativity?” (1990, p. 200). Vygotsky was curious about where creativity was at a given developmental point. His question of interest was: from where did that individual’s creative activity come and what was the extent of his or her potential for creative development (Vygotsky, 1930/1967)?
Both Vygotsky (whose theory was being tested in this study) and Torrance (whose tests were used to measure the degree of creative potential of the participants in this study) regarded creativity as a developmental process. Both were committed to the notion that the potentiality of creative ability existed in all people. Torrance believed, however, that there was a difference between lowercase “c” and uppercase “C” when distinguishing between the creative potential in all individuals and that special manifestation of creative strength in certain gifted individuals (Cramond, 1993). Both Vygotsky and Torrance operated from a definition of creativity that consisted of the same qualities, all of which could be measured—fluency of ideas, originality, elaboration, and flexibility (Vygotsky, 1930/1967; Torrance, 1966). Torrance added two more qualities as he developed his tests—resistance to premature closure and the descriptive quality of titles.

Vygotsky’s interest in the developmental nature of creativity was, in addition to being innovative for his time and within his culture, an impetus for scholars in the late 1900s to view creativity through new lenses (Slavin, 2000). Unlike the conventional view that regarded creativity as an innate quality which some individuals possessed and others did not (Renzulli & Delcourt, 1986; Simonton, 2000), Vygotsky’s notion held a hopeful possibility for all people. Even though he claimed that creativity was a developmental process existent in all individuals, he cautioned that its expression was dependent on the richness of one’s imagination. The likelihood, however, that this quality could be fostered in all individuals through learning was a real prospect. Vygotsky boldly suggested a new framework from which to consider creativity. He, along with other contemporaries, set
the stage for what now constituted a generally-accepted assumption that learning to think and act in more imaginative and creative ways was quite possible (Capossela, 2000; Vygotsky, 1930/1967).

Statement of the Problem

While a considerable amount of research shows that intelligence is improved by learning to think in more creative ways, there is no clear evidence that being taught to think creatively improves individuals’ capacities to be creative, as suggested by Vygotsky’s theory of creativity (Getzels & Jackson, 1959, 1962; Torrance, 1959; Wallach & Kogan, 1965). Being creative depended on three strong influences impacting the human mind, according to Vygotsky. One was the importance of accumulating rich life experiences; the second was the increasing ability of the human mind to utilize more sophisticated mental processes that resulted in the ability to reason and to think logically; and the third was the role of formal schooling in the growth of each of these influences.

These influences worked concurrently with both the development of the mind and the growth of the imagination. As children and adolescents proceeded through their years in which school learning was the key source of accumulating new knowledge and experiences, they became increasingly proficient in “thinking in concepts” (Vygotsky, 1930/1978). Creative activity was the result of this mental process, Vygotsky believed. This process was one in which the imagination “collaborated” with the formation of conceptual thought at each developmental phase (Smolucha, 1992).

This parallel development of the intellect and the imagination was a major construct in Vygotsky’s understanding of the growth of the human mind. The
imagination was expanded and nourished by the developing mind; the imagination served as the basis for all creative activity (Ayman-Nolley, 1992). Vygotsky considered formal schooling (his term for structured education) to be especially influential in the accumulation of knowledge and experiences that expanded an ever-growing mind. Again, he singles out the growth periods of middle and late childhood and early adolescence as being especially influenced by formal schooling (Smolucha, 1992).

The major points of interest in this study rest upon these ideas of Vygotsky: the role of formal instruction in learning to think creatively; the learner’s accumulation of knowledge and experiences that make for a richer and more abundant imagination; and the development of higher-level mental processes as creative activity becomes more complex throughout the process of maturation (Vygotsky, 1930/1967). Formal schooling, at the point of early to late-childhood within the human life-span, is one of the key agents for enriching this accumulation of knowledge and life experiences. Consequently, according to Vygotsky, the learner’s capacity for creative activity is greatly increased during the period when formal schooling is the center of most individuals’ lives (1933/1978). In addition, as children grow, their imaginations develop. This development is closely connected to the increased ability of the maturing individual to reason and to think at more sophisticated levels.

For Vygotsky, formal schooling had a long history, including the structured education in his Russian upbringing, of being intricately tied to teachers’ skills and training. A teacher’s preparedness for and attitude toward advancing the growth of students’ creative capacities were critical links to the enrichment of the learner’s
imagination so that creative activity resulted (Ayman-Nolley, 1992; Lowenfeld & Brittain, 1970). This connection was implied in Vygotsky’s writing about the development of the imagination.

The creativity research provided plenty of evidence that teachers were frequently unprepared to equip learners with thinking strategies as they attempted to handle various thinking-related tasks (Harris, 1998; Lowenfeld & Brittain, 1970). One of those thinking strategies, namely creative thinking, was a life-long developmental process that could be advanced through formal instruction, stated Vygotsky. If this was the case, then teaching learners to think in more creative ways would have direct implications for the classroom and for teacher-preparation programs.

Much of the thinking required of today’s learners emphasizes the ability to analyze—how to understand assertions, follow or formulate a logical argument, determine the answer, eliminate the inaccurate or impractical possibilities and focus on the correct response (Slavin, 2000). However, another way of thinking exists—a way that prompts the exploration of ideas, the generation of multiple possibilities, and the search for multiple right answers instead of one correct answer. Both of these ways of thinking have been crucial to success in the world of work, yet the latter one has tended to be ignored in public schools (Harris, 1998; Lowenfeld & Brittain, 1970).

A social dynamic has existed in the overall culture within the United States (U.S.) that pushes individuals toward “the ruthlessly practical and conformist” (Harris, 1998, p. 5). Judging from the context of Harris’ comment, ruthless describes that unfeeling procedure through which learners have to go in order to produce the response that is most
compatible with the teacher's expected response. There also exists within U. S. public schools, wrote Harris, the kind of thinking that conforms to mainstream culture. But researchers have long been intrigued with studying persons who seem to flourish, yet who at the same time seem to be unconstrained by the dominant culture's accepted ways of thinking (Bibler, 1983).

As individuals like Harris and others enter this discussion within education about the role of thinking (as opposed to knowing), an important matter to consider has been a common understanding of terms. Creativity has traditionally been defined as producing a novel mental or physical product, the ability to imagine or invent something new, the quality of having generated innovative ideas by combining or reapplying existing ideas (Harris, 1998; Slavin, 2000). However, when Vygotsky used the same term, creativity, he used it with this same meaning but in the context of a developing process in individuals. In his three papers that discuss creativity in detail, Vygotsky used the terms creativity, fantasy, and imagination in a variety of ways. While sometimes making clear distinctions between each, he often used them interchangeably.

The process of becoming increasingly creative, according to Vygotsky, involved evidences of thinking in concepts that were age-fitting and which therefore became more complex as one developed. This conceptual-thinking process interacted with the human imagination to form new combinations of ideas and objects that possessed varying degrees of meaning. For the sake of this study, then, creativity refers to the process of constructing something new which serves a function (Ayman-Nolley, 1992). In this regard, there is considerable agreement throughout the creativity research that creative
thinking is a distinct approach to various cognitive tasks and that it does not exist without some level of functionality.

As this process is operationalized, there are creative thinking skills put into play by individuals. Even though the phrase, creative thinking, was not used by Vygotsky, during the 1950s the phrase became descriptive of the path toward being creative. In

1966, E. Paul Torrance introduced the most widely-used test of creativity—the Torrance Tests of Creative Thinking (Childs, 2003). The phrase, creative thinking, as used by Torrance, refers to the thinking process that leads to creative activity.

Creative thinking skills designate a cluster of particular abilities used by persons to engage in creative thinking. This was not only the meaning that Torrance (1998) gave to this phrase but was the way in which most creativity research of the last quarter-century used the phrase. Prior to the contributions of Torrance, theorists like Vygotsky and Piaget inferred that creativity was enacted through the use of these skills, even though the phrase, creative thinking skills, was not used (Piaget, 1952; Vygotsky, 1930/1967). Vygotsky referred to the “tools of the imagination” as that which served as the necessary abilities leading to creative activity. Researchers typically agreed that this particular group of skills, or “tools,” involved the following elements: (a) to look at a dilemma and generate multiple solutions; (b) to think of novel responses to a concept; and (c) to organize several possibilities in planning how to solve a problem. The use of creative thinking skills (i.e., to look at, to generate, to think of, and to organize multiple possibilities) is the process, therefore, that engenders creative thinking (Slavin, 2000). The qualities of fluency of thought, novelty of ideas, elaboration of concepts, and
flexibility of object and idea function were seen as the ways in which the thinking skills described above could be measured (Guilford, 1966; Torrance, 1966). This study focused on the effect of being trained in the process that facilitated creative thinking.

Purpose of the Study

This study examined a specific sample of participants and their capacities for creative thinking. The sample population was that of preservice teachers. A factor that was implied in Vygotskian theory was the effect of teachers’ attitudes regarding the value of creative thinking. This was consistent with Vygotsky’s emphasis on social and cultural environments in the cognitive development of all individuals, as well as the crucial role of adults and caregivers in valuing learning environments that increased students’ capacities to think in ways that are imaginative, inventive, novel, productive, and creative (Smolucha & Smolucha, 1992).

If Vygotsky was correct, instructing any group in an age-fitting manner about using creative thinking skills would improve the capacities of that group’s members to think creatively. But since implications of Vygotsky’s theory for effective teacher preparation were the hoped-for results of this study, teachers-in-training (or preservice teachers) comprised the study’s sample. After all, if teachers understand what skills are involved in thinking creatively, they will more likely impact the capabilities of their students to think in creative ways. A corollary to this is that the attitudes of teachers and other caregivers toward the value of creative thinking plays a role in the teachers’ own capacities and that of their students to think creatively. Lowenfeld (1970) made a strong case supporting the vital impact on learners of teachers’ attitudes toward creative
thinking. This issue raises the question of whether a preservice teacher’s level of creativity is related to that individual’s perception (i.e., attitude based on one’s observations and thoughts) of the value of knowing how to think creatively.

The benefit of testing Vygotsky’s theory of the creative imagination by using a population of preservice teachers is two-fold. First, such a study provides insight into the question of whether enriching the accumulation of knowledge of preservice teachers by instructing them in the use of creative thinking skills actually increases their capacities for creative activity. Second, the study addresses the question of whether the level of a preservice teacher’s capacity for creative thinking is related to that individual’s perception of the importance of learning to think more creatively. The answers to both of these questions hold major implications for how teachers might be prepared to more effectively create learning environments that increase learners’ capacities to think in ways that are truly creative.

The Research Questions

The fundamental question to be addressed here is the impact of formal instruction in the use of creative thinking skills. Can such instruction add richer knowledge and experience to the imaginations of preservice teachers in order to improve their capacities for creativity? A “yes” answer to this question was strongly implied in Vygotsky’s creativity theory (Ayman-Nolley, 1992). To test this assumption, a quasi-experimental design consisting of pre- and post-tests, two intervention groups, and a control group was used. The two intervention groups underwent training in dissimilar approaches to thinking. The first intervention group was trained in the fundamental skills of creative
thinking as identified throughout the creativity literature and implied in Vygotsky’s descriptions of creative activity. The second intervention served as a foil with participants in Group 2. Participants in Group 3 comprised the control group.

This central research question as described in the paragraph above is stated quantitatively in this manner: Given Vygotsky’s claim that formal instruction improves one’s capacity for being creative, to what extent, if any, are there differences between the pre-test and post-test creativity scores for the three groups?

Two secondary research questions follow from this central question. (1) To what extent, if any, are there relationships between preservice teachers’ pre test scores, and (a) select demographic variables (i.e., size of high school which they attended, gender, and age), and (b) their perceptions of their own experience with creative thinking (i.e., their own preparation to teach learners about creative activity and their regard for the value of knowing how to think creatively) prior to their participation in the study? (2) To what extent, if any, are there differences among the three groups in the preservice teachers’ perceptions of creative thinking following participation in the study?

Methods

As stated above, a quasi-experimental design was employed in this study. Preservice teachers were assigned to one of three groups—a control group and two intervention groups in which each group was instructed in one of two different approaches to thinking. The Torrance Tests of Creativity, Figural, Forms A and B (Torrance, 1966) served as the pre-test and post-test for the study (Appendices A and B).

A pre-study and post-study questionnaire that, in addition to demographic
information, addressed the perceptions of the preservice teachers relating to creative thinking, were completed by each participant (Appendices C and D). The participants’ perceptions covered in the questionnaires were their prior creative thinking experiences, their own understanding of and feelings toward creativity, and the sense of their own preparedness to nurture creative thinking in students.

Significance of the Study

With more insight into whether creative thinking can be improved through instruction, teachers can provide learners with more cognitive tools that would increase learners’ choices of how to think. This study contributes to the exploration of how skilled teachers can intentionally promote creative thinking skills within all subject areas. In an age of unprecedented amounts of new information, strategies can be developed that promote increased formation of higher-order thinking skills. These, in turn, can lead to new ways of thinking when one is confronted with a variety of mental tasks. These higher-order cognitive skills can allow learners to approach certain tasks with greater proficiency. Higher levels of thinking as identified, for example, in the taxonomical work of Bloom (1956) were implied in the creative thinking skills referred to in the creativity research (Simonton, 2000). One issue that emerges in this study, then, is whether or not teacher education programs can more effectively prepare teachers-in-training to value and promote the concrete expression of the creative imagination.

In considering the study’s significance, it is important to view it within the context of implications for teacher preparation. Vygotsky provided a careful articulation of how all individuals could learn to approach certain higher-level mental tasks by allowing the
imagination to shape their thinking. Preservice teachers are in the position to markedly influence that process.

In the current state of affairs within education, the matter of learning to think in divergent and creative ways is considered low in priority given the growing emphasis on demonstrating measurable outcomes (Leonard, 2000). Nevertheless, the neglect of the development of creative thinking skills within the traditional school is of great concern to an increasing number of educators. These teachers are among a growing public that advocates for a serious re-examination of the purpose of schools. They see education as a complex process that embraces how learners learn to think and how that process is advanced (Richards, 1996). In this regard, the study here assists in reframing the conversation about preparing preservice teachers. Rather than seeing effective teaching as that which provides learners the way to produce the correct answer, one could consider effective teaching as that which enables learners to discern when it is necessary to think in ways that generate several correct answers. To engage in that sort of thought process invites learners to use creative thinking skills.

Summary of Chapter One

Although the literature that addresses the nature of creativity is considerable, Vygotsky’s ideas have not been widely examined. In addition, even though there has been substantial research relating the learning of creative thinking skills to increased intelligence, there is no clear evidence linking this kind of instruction to an individual’s capacity to be creative. Creativity research contains assumptions about the likelihood that people can learn to be more creative (Rimm & Davis, 1976; Russo, 2004; Thurstone,
1952; Torrance, 1972). Primary studies about the relationship of specialized instruction in how to think creatively and its influence on improving a person’s ability to be creative are few. The assumptions made by some researchers have indicated that there is an influence of specialized instruction in creative thinking skills on one’s capacity for creative activity (Russo, 2004). One of the few studies linking increased creativity capacity and the instruction of creative thinking skills consisted of a survey conducted shortly after Torrance introduced the TTCT in 1966 (Taylor & Williams, 1966).

Consequently, the study described here is a useful resource within the limited research that addresses the question of whether individuals can be taught to think and act more imaginatively. Given the lack of research regarding Vygotsky’s ideas about the development of creativity, this study used a quasi-experimental design to test the major elements of his theory of the creative imagination. In so doing, this Vygotskian theory was examined from the perspective of teacher preparation.

An examination of the creativity literature that looks at the developmental qualities of this cognitive process is provided in chapter two. A detailed description of the research design used in this study and the ways in which the data were analyzed are offered in chapter three. The fourth chapter gives a summary of the results of the study, including some speculations of results that did not produce decisive findings. And finally, in chapter five the implications of this study in terms of further research and in terms of teacher preparation are offered.
CHAPTER II

REVIEW OF THE LITERATURE

As evidenced by many studies and publications, the subject of creativity has spawned much interest over the past century. While the ongoing discussion centers largely on the archetypal issue of nature versus nurture (Cohen, 1989; Feldman, 1988; Gardner, 1993; Simonton, 2000), this study has attempted to deal with a small piece of that issue—the impact of instructing preservice teachers to think in increasingly creative ways and the resulting attitudes these individuals have toward creative thinking.

This chapter provides a review of the literature as it relates to five topics: (1) the broader context of 20th Century developmental theory in which to consider Vygotsky’s work, (2) Vygotsky’s theory of the creative imagination and the research on this work to date, (3) measurement of people’s capacity for creative thinking, (4) creative thinking skills, and (5) influences on creative thinking.

The Broader Context in Which to Consider Vygotsky’s Theory

A review of the creativity literature shows that the overwhelming interest lies in the area of what produces creativity (Csikszentmihalyi, 2000; Gardner, 1983; Simonton, 2005). The major theories of cognition (e.g., behaviorist theory, psychoanalytic theory, cognitive-developmental theory, social-historical theory, biological-genetic model), while not specifically addressing a theory of creativity, generally considered creative abilities from a reductionist perspective. Such a perspective claimed that creativity was either a result of an innate quality, a manifestation of giftedness, or it was a result of a developmental process influenced by assorted forces with varying degrees of intensity.
While much of the creativity research has focused on examining differences in the characteristics of individuals who have been identified as creative, Csikszentmihalyi (2000) pointed out that very few researchers have looked at factors that predict the capacity for creativity before it becomes evident in individuals. Only within the last thirty years, the integration of several models of creativity (e.g., the Integrated Intelligence Model; the combination of intelligence quotient, behaviorist theory, and multiple intelligences theory) has emerged in the literature (Hetzel & Barr, 2000; Smolucha & Smolucha, 1992). Although formulated much earlier in the century, Vygotsky’s theory of the creative imagination is an example of a synthesis of quite different theoretical positions—Freud, Piaget, and Vygotsky’s own earlier work (Smolucha & Smolucha, 1992).

The matter of how creative thinking manifests itself has been examined in infants, young children, adolescents, anomalous populations, and gifted and talented learners (Herman, 2001; Piirto, 1999; Simonton, 2000). In general, the interests of creativity research have tended to address the following: (1) the notion of giftedness and the phenomenon of gifted education (Guilford, 1967; Hetzel & Barr, 2000; Torrance, 1979), (2) intelligence theory, including the intelligence quotient, behaviorist theory, and Gardner’s multiple intelligences theory (Gardner, 1983; Guilford, 1959; Russo, 2004), (3) the psychosocial dynamics of creativity, such as “madness” and creativity, the relationship of creative students’ behavior to teacher attitudes, as well as creative abilities and social adeptness (Amabile, 1983; Donnell, 2004) and (4) productive thinking in a
global economy (DeBono, 2006; Hargadon & Sutton, 2000; Woodman, Sawyer, & Griffin, 1993).

Within this wide conversation about the nature of creativity, studies have frequently focused on the familiar psychosocial developmental theories coming out of the early to mid-1900s. Based on Erikson’s identity model in *Identity and the Life Cycle* (1980), research into the successful accomplishment of the tasks in each of the eight stages of human psychosocial growth has been applied to the parallel growth of the uninhibited imagination. Erikson’s stages of mental growth have all been linked to populations that give evidence of keen intellectual abilities—e.g., attaining an identity of trust in one’s safety and in the reliability of caring adults; an identity of competence and fitting individuation; and an identity of initiative. This latter stage which involves the attainment of an identity of initiative includes responding positively to challenges, trying out new ideas, and feeling encouraged to use one’s imagination and curiosity (Hoare, 2001; Mintz, 2003; Ollhoff, 1996). Particular studies have also indicated that the thriving growth of one’s self-identity as described by Erikson was connected to the high-level of creative activity manifested in some individuals (Richards, 1996).

Piaget’s *The Origins of Intelligence in Children* (1952) launched a number of studies exploring the developmental process of creative thinking in children within the context of his broad theory of the development of the mind. He considered his model of adaptation (his term for learning) to be a biologically-based process. Infants learned through the adaptation of schemas, or skills, that guided them in exploring their world, in gaining new knowledge and in building more complex exploratory skills. Adaptation,
while common to all living things, was fundamental to the beginnings of creativity in humans as more sophisticated schemas were put into play. Piaget saw assimilation and accommodation by children as two distinct aspects of adaptation (Piaget, 1952; Richards, 1996). Research has been carried on to elaborate on how Piaget's general theory of cognitive development explained the growth of creativity within individuals (Richards, 1996).

One of the issues within creativity research was the question about how creativity developed throughout the human life-span. Most of the theories of creativity spoke to the creative process at only a single point in time (Ayman-Nolley, 2000). Freud provided a good example of this in his complex description of the role of conscious and unconscious processes in creativity. He concluded that people's creative activity could be looked at as wish fulfillment (Freud, 1958). But if creative activity developed throughout the life cycle, as many experts, including Freud, had come to believe, the question of how this happened remained (Ayman-Nolley, 2000).

An Ongoing Controversy

The notion that creative thinking skills were the result of a developmental process spanning the human life represents a relatively recent view of creativity. This framework took shape during the last half of the 20th Century. It allows one to view the process of becoming creative as a cognitive procedure that manifests itself in unique ways along the course of one's life (Lowenfeld & Brittain, 1970). Researchers such as Ava Capossela of Claremont Graduate University (2000) along with author Victor Lowenfeld (1970) in his seminal work, *Creative and Mental Growth*, advanced this notion as they made a case for
creative activity becoming fully mature in adulthood. In addition, Vygotsky described a growth process that was quite contrary to the popular exclusivist opinion of his day. He explained the life-long developmental nature of creativity and concluded that only in adulthood did the process of becoming creative fully mature. It was a process that occurred in all individuals at a level that was dependent on the richness and abundance of one's imagination (Vygotsky, 1930/1990).

**Exclusivist Perspective**

The creativity research of the last century, however, still reflected a strong commitment to the exclusivist perspective. In a recent lecture at the Torrance Center for Creativity, University of Georgia, Dean Keith Simonton claimed that there was a solid case for a strong genetic explanation of creativity (2005). Looking at creativity from the perspective of giftedness and exceptional manifestations of creative behavior, the innateness of this quality, said some researchers, could not be doubted (Cohen, 1989; Feldman, 1982, 1986, 1988). Studies suggested that even though there could exist a cognitive process of growing creativity that was at work in all people, there was a pre-dispositional trait that explained why some individuals were more creative and produced greater amounts of creative output over time (Dacey & Lennon, 1998; Kelly & Caplan, 1997; Roberts, 1997).

**Survival Perspective**

Another view that surfaced in this discussion looked at creativity as the manifestation of an innate survival mechanism. It stated that creativity did not reside within humans at all but was a human response that was manifested when conflict arose.
in and around people. Creativity was one of the strengths that higher organisms possessed in order to survive. It pushed humans to react. This proposal maintained that some external stimulus had to be present in order to move individuals to think or act in ways that were considered to be creative. It was only in this context that creativity was evident (Chrenka, 2004).

Other Theoretical Perspectives

Although Vygotsky and Torrance’s understanding about creativity was strongly influenced by the advent of the study of psychology in the late 1800s, various perspectives began to surface in the latter part of the 20th Century (Dennis & Trotman, 1991). The post-modern view of creativity, chaos theory, and critical theory emerged in contrast to the classical perspective that remained unchanged through the mid-20th Century. Critical theory provided both the descriptive and the normative bases for social inquiry. It targeted ways in which the domination of traditional thought within society was decreased and freedom in all forms was increased. This applied to the classical view of creativity—the perspective that creativity is determined by one’s genetic makeup and personality traits.

Studies about organizational creativity have increased over the last ten years. Topics like “creative collaboration in product creation and creative collaboration in product implementation” reflect the complexity of modern technology (Sonnenburg, 2004, p. 254). The need for larger group involvement, especially within business settings, has brought about the new study of “collaborative creativity” (p. 255).
One of the phenomena that arose in the late 20th Century (and continues today) was an interpretation of creativity that was grounded in popular culture. Popular writers presented creativity as a psychological characteristic that could increase productivity in the workplace, that could increase one’s success in business, that could be nurtured by self-help techniques, and that could improve one’s overall happiness (Dahl, 2000; Gryskiewicz, 2000; Hargadon & Sutton, 2000). This compelling trend within creativity research has reached into the popular media. Mainstream publications like Psychology Today, Fast Company, and the business-oriented Harvard Business Review have addressed recent findings drawn from creativity research. The in-depth work regarding creativity theory by individuals like Vygotsky and Torrence has given way to applications of creativity and “how-to” techniques. Authors Edward de Bono (1992, 2006), Morgan Jones (1998), and Joyce Wycoff (1991) have touched the general population with bestselling books about increasing creativity and productivity in the U.S. workplace.

Vygotsky’s Theory of Creativity and Imagination

Because Vygotsky’s writings, especially about creativity, have only recently been introduced to educators and psychologists in the U.S., there has been little discussion of his theory of creativity or any substantive research into his work (Smolucha & Smolucha, 1992). Vygotsky’s name has become well-known in connection to his larger construct of how cognition develops; his constructivist ideas have had a remarkable effect on U.S. schools since his work was first recognized in the West in the late 1970s and early 80s. Social learning theory has quickly become associated with Vygotsky. But his particular
set of ideas regarding the development of the creative imagination has not yet undergone
the examination it deserves. In the mid-1980s, Francine and Larry Smolucha of the
University of Chicago had translated into English the three major articles written by
Vygotsky describing his theory of creativity. Even though his ideas in the area of the
creative imagination are not widely known, some U.S. researchers already consider his
larger theory of cognitive development to be a major set of concepts in understanding the
development of the human mind. This major set of concepts of Vygotsky has been
compared in significance to the foremost psychoanalytic, behavioral, humanistic,
information-processing, bio-psychological, and Piagetian theories (Smolucha &
Smolucha, 1992).

While the major theorists of the 20th Century have put forth complex theories that
address the development of human cognition, the growth of creative thought had usually
been acknowledged only in passing. Even though Vygotsky’s overarching social learning
theory continues to need more examination, the social science community within the U.S.
has demonstrated a vast amount of intrigue (Ayman-Nolley, 2000; Smolucha &
Smolucha, 1992). This intrigue acknowledges in Vygotsky’s work an unparalleled
interconnectedness of a general theory of cognition and the related aspects of cognitive
growth, such as the development of the imagination. That community saw in Vygotskian
theory a strong consideration of the development of creativity, the role of play, the role of
imagination, the growth of structures within the brain, and the impact of social interaction
on all aspects of cognitive development (Ayman-Nolley, 2000; Smolucha & Smolucha,
Vygotsky, a contemporary of Piaget, saw learning as a mental functioning that had to precede the development of certain structures in the brain. The development of specific cognitive structures within the brain was prompted by a child’s interactions with people, beginning with play that included adults. The development within the brain gradually made certain types of learning possible. Intellectual development, according to Vygotsky, had to be examined only within an individual’s personal history and cultural background (Slavin, 2000). Because of Vygotsky’s emphasis on one’s own history and culture in the formation of the mind, he was considered by many educators to be a socio-cultural theorist (Smolucha & Smolucha, 1992).

An underlying concept of Vygotsky’s work in creative growth is that all imagination begins with a child’s pretend play through interactions with an adult or more capable peer (Smolucha, 1989). For him, the process in pretend play from which creative activity develops is specifically the process of object substitution. As people grow, this process of object substitution in pretend play takes the form of inner speech in which individuals make use of semiotic devices—the signs and symbols, the metaphors and visual analogies, and the symbolic representations of whole constructs and systems that may have been previously learned through play with an adult. Now, the use of signs and symbolic representations learned from an adult or more competent peer takes the place of what originated in children’s play (Smolucha, 1984). The devices of signs and symbols, or the tools of the imagination as Vygotsky called them (1984), are expressed through that set of skills which Torrance referred to as “creative thinking skills” (Guilford, 1966; Torrance, 1966; Smolucha, 1984). It is this set of skills, identified originally by Guilford...
and based on his interest in Vygotsky’s theory (Guilford, 1966), that provides mechanisms by which creative potential or creative capacity can be measured (Torrance, 1966).

Even though his developmental theory of cognition strongly embraced the influence of the individual’s cultural milieu, particularly the interactions with others, Vygotsky’s concept of “inner speech” and the growth of the imagination is grounded in the very early interactions with one’s surroundings (Vygotsky, 1930/1967). In addition, he claimed that learning was fully dependent on children acquiring signs through instruction and knowledge from adults or more capable peers. The sign systems, as Vygotsky called the symbols that human cultures created to help individuals think and solve problems, were dependent on children’s interpersonal experiences, especially the interactions with their caregivers (Vygotsky, 1930/1967).

Following the acquisition of signs, cognitive development took place when these signs were internalized so that the child was able to think, to solve problems and to connect unrelated pieces of information into new knowledge. Vygotsky referred to this internalization as self-regulation—the ability to think and problem-solve by combining prior experiences into new constructs without assistance from others. Cognitive development continues to take place, however, as individuals engage in increasingly sophisticated “thinking in concepts” (Vygotsky, 1930/1990) while moving through the human life-span. His theory of creativity was an important outgrowth of this general theory of cognitive development (Smolucha, 1992). Both his theory of the creative
imagination and his theory of play served as fundamental constructs in his general
developmental theory of the mind.

Vygotsky presented a creativity theory in which elementary creative thinking emerged from a child’s play. This led to a higher cognitive function which could be monitored through that child’s inner speech—a child’s self-verbalizations, at first audible and eventually silent, that directed the child’s own thinking and action. As imagination and thinking in concepts started interacting during adolescence, a different level of creative activity became evident (Vygotsky, 1933/1978). Vygotsky, however, claimed that it was not until adulthood when one’s capacity for creativity was fully developed. This was evident in the scientific, technological and psychological constructs that humans created in the mind and in the physical world (Smolucha, 1989).

Vygotsky, perhaps more than any other individual, addressed the matter of creativity in a manner that was thoroughly integrated with a larger theory of cognitive development. He articulated a proposition that perceived the growth of intellect as being closely integrated with the physiological development of the brain. He believed that the brain growth was dependent on the acquisition of mental patterns through the signs in one’s physical world. It was also dependent on one’s cultural and social history in determining what signs were present in an individual’s social and physical environment. Not only did these ideas address the larger construct of cognitive development but the intertwining development of the imagination and one’s creative capacity (Ayman-Nolley, 2000).
There has been a strong notion among scholars that by coming to better understand Vygotsky's work one moved closer to a cohesive perspective on how creativity developed over the human life-span. People looked throughout the creativity research for clarity in explaining how this abstract quality of creativity came to be evident in individuals. Vygotskian theory was being viewed as a strongly interrelated perspective on the development of not only creativity but of multiple cognitive processes (Ayman-Nolley, 2000; Smolucha & Smolucha, 1992).

Measuring the Capacity for Creativity

Torrance (1974) defined creativity as the process of becoming sensitive to problems, weaknesses in practice, gaps in knowledge, elements that are missing, and disharmonies within the world. Furthermore, this process brought together available information, defined the weakness or identified the missing element. He said that creativity searched for solutions to problems, made guesses and modified solutions, restated the strongest solution, perfected it and finally communicated the results. Torrance was immensely curious about unleashing creative abilities in people who possessed this potential; he was more interested in how to measure an individual's creative capability than in providing a theory of how humans learned.

Torrance: Defining Creativity

Torrance's definition of creativity, while much more elaborately stated in the paragraph above, is similar to the definition used for this study and reflected the generally-accepted views in the creativity literature during the mid-1900s. How creativity looked and acted when it was expressed was basically unchanged during the first part of
the 20th Century (Lowenfeld & Brittain, 1970). This generally-accepted definition of creativity, however, did not speak to the issue of the source of creative activity nor to the issue of how creativity became evident in individuals. Torrance’s definition suggested that a process began with sensing problems and that this led creative thinkers to engage in using a specific set of skills (1977). Guilford (1959), Rimm and Davis (1976), and Torrance (1966) claimed that these skills, specific to creative thinking, could be measured. “I suppose creativity is a part of intellect, but there are many abilities involved in intellect,” Torrance stated in a 2001 interview. “For the full development of creativity in children and adults, I am convinced they have a better chance in life if their best abilities are identified and encouraged” (Childs, 2003, p. 1). Even though Torrance (1992) viewed creative activity as the result of a developmental process that was existent to some degree in all people, he regarded creativity designated with an uppercase “C” to be a quality particular to those who possessed intrinsic creative abilities.

The connection of giftedness to being creative became a major topic of interest in creativity research during the 1950s. Thurstone (1952) found that university students with high intelligence quotients were not particularly strong in idea generation. Guilford (1962) built on his view of divergent thinking. He, among others, claimed that persons involved in divergent thinking are actually engaged in behaviors which he determined to be useful in measuring one’s capacity for creative activity—fluency, flexibility, originality, and elaboration. Fluency, abstractness of thought, originality, elaboration, and resistance to premature closure—these were terms used by Torrance (1962) and to some extent Guilford (1962), both experts in exploring the measurement of creativity, to
describe the particular skills that they believed measured one’s capacity for creative activity. Guilford used one term, *flexibility*, rather than the two phrases “abstractness of thought” and “resistance to premature closure” (1962).

Torrance defined fluency as the amount of relevant, yet diverse, responses one could generate in regard to a thinking task. Fluency was measured by the number of relevant responses to items on the *Torrance Tests of Creative Thinking* (TTCT).

Abstractness of thought was defined as one’s ability to “synthesize and organize processes of thinking...[at] the highest level, there is the ability to capture the essence of the information involved, to know what is important,” enabling one to observe a phenomenon or to think about an idea more deeply and richly (Torrance, 1991). This was measured by the number of response categories on the TTCT. Originality was defined by Torrance as “the statistical infrequency and unusualness of the response” (1991). This score indicated if a student used many trite and common responses (i.e., low originality), or if the student produced a number of unique and highly imaginative test responses (i.e., high originality). Originality was measured by the total number of scoring weights on the TTCT that indicated the infrequency of test-item responses as compared to the appropriate norms group for the TTCT. Elaboration described that ability to combine ideas or objects, to add on to what already existed, and to create richness and greater clarity through details that were not previously existent (Torrance, 1998). Resistance to premature closure indicated one’s ability “to keep open and delay closure long enough to make the mental leap that makes possible original ideas” (Torrance, 1991). Whereas less
creative people tended to leap to premature conclusions with no consideration of information that was available, they eliminated opportunities for more powerful and unusual ideas. In spite of disagreement within the creativity research about the value of Torrance’s contributions, his definitions of these terms and the characteristics of creative activity were widely accepted (Childs, 2003).

With Torrance’ particular curiosity regarding the advancement of gifted and talented education, the TTCT was initially developed to identify individuals with hidden abilities for creative activity. Since its introduction, the TTCT has been the most widely-used instrument in measuring the general capacity of individuals for being creative. The popularity of this instrument has been evident by its ranking in 1975 among the top twenty most reviewed instruments in the *Mental Measurements Yearbook* (Buros, 1975). In addition to its use for identifying individuals who have the potential for achieving a high level of creativity, Torrance saw the usefulness of his tests in planning individualized instruction and in guiding curriculum improvement (Cramond, 1993). The TTCT was said to provide useful insights into creativity as long as the tests were used with sensitivity and good judgment by qualified professionals (Swartz, 1988; Treffinger, 1985).

Torrance received criticism soon after he introduced his tests in 1966. Some of the most recent criticism focused on the lack of reporting in regard to the demographic characteristics of the latest norming sample (Cramond, 2002). Cramond, the present director of the Torrance Center for Creativity and Talent Development at the University of Georgia in Athens, believes that researchers in the creativity field would have been
helped by a full report of these demographic characteristics of the norm group, even though she understands why they were not. Some variables, she implies, do not help researchers in understanding the “structure and complexity of the construct, ‘creativity,’ more completely” (Cramond, 2002). But over the past quarter-century, the TTCT-Figural has been the object of extensive development and evaluation (Millar, 2002).

The norming sample is one of the largest of any social science measuring instrument. In addition, there is useful longitudinal data supporting high predictive validity over a broad age range (Cramond, Matthews-Morgan, & Bandalos, 2005; Cropley, 2000). Although the scoring procedures for the TTCT have also been criticized, these have appeared to be improved (Chase, 1985). Some questions existed regarding the sub-scores, whereby some researchers pointed to the need for a close examination of the structure of the sub-scores and how each of the sub-scores predicted creativity (Clapham, 1998). Cramond acknowledges that future studies need to examine how each of the sub-scores functions in predicting creative achievement (1998). Another aspect of this concern was the extent to which each sub-score was related to the others as well as to the sub-scores of other tests measuring creative activity (Cramond, 1994). These concerns, however, do not affect the validity and reliability levels of the test as a whole (Chase, 1985; Cramond, 2002).

Early on in the process of developing the TTCT, Torrance admitted that there existed serious doubts about a test that could be constructed to quantitatively measure a quality like creativity. One issue was whether a test could be developed that could effectively be taken by anyone—regardless of culture or previous experiences. Torrance
and others agreed that this had been accomplished with the TTCT. This, according to Torrance, was the reason for the test having been translated into more than 35 languages and for it being the object of over 2,000 studies. It had been determined that the TTCT was fair in terms of gender, race, community status, socioeconomic status, and culture (Cramond, 1993; Torrance, 1977).

The TTCT was re-normed four times since its original publication, although the test itself remained basically unchanged. The TTCT was highly recommended both within the educational field and within the world of business. The TTCT was not only the most widely used test of creativity (Colangelo & Davis, 1997), but the tests held the most references of all instruments measuring creative activity (Lissitz & Willhoft, 1985). Compared to other creativity tests and psychological tests, the TTCT had fewer limitations and cautionary concerns for application. During the twenty years following its publication, research studies examined it more than any other instrument (Swartz, 1988; Treffinger, 1985). Again, researchers concluded that the TTCT displayed adequate reliability and validity for the purposes of the test (Cooper, 1991; Treffinger, 1985).

The TTCT was selected by this researcher for this study for two reasons. First, the TTCT has been established as a valid predictive instrument in connection with the measurement of “capacity,” an important concept in this study. Second, in spite of earlier criticisms, the research community has evaluated this instrument more than any other social science test (Millar, 1995) and has concluded that it measures more characteristics of creativity than Guilford’s test or the Kogan and Wallach test (Kim, 2006).
On a personal note, this researcher assisted a doctoral student in a study which involved the use of the TTCT-Figural with pre-school students in 1979, twelve years after Torrance published the TTCT. Personal contact with Torrance during that study and the opportunity to address some of the weaknesses that became apparent during the data collection phase served as a motivator in selecting the same instrument 18 years later. Observing the procedural revisions that have occurred over that time period was useful in analyzing the data gathered for this study. In addition, personal contact with Cramond, a student of Torrance, on three occasions during this study also provided help in properly interpreting some of the data.

Torrance emphasized potential when discussing creativity. Measurement of a particular creative act was not the object of his interest. Rather, his interest was the potential of learners to be creative. Creativity for Torrance was always considered within the context of one’s capability to be creative (Cramond, 1993). In this regard, Torrance was a developmentalist like Vygotsky. For this reason, Cramond, emphasizes the high level of predictive validity contained in the Torrance Tests of Creative Thinking (Cramond, 1994). Plucker (1999) concluded that Torrance Tests of Creative Thinking (TTCT) were the best predictor for adult creative achievement. He found that the TTCT score accounted for about 50% of adult creative activity, an amount that is three times greater than that of the standard IQ scores. Wechsler, in providing an example in her study of the predictive validity of Torrance’s tests, concluded that her study showed significant relationships between participants’ creative achievements and the creative indicators in the TTCT ($r = .14$ to $r = .33$, $p \leq .05$ to $p \leq .001$) of future achievements.

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The presence of creative predictors in Wechsler’s study showed significant correlations among persons with and without creativity-related achievements (Wechsler, 2006).

**Measuring a Complex Mental Process**

Vygotsky stated that the mental process of combining pieces of previously-learned knowledge emerged from the play of humans. Play began with the substitution of objects representing concepts, then the pretending of new realities through the play, and the continuing development of these forms of combinatorial activity to a higher mental function as a person grew. These were examples of fluency, flexibility, originality, and elaboration in Vygotsky’s concepts of creativity (Smolucha, 1989).

While *divergent thinking* became nearly synonymous with *creative thinking* during the 1970s, divergent thinking is used in this study to mean the ability to look at a problem and formulate several solutions. It includes creative thinking but encompasses a broader assortment of unusual thinking responses. Since the 1970s, researchers have tended to regard divergent thinking as a more expansive construct than creative thinking (Lovell, 1980). *Imagination*, as defined by Vygotsky (1930/1967), was an individual’s conscious world of fantasy upon which all creative activity was based.

While their earlier studies concluded that intelligence and creativity were only slightly related, Getzels and Jackson (1962) modified their view by asserting that creativity, though not the same as intelligence, was closely related to intelligence. Jones defined creativity as a combination of the same components identified by Guilford but that the combination “enables the learner to break away from usual sequences of thought into different and productive sequences, the results of which give satisfaction to himself
and possibly others” (1972, p. 7). The results of a number of studies that came out of the 1970s and 80s supported the notion that creativity was essentially another type of giftedness (Renzulli & Reis, 1986). Several experts determined that intelligence and creativity had to exist together in gifted persons. Some researchers, although viewed skeptically over time, concluded that these two terms were synonymous (Renzulli, 1977, 1978; Renzulli & Reis, 1986; Tannenbaum, 1986).

A number of later studies, however, showed creativity to be a different trait than intelligence. Much of this more recent research focused on the psychosocial aspects of both learners who have above-average intelligence and learners with a high level of creativity (Davis & Rimm, 1994; Taylor, 2003). Russo concluded from her comparative study of creative problem-solving strategies of highly intelligent and average middle-school students that intelligence quotient did not correlate with measures of creativity, “which is consistent with previous research studies” (2004, p. 188). Torrance (1980) and Ball (1992) found low correlations between creativity and intelligence. Before these more recent studies which established a distinction between intelligence and creativity, Torrance (1980) speculated that intellectual skills were a requirement for creative activity, but were not adequate by themselves.

The Particular Abilities of Creative Thinking

Regardless of how individuals viewed the source of human learning in general, and creative activity in particular, there existed, for the most part, a common intuition on what creative thinking was. Generally, creativity research considered creative thinking to be the result of using a specific set of abilities. To organize several possibilities in
planning how to solve a problem was one creative thinking skill (Gardner, 1982; Leonard, 2000; Mayer, 1983). The ability to think of novel responses to a concept was also part of this skill set (Amabile, 1989; Lehmann & Mehrens, 1979). This was shown, for example, in the original questions about one’s autonomy, the nature of life, and matters of morality and justice that began to be articulated by many pre-adolescents. Also, the ability to exhibit originality amidst conformity would begin to emerge in some teenagers (Kirschenbaum, 1992).

The ability to generate multiple ideas about a particular phenomenon was another aspect of creative thinking. Erikson’s view of adolescence, for example, emphasized the explorative characteristic of a teenager identifying how she wanted to be defined by herself and others (Erikson, 1980). Even decisions about what career to pursue, colleges to consider, social norms to challenge or to accept, and leisure-time activities in which to engage involved a generative process. Making these decisions required one to come up with multiple possibilities and involved creative thinking (Slavin, 2000).

What Influences Creative Thinking?

Being creative, according to several studies, seemed to be advanced by specific factors in an individual’s home and social environments. One of the most frequently cited features was the absence of judgment and evaluation (Smolucha & Smolucha, 1992). An important dynamic within a person’s social environment was one of tolerance (Harris, 1998). During adolescence, it was in the communal setting of peers that young people perceived their peer-social group to be more supportive of a growing individuality than they perceived their parents to be (Furman & Buhrmester, 1992).
environment, middle-school youth were most likely willing to reframe the beliefs with which they grew up (Damon & Hart, 1988). Self-identity grew to be more differentiated in spite of the popular notion that early adolescents tended to conform to peer identification (Harter, 1990). Vygotsky maintained that in adolescence new forms of imagination were generated by “the forceful emergence of subjective experience...so that at this time [the adolescent’s] own internal world is created” (1930/1966, p. 95).

Creativity was manifested more dramatically during adolescence than at any other period during the human life-span. Vygotsky claimed that this was the result of a physiological change—the formation of the adult brain (1930/1966).

Young adolescents, determined DeMoss, (1993), developed creative thinking skills that had positive correlations to specific conditions in their learning environments. Two separate studies showed statistically significant correlates between cognitive ability, mental health, peer relationships, positive attributional style (i.e., ascribing life events as a result of one’s own behavior and giving appropriate credit to others for their roles in various life events), and the growth of creative thinking (DeMoss, Milich, & DeMers, 1993; Esquivel & Lopez, 1998). DeMoss, like Vygotsky (1930/1966), recognized the intersection between social and cognitive structures and their importance to the development of creativity.

Common Factors that Foster Creative Activity

While not showing causality, some common factors that seem to promote creative thinking in early adolescents are present in their school environments (Herman, 2001; Kaltsounis, 1976). Teaching strategies, school culture characteristics, teachers’
attitudes and a school’s demographic profile are some of the environmental factors that appear to impact young people’s development of creative thinking skills (Kaltsounis, 1976).

Palladino (1997) attempted to show that schools which officially recognize creativity as an ingredient implicit across the curriculum have tended to foster within students the capability to generalize the use of creative thinking skills in situations beyond school. For example, in classroom settings where teachers used student-centered and discovery-driven instructional strategies, students were likely to demonstrate more creative thought and originality in their work than students in classroom settings where teacher-directed instruction was the dominant teaching style (Slavin, 2000; Ticho, 1982). Teachers whose instructional styles were less prescriptive and more inquiry-based tended to nurture a greater number of students who exhibited the use of creative thinking skills in their work than teachers who used other instructional styles (Lawton & Busse, 1972; Ticho, 1982).

These findings are consistent with Vygotsky’s claim that the activity of the imagination became less visible as a child moved into adolescence. This activity, however, was no less forceful, either within or outside of school. A critical transition was taking place within each young person as the struggle, asserted Vygotsky, between the subjective imagination of childhood and the objective imagination of adulthood was lived out internally. The young person’s internal world was deepened and the fantasies of childhood were curtailed. With fewer restrictions on the activity of the transitioning imagination, the more freedom the maturing young person felt to express new forms of
creative activity that were more deeply rooted in objective reasoning (Vygotsky, 1930/1966).

The time periods of middle-to-late childhood and early-to-middle adolescence have been emphasized in the preceding paragraphs. This is reflective of the creativity research, much of which focuses on the manifestation of creative activity in youth. This, in turn, reflects an underlying, though misinformed, assumption that creativity is most strongly displayed in children and adolescents (Capossela, 2000). With this, the discussion circles back to Vygotsky’s bold claim that creative thinking is a life-span developmental process which fully matures in adulthood.

It is this life-long process of increasing one’s capacity for creative activity, according to Vygotsky’s theory of the creative imagination, which is at the center of his ideas about creative activity. The growth of creative thinking abilities throughout the human life-span is the part of those ideas that holds important prospects in regard to effective teacher preparation.

_A Curriculum to Teach Creative Thinking Skills_

Studies about the developmental process of creative activity throughout the human life-span have been fewer than the comprehensive studies dealing with the more abstract nature of creativity (Mayer, 1983). While considerable research supported the assumption that instruction in how to think creatively increased one’s intelligence, there were conflicted findings about the relationship of creativity and intelligence. Judging from several studies (Davis & Rimm, 1994; Russo, 2004; Taylor, 2003), there was a distinction between intelligence and creativity. There was, however, little research to
clearly establish a link between instruction in the use of creative thinking skills and an individual’s capacity to become more creative. There is little in the creativity research that addresses the creative capacities of teachers, their attitudes toward the value of creative thinking, or the impact on students of teachers’ preparedness to promote creative thinking skills.

A question that engaged Vygotsky’s interest as he considered the growth of creativity within the larger process of the developing mind was whether creative thinking continued to become more sophisticated as one grew older. His theory about the developmental nature of creative thought emphasized repeatedly that creative thinking was “a higher mental process, not ‘sub’ consciousness…and that it depends upon reasoning” (Capossela, 2000, p. 49). Here, he took issue with Freud by being concerned with the conscious, mental process of creativity and its beginnings as a relational dynamic between caregivers and their children (Wertsch, 1985). Vygotsky kept returning to the process itself—the life-long development of an increasingly sophisticated function of the mind.

Since there has been a gap in the creativity literature regarding both Vygotsky’s theoretical and practical contributions toward understanding the advancement of creative thinking, this study attempted to provide some insight into his work. It also was an attempt to test a central element of his theory of the creative imagination. It did so with a population poised to positively impact the creative development processes in learners—pre-service teachers.
It is this life-long process of increasing one’s capacity for creative activity according to Vygotsky’s theory of creative imagination that invites further exploration. The growth of creative thinking abilities throughout the human life-span holds important prospects within the context of teacher preparation. If this study demonstrates a significant impact on preservice teachers’ capacities for creativity, there are many implications for fostering the growth of creative thinking in learners at various levels of development. Though not explicitly, the need for teachers to understand creative thinking, to think creatively themselves, and to be skilled in fostering creative activity in their students is evident within the research (Capossela, 2000; Donnell, 2004; Gardner, 1982, 1983; Slavin, 2000).

Summary of the Literature Review

Studies about the developmental process of creative activity throughout the human life-span are fewer than the comprehensive studies dealing with the more abstract nature of creativity (Mayer, 1983). While there are many studies on the effect of instruction in the use of creative thinking skills, the subject of interest is usually intelligence. While considerable research may support the assumption that instruction in how to think creatively increases one’s intelligence, there are conflicted findings about the relationship of creativity and intelligence. Judging from several studies (Davis & Rimm, 1994; Russo, 2004; Taylor, 2003), there is a distinction between intelligence and creativity. There is, however, little research to clearly establish a link between instruction in the use of creative thinking skills and an individual’s capacity to become more creative. There is almost nothing in creativity research that addresses the creative capacities of teachers, their...
attitudes toward the value of creative thinking, nor the impact on students of their teachers’ preparedness to promote creative thinking skills.

Considering the demands in contemporary society for individuals who can think in novel, original, and creative ways, the quasi-experimental study described in Chapter 3 is an attempt to shed more light on Vygotsky’s ideas. Whether or not formal instruction significantly affects the ability of individuals to think in increasingly creative way is tested with a sample population of preservice teachers.
CHAPTER III
METHODOLOGY

The selection of methodology for any study ought to be driven by what the researcher wants to know, by the questions that need to be answered in order to obtain that knowledge, and by the procedures that are the most helpful and proficient to answer these questions. In general, if the intent is to formulate a theory by identifying patterns and examining the many meanings with which people define their life experiences, a qualitative process is the most fitting. If, on the other hand, the purpose is to find out whether answers to research questions fit into a predetermined set of constructs, then a quantitative approach is going to be the most useful.

The study described here is of this latter sort; it is a quantitative study that addresses a specific developmental theory of creativity. Non-randomly selected or assigned participants were drawn from a population frame and were then placed in one of three groups—two treatment groups and a control group. Since the effect of the different treatment conditions on the three groups was crucial to answering the central research question, the design was quasi-experimental. The effect of the two treatment variables on outcomes (i.e., the mean difference between pre- and post-test creativity scores for each of the three groups) served as the core data to be analyzed (Brase & Brase, 2004).

The Research Design and Its Purpose

This quasi-experimental study tested Vygotsky’s theory of the creative imagination which claimed that the richer and more abundant an individual’s knowledge and life experiences are, the more fertile one’s imagination becomes. This is the basis for
one’s capacity to be creative. Implications of the study’s findings in regard to teacher preparation were of particular interest. Vygotskian theory stated that individuals’ accumulated knowledge and life experiences provide the human imagination with the material from which learners can draw in order to engage in creative activity (Vygotsky, 1930/1967).

**The Study Sample**

This study consisted of 113 preservice teachers selected from a single university, Grand Valley State University, Grand Rapids, Michigan. The unbalanced design consisted of 30 participants in Group 1, 42 participants in Group 2, and 41 participants in Group 3, the control group. The major dependent variable of the study was the difference between the pre- and post-test creativity scores of Group 1. The change scores for all of the groups were continuous, ratio scales of measurement. Independent variables (i.e., age, gender, size of high school which each participant attended, pre- and post-study questionnaire items, and assigned group) were dichotomous, categorical, or nominal variables.

The total population frame for this study consisted of approximately 1,025 students who were considered to be pre-application status to College of Education (COE) admission, a secondary admission process. This university of 23,295 graduate and undergraduate students (2006-2007 academic year) had an incoming-freshman class of 3,632 students with a grade point average of 3.53.

Of the 19,388 undergraduate degree-seeking students in 2005-2006, 60.6% were female; 39.4% were male. The university’s COE, similar to most U. S. teacher-education...
programs, typically had an enrollment of more female students than male students as compared to the overall gender ratio within the university. There were 841 students admitted in the fall of 2006 to the COE; 643 (76.5%) were female, 198 (23.5%) were male. The gender demographic in this study’s data set was 79.5% female and 20.5% male from a total sample of 113 preservice teachers.

Of the 2006 GVSU incoming-freshman class, 962 students (26%) came from high schools with less than 500 students; 2,670 students (73%) came from schools with more than 500 students. In the study’s sample, 28% of the 113 participants attended schools with fewer than 500 students while 72% of the participants attended schools with more than 500 students.

Students admitted into the COE or indicating an intention of applying for COE admission totaled 2,771 at the time of this study. This number was determined by the enrollment in education courses, both pre-admission and post-admission classes, for the 2006-2007 academic year.

Course Selection

The design of this study required that each of the participants were to be part of one of three groups; six of the 39 pre-application education classes (total number of class sections offered from three of the required pre-application courses) served as the sampling set for this study. Of the six classes in the sampling set, two were assigned to each of the three groups in the study. Group 1 was the group receiving the creative thinking skills instruction; Group 2 was the foil group receiving training in general thinking strategies; Group 3 served as the control.
While the selection of participants and the assignment of the preservice teachers to each of the three sample groups were not carried out as an intentionally random process, there was a random quality in determining the six classes that would comprise the sample set. Since students could enroll in the three courses at any time and in any sequence before applying for admission to the COE, each of the scheduled course classes were made up of students that tended to reflect a typical cross-section of the pre-admission COE student population. The six classes were all similarly scheduled—mid-day classes ranging from 11:00 a.m. to 2:30 p.m. Equal number of classes met on either of the university’s two campuses. Three were scheduled as a Monday, Wednesday, Friday class which met for 50 minutes each class session; three met on Tuesdays and Thursdays for 75 minutes each class session. As the above details have indicated, the demographics of the entire sample set were very similar to the demographics found within the population parameter of the COE.

Courses Assigned to the Sample

The agreement to participate by the instructor of each of the six classes was ultimately the factor that determined which classes became part of the sample set. Each instructor had to be willing to provide the researcher with class time for the study. A fifty-minute period in each class was needed at the outset of the study to administer the pre-study questionnaire and the pre-test. Additionally, the instructors of the two classes that comprised Group 1 and of the two classes that comprised Group 2 each provided three hours of class time for the researcher to administer one of the two different treatments. And finally, at the close of the study, each of the six classes took 50 minutes
to complete the post-test and the post-study questionnaire.

The six participating classes required an instructor who was willing to make up to five hours of class time available to the researcher. Additionally, the instructors of these six classes were viewed by previous students enrolled in their classes (as indicated by past course evaluations completed by students) as average, above average, or good. In other words, the climate in each of the classes was likely not determined by the instructor’s reputation as a teacher or the instructor’s personality. There is evidence in the pattern of how each class filled up during the time of student registration for Winter 2007 that indicates a similar rate of enrollment in each of the classes. It seems that students enrolled in each of the classes for reasons of personal convenience and interest rather than for reasons related to the particular instructor. This point is made, of course, to provide further evidence of similarity among the three groups.

Arranging Sampling Groups of Adequate Size

The researcher selected two classes for each of the study’s three groups to insure that there would be enough valid participants to provide adequate power for detecting significant differences between each of the groups. The number of valid participants in each sample ended up as follows: Group 1 (treatment one) consisted of 30 participants, Group 2 (treatment two) consisted of 42 participants, and Group 3 (control) consisted of 41 participants. Again, the total number of participants in the study was 113. For the sake of keeping the participants’ work nameless to the researcher, each participant was issued at the outset of the study an identifier (a five-digit number) with which to designate his or her work.
A pre-study power analysis showed that 81 (each of the three groups having 27 participants) was the minimum total sample size to ensure adequate power to detect significant differences between the groups. This assumed the following: $\alpha = .05$, power set at .80, and hypothesized effect size of 0.50 in a one-tailed test. This would provide outcomes which were statistically significant (Bausell & Li, 2002). In allowing for attrition of participants, however, the group size of more than 27 participants served as a safeguard to maintaining adequate power. Because this was an exploratory analysis of power, alpha was set at .10. If $\alpha \leq .05$, significance at .05 would be maintained and it would provide even stronger support for the adequateness of the study’s power.

This pre-study power analysis gave information about what was needed in the design to ensure that the results had statistical significance and provided the odds that any observed treatment effect was indeed a valid effect. The greater the statistical power of any study, the less likely a researcher would make a type-I error (i.e., rejection of the null hypothesis when it was true). There was a greater likelihood for detecting differences large enough to be of practical importance. Given the intensity of participant and researcher involvement in this study, it was particularly important to determine a sample size that was large enough to detect important differences but small enough to be efficient. The sample sizes for the two treatment groups and the control group were critical to insure a reasonable power (Glass & Hopkins, 1996). (See Table 1)

By setting alpha at .10, there was a greater risk of committing a type-I error (rejecting the null hypothesis when it was indeed true). While no statistical hypothesis
could be rejected (or accepted, for that matter) with 100% certainty, the evidence used to support or reject a proposal had to be as strong as possible. In determining whether or not this risk of making a type-I error was advisable, it was important to consider that an alpha level of .10 required a larger sample size. Even though researchers tended to strive for power that was greater or equal to .90 with an alpha level of .05, it was true that a power lower than .90 could detect significant differences, still yielding results that provided valid conclusions while allowing for a smaller sample (Bausell & Li, 2002).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>B 1 Pre-test: Capacity for Creativity</th>
<th>B2 Post-test: Capacity for Creativity</th>
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<tbody>
<tr>
<td>A 1</td>
<td>Treatment 1</td>
<td>Treatment 1</td>
</tr>
<tr>
<td>(n_1 = 30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 2</td>
<td>Treatment 2</td>
<td>Treatment 2</td>
</tr>
<tr>
<td>(n_2 = 42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 3</td>
<td>Control</td>
<td>Control</td>
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<tr>
<td>(n_3 = 41)</td>
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</tbody>
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Given estimated effect size, alpha level and power, the sample size table indicates that \(m > 27, n_2 > 27, n_3 > 27, n > 81\).

Assuming that everything proceeded as planned, there must exist a reasonable chance of achieving statistical significance. In order to insure such a reasonable chance, the following estimates needed to be made: (1) what was the most likely effect size of the
treatments, (2) what were the odds that the observed result was due to chance, (3) what number of participants in each sample group was needed to yield an acceptable power estimate while still being an efficient number, and (4) what statistical procedure was most fitting for this particular study (Kraemer & Thiemann, 1987).

For this study’s power analysis, an estimated effect size was set at 0.50. This effect size is important to the treatment relative to the “noise” in the measurement. Statistical noise is the informal term that refers to the recognized amounts of variation in a sample; it is the strength of the relationship between the independent variable and the dependent variables in this study.

The Intervention Process

*Pre-Study and Post-Study Questionnaires*

A pre-study questionnaire (Appendix A) was administered to the 113 preservice teachers. The questionnaire contained two sections. The first section asked for demographic information on three matters—age, gender, and size of high school attended by the participant. These categorical data were identified from the creativity literature as three common demographic variables that may affect capacities for creative activity (Lowenstein & Brittain, 1970). For gender, one (1) was assigned for male, and two (2) for female; for age, one (1) was assigned for 18-20 years, two (2) for 21-22 years, and three (3) for 23-25 years of age. Regarding the size of high school attended by the participants, one (1) was assigned for schools with less than 250 students, two (2) was assigned for schools with 250-499 students, three (3) was assigned for schools with 500-799 students, and four (4) was assigned for schools with 800+ students.
Furthermore, the questionnaire asked seven questions, each with four possible responses. The questionnaire used a four-point Likert-type self-rating scale about participants’ perceptions of creativity-related matters. From their perceptions of how they were prepared to think creatively to how important they felt that it was for K-12 students to learn how to think in creative ways, the participants’ attitudes prior to participating in the study were established. The pre-study questionnaire tried to show whether there existed correlations between participants’ initial attitudes and their pre-test creativity scores. (See Appendix A.)

The post-study questionnaire attempted to show if there was any change in the preservice teachers’ perceptions regarding creative thinking after their exposure to each of the two interventions and to the experience of participating in the study. Preservice teachers’ attitudes toward the value of knowing how to think creatively were measured at the close of the study. Were there significant differences between the groups in terms of their attitudes following participation in the study? (See Appendix B.)

In addition to information about the perceptions of the preservice teachers, the first questionnaire provided some data regarding three demographic variables. As a preservice teacher came into the study and completed the pre-test, were the variables of age, gender, and size of the participant’s high school related to one’s pre-test score? It was hoped that the first questionnaire would help to determine if there were relationships between the preservice teachers’ pre-test scores and these select demographic variables as well as their perceptions of creative thinking prior to participation in the study.
Pre-Test and Post-Test: Torrance Tests of Creative Thinking

Following completion of the pre-study questionnaire, the 113 participants were given Form A of the Torrance Tests of Creative Thinking, Figural. Five weeks later, following the interventions administered to Group 1 and Group 2, each participant completed Form B of the Torrance Tests of Creative Thinking, Figural.

Descriptions of Interventions

Treatment Number One

The treatment administered to Group 1 taught the use of a specific cluster of creative thinking skills as identified by creative thinking experts (Beyer, 1997; Frederiksen, 1984; Slavin, 2000). These skills were reflective of Vygotsky’s (1930/1967) description of creativity and imagination. The intervention consisted of specific instruction in three basic skills which have been identified throughout the creativity literature as essential to thinking in creative ways (Beyer, 1997; Frederiksen, 1984; Slavin, 2000). These three skills were (1) the ability to look at a dilemma or problem and to generate multiple solutions, (2) the ability to think of novel and unusual responses to a concept, and (3) the ability to organize several possibilities in planning how to solve a problem.

The instructional approach consisted of the presentation of new information through the use of PowerPoint® slides, small-group interaction focusing on instructor-provided scenarios and dilemmas, individual completion of a number of tasks for each session, and volunteer demonstrations of that session’s skill. The instruction made use of group interaction, responses to everyday situations, visual and verbal statements that
elaborated on a specific concept, and the opportunity to review each of the three sessions of training by means of posted PowerPoint® summaries of each session on a website which was available to each participant in Group 1. The instructional sessions were designed to engage each participant by accommodating all of the preferred learning approaches. This treatment required participant-generated work that was submitted at the close of sessions one and two.

This instructional intervention was developed for the specific educational level of the treatment group and was planned to fit within the time period of the three fifty-minute sessions. It intentionally matched the skills used in creative thinking as defined within this study and as inferred by Vygotsky in his writing.

*Treatment Number Two*

The treatment given to Group 2 trained participants in a thinking strategy called mind-mapping (Buzan, 2002; Slone & MacHale, 2005; Wycoff, 1991). According to Vygotsky’s theory, it was not possible to isolate the imagination from engagement in some kind of creative thinking. This was the case regardless of the kind of instruction. Nonetheless, the intervention for Group 2 was an approach to thinking which did not intentionally promote creativity. It served as a foil (i.e., an irrelevant treatment that is intended to appear relevant to the study) to the treatment given to participants in Group 1.

This intervention was developed to use instructional strategies that were similar to those of treatment one. Group 2’s intervention consisted of instruction in approaches to thinking tasks that were actually strategies in how to organize one’s thinking. The first session focused on the various tools one can use in thinking about an idea. The second
session was instruction in making mind-maps of thinking tasks. The third session consisted of real-life applications of the use of mind-mapping. The instructional strategy used in treatment two made use of active engagement by the participants, PowerPoint® summaries, direct presentation of information, rehearsal of thinking techniques, group discussion and whole-group activities. The summary of each of the sessions was posted on a website which was available to each participant for the sake of review. As in the first treatment, the instruction used in treatment two was designed to accommodate the diverse learning preferences of the group’s participants. This treatment also required participant-generated work which was submitted after both the first and second sessions. It was administered in three 50-minute sessions.

The Control Group

The third group received no treatment. Even though the participants in this group were aware of two other groups in the study, both of which were receiving some sort of instruction, they were not aware of the kinds of instruction being given to Group 1 or Group 2.

Administration of the Two Interventions

The existence of researcher bias in delivering the instructional intervention to Group 1 was certainly a possibility. However, deliberate effort was taken when designing both treatments one and two to make their administrations as similar as possible. Both treatments were carefully reviewed by six independent doctoral or post-doctoral students. The researcher made a conscious attempt to administer both treatments in as compelling a way as possible. In spite of these attempts to avoid any unfairness in how the treatments
were administered, the possibility of some degree of partiality cannot be absolutely dismissed.

Pre-Test and Post-Test: Torrance Tests of Creative Thinking

The TTCT include forms A and B for both figural and verbal tests. For this study, the figural forms were selected since they produced scores for 5 mental tasks associated with creative thinking as well as producing the 13 creative strengths rankings. Compared to the verbal forms which measured 3 mental tasks and did not produce the criterion-referenced creative strengths rankings, the figural forms provided a more comprehensive assessment of creative capacity. Both the figural and the verbal forms of TTCT could be administered individually or to groups, reliability being the same for either type of administration (Cramond, 1993). Each form of the test consisted of three parts, each part producing two or more sub-scores that added up to 5 distinct sub-scores.

The scores produced by the TTCT included a vast amount of information about the creative capacities of the participants. Each test contained a number of scores to provide a comprehensive measure of creative thinking. In order to understand the assessments of creativity in the TTCT, it is essential to comprehend the separate norm-referenced assessments of creativity as evidenced by the five sub-scores: fluency, originality, abstractness of titles, elaboration, and resistance to premature closure. In addition, there was a criterion-referenced assessment of creativity provided by a checklist of 13 creativity strengths. Finally, the composite assessment of creativity included the average standard score plus the number of creative strengths. All scores used in the interpretation of these creativity assessments included both percentile ranks—national
grade-level and national age-based percentiles. In addition, there were normalized standard scores that corresponded with the population of a study’s data set. The Torrance Tests’ Norms and Technical Manual provided the various normalized standard scores.

Obtaining a TTCT Creativity Score

The separate norm-referenced assessments of creativity provided five sub-scores. The fluency score was based on the total number of relevant responses and served as one of the most critical results of the test. All other scores depended in part on this fluency score because any other dimension could not be given a score if the test response was not first of all found to be relevant. The originality score was based on the infrequency or frequency of a response as compared to the normative sample being used for a particular set of participants (provided by the Torrance Norms and Technical Manual, 1998).

Abstractness of titles produced a score that indicated a student’s ability to bring together at the highest level of thinking the core of the meaning of the information involved. Elaboration provided a score based on the participant’s addition of details to an idea, the ability to go beyond a simple response. The last of the five separate norm-referenced assessments came from the resistance to premature closure score. This score indicated a participant’s ability to continue considering all possible responses to an idea long enough to produce the unusual and unique ideas.

While the above assessments were norm-referenced, and, according to Torrance, made up the fundamental assessment of creative capacity, there were 13 criterion-referenced measures that served to provide a more complete creativity assessment. These 13 measures gave scores of zero (0), one (1), or two (2). They were then added to the
norm-referenced measures to produce the creativity index, a score found by Torrance to provide an overall measure of creative capacity. The creative strengths in the criterion-referenced checklist included the following: emotional expressiveness, storytelling articulateness, movement or action, expressiveness of titles, synthesis of incomplete figures, synthesis of lines or circles, unusual visualization, internal visualization, extending or breaking boundaries, humor, richness of imagery, colorfulness of imagery, and fantasy. With the age-based standard score and the grade-based standard score, an average of these two standard scores was obtained to which the number of creative strength ratings from the 13 criterion-referenced assessments was added to determine the creativity index. The total score was based on a 150 point scale plus a possible 26 additional points that could be obtained from the creative strength rating.

With the mean creativity index score for each group in the study, each group received a criterion-referenced and norm-referenced measure of its mean capacity for creative thinking. The change variable gave the difference between the pre-test creativity index score and the post-test creativity index score. While the sub-scores produced a helpful view of how the normalized standard scores were derived, the fluency sub-score and the average of the five sub-scores provided scores that would predict the participants’ creativity index scores. Each age-based and grade-based standard score was accompanied by a national age-based percentile and a national grade-based percentile.

Hypotheses Reflected by the Research Questions

As stated throughout this study, the central question was whether there were differences in the pre-test and post-test creativity scores among the three groups. What
kind of impact, if any, did instruction in the use of creative thinking skills have on preservice teachers’ capacities for being creative?

Any relationships between participants’ pre-test scores and select variables at the beginning of the study were addressed by a secondary research question. These variables included three demographic factors—gender, age, and size of high school that each participant attended. The questionnaire’s items were also included in the secondary research question. These items included the participants’ perceptions of their prior experiences with creative thinking, their own preparation to teach learners how to use creative thinking skills, and their attitudes regarding the importance of learning these skills.

The other secondary research question asked: to what extent, if any, were there differences regarding perceptions about creative activity among the three groups when the responses to five items on the pre-study questionnaire were compared to five items on the post-study questionnaire.

Primary Hypothesis

Reflecting the research questions of the study, these hypotheses were either upheld or rejected (the null hypothesis is stated first, followed by the alternative hypothesis). The central hypothesis is indicated as:

\[ H_0: \mu_1 = \mu_2 = \mu_3 \]

In narrative form this states that instruction in the use of creative thinking skills does not have an effect on a preservice teacher’s capacity to be creative (\( \mu_{1,2,3} \) = mean of differences between pre- and post-test creativity scores for each of the three groups).
The alternative hypothesis is shown as:

\[ H_a: M_1 > M_2 \geq M_3. \]

Again in narrative form, this hypothesis states that instruction in the use of creative thinking skills \((M_1)\) improves a preservice teacher’s capacity to be creative; instruction in general thinking strategies \((M_2)\) improves a preservice teacher’s creative capacity to a lesser degree or not at all while no intervention \((M_3)\) results in very little or no improvement.

**Secondary Hypotheses**

Both of the secondary research questions are reflected by these hypotheses. The first of the secondary hypotheses is indicated by:

\[ H_0: \rho (M_a \text{ and } M_1 \text{ and/or } M_2 \text{ and/or } M_3) = 0. \]

This hypothesis states that there is no correlation between the mean of the pre-test scores \((M_a)\) of the preservice teachers and \((M_1)\) select demographic variables and \((M_2)\) the preservice teachers’ perceptions of their own experiences with creative thinking, \((M_3)\) as well as their perceptions of their own preparation to teach learners about the use of creative thinking skills and their attitudes toward the value of knowing how to engage in creative thinking.

The alternative hypothesis is indicated by:

\[ H_a: M_a \text{ and } M_b \text{ and } M_c \neq M_1 \text{ and/or } M_2 \text{ and/or } M_3. \]

Again in narrative form, this hypothesis is stating that there is a relationship between the participants’ pre-test scores in the three groups \((M_a, M_b, M_c)\) and (a) the select demographic variables \((M_1)\) and (b) the preservice teachers’ perceptions of their own
experiences with creative thinking ($M_2$), as well as their perceptions of their own preparation to teach learners about the use of creative thinking skills and their attitudes toward the value of learning creative thinking skills ($M_3$).

The other secondary question is reflected in this hypothesis:

\[
H_0: r (M_1 \text{ and } M_2 \text{ and } M_3 \text{ and/or } M_a \text{ and/or } M_b \text{ and/or } M_c) = 0.
\]

This hypothesis is stating that there is no relationship between the three groups’ mean pre- to post-test differences ($M_1, M_2, M_3$) and the attitudes of the preservice teachers toward aspects of creative thinking (e.g., perceptions of readiness to teach future students the skills used to think creatively) as measured by the second questionnaire ($M_a, M_b, M_c$).

The alternative hypothesis is indicated by:

\[
H_a: M_1, M_2, M_3 \neq M_a \text{ and/or } M_b \text{ and/or } M_c.
\]

This hypothesis is stating that there is a correlation between the three groups’ creativity pre- to post-test differences ($M_1, M_2, M_3$) and the attitudes of the preservice teachers toward aspects of creative thinking as measured by the second questionnaire ($M_a, M_b, M_c$).

**Data Collection and Analyses**

The statistical procedures that were used in the data analyses of this study were paired-samples $t$ tests and Pearson correlation coefficients. Alpha level (or the odds that the observed result was due to chance) was determined to be $\alpha = .05$. These procedures were carried out by the predictive analytics software of SPSS 13.0®, SPSS, Inc., Chicago, Illinois (Pallant, 2006).
Procedural Review of Locally Produced Instruments

Since the questionnaires and the two treatments were specifically designed for this study, there were no established validity or reliability of scores obtained from prior use. In an attempt to set up content validity, these instruments underwent the scrutiny of six education leaders—three doctoral candidates and three post-doctoral graduates. Each reviewer, independent of one another, was asked the following questions: (1) did the items measure what they were designed to measure, (2) did the items measure hypothetical constructs that were evident in the study, (3) and did the items serve a useful function and provide a positive outcome when analyzed (Creswell, 2003; Rudestam & Newton, 2001)?

Following each of the six reviews, a discussion took place in which the reviewer identified parts of the instructional models and the questionnaires that needed revision. The goal was that, at the minimum, content validity would be established through this process. In regard to the questionnaires, the reviewers also attempted to identify ambiguities in language that could confound the meaning of any of the items. Each reviewer was asked to suggest any modifications that could improve the accuracy of the information that instrument was intended to gather.

Analysis of the TTCT

Data was gathered using the pre-test and post-test, the Torrance Tests of Creative Thinking, Figural, Forms A and B. Pre-testing took place during the first week of March, 2007. Groups 1 and 2 began their respective treatments during the second week of March, 2007. The treatments for both groups were conducted over the next four weeks during the
scheduled class of each of the six sections. The post-test for all participants was administered during the second week of April, 2007.

The researcher administered both the pre- and post-tests. Normative data were obtained from *Torrance Tests of Creative Thinking: Norms-Technical Manual*, Figural, (Streamlined) Forms A and B (Torrance, 1998). The goal was that by having the testing company score the tests, one potential threat to external validity, scorer error, would be decreased considerably (Donnell, 2004).

In this study, the independent variable was the treatment provided to participants in Group 1. The study’s three groups were categorical, consisting of participants who happened to be enrolled in one of the six selected class sections of the three pre-admission courses. Each participant was issued an identifier, a five-digit number in a nominal scale, representing the non-ordered character of the groups. Group 1 was the group that was administered treatment one (training in the use of creative thinking skills); Group 2 received a foil treatment (training in strategies to organize one’s thinking about a specific idea); and Group 3, the control, was given no treatment at all.

The change variable in the study was the difference between the individuals’ pre-test scores and the post-test scores. These differences were represented by ratio data. The pre- and post-test sub-score differences were analyzed through the use of the Pearson correlation to correlate fluency, originality, title of picture, elaboration, and closure of the combined scores in each of the groups—the two experimental groups and the control group (Donnell, 2004).
Analysis of Questionnaires

In analyzing the data from the questionnaires, descriptive statistics were provided for each of the three groups. Each item provided data regarding each group's overall perception of a distinct aspect of creative thinking. The two sets of data, the groups’ differences in pre- and post-test scores and the participants’ perceptions as measured by the questionnaire items, were correlated. The Pearson correlation was used to compute the relationships between the questionnaires’ items and the pre- and post-test differences.

Limitations and Delimitations

In a well-designed quasi-experimental study, the goal is that there be no unanticipated variables. Rather, it is hoped that there is a statistical control for all variables. This ideal goal is seldom obtained in social science research. In this study, the data provided by the pre- and post-tests and the questionnaires, as well as the empirical data gathered from observing the implementation of the two treatment conditions, demonstrated that possible confounding variables existed. As a result, these unexpected variables ended up being relevant to varying degrees in regard to the results of the study. Any extraneous factors are discussed in the final chapter of the study. These extraneous factors may have influenced the results in some way, making their interpretation confusing or distorted.

One of the study’s limitations was the population from which the participants were drawn. This study was confined to testing a core element of Vygotsky’s theory of creativity with participants who were all preservice teachers enrolled in the same Midwest state university. These factors, along with the common goal of all the
participants to become teachers, narrowed the scope of the study and acted collectively as a limiting factor.

Another limitation came from the relatively small number of participants in the study. While the sample size was determined through a power analysis to be large enough to detect important differences for the group as a whole, any results of the study would likely not have the power to detect differences between such sub-groups as, for example, elementary preservice teachers, science and mathematics majors, or art majors.

A major delimiting factor was the amount of time used to train participants in the use of the thinking skills in both treatment one and treatment two. There was some indication that the time during which individuals were instructed in using creative thinking skills must be extensive if any significant effect was going to occur (Donaghy, 1987). Other studies showed that the amount of instruction needed to effect some change was uncertain (Cotton, 1991). A factor that was likely to influence the preservice teachers in both experimental groups, regardless of the brief amount of time for instruction, was the exposure that participants had to the language of creative thinking and to previously unfamiliar ideas about thinking strategies.

As a result of the complexity of creativity, there was yet another delimitation. There is no universally-accepted explanation of creativity. Nor is there consensus on the criterion for predicting creativity in individuals. At best, all of these factors make creative abilities difficult to determine (Torrance, 1986). There is no precise instrument that can adequately measure all of the aspects of such a complicated human quality. As a result, the TTCT being used in this study to measure the capacity for creativity served as a
psychometric procedure that was capable of assessing specific creative thinking skills. According to a large portion of the creativity research, these skills could be assessed by measuring fluency, flexibility, elaboration, and originality (Guilford, 1967; Torrance, 1966). Even though the TTCT has been shown to be a reliable instrument in measuring creativity, it does not measure all of the creativity characteristics that researchers have identified (Renzulli & Delcourt, 1986).

Summary of Methodology

This quantitative study used a quasi-experimental design, consisting of pre-test and post-test instruments, to test a theory and to identify, from the results of the test, implications for teacher preparation. The central hypothesis (alternative) was that instruction in the use of creative thinking skills improved a preservice teacher’s capacity to be creative. Secondary hypotheses stated that (1) the capacity of a preservice teacher’s creativity was related to that individual’s perceptions of her or his experience with creative activity and her or his attitude toward the value of creative thinking; (2) the degree of increased creativity was related to the change in participants’ perceptions.

These hypotheses reflected a key assumption in Vygotskian creativity theory. The assumption was that the capacity for creativity existed in all individuals, emerging gradually throughout the human life-span, and that it was dependent on the richness and amount of one’s knowledge and life experiences. The research design in this study involved a non-random assignment of participants to three groups—two treatment conditions and a control group. All participants were pre-tested and post-tested. The
various ways in which this design controlled the threats to its validity were discussed, along with the precautions that were taken for accuracy. The findings produced by the analyses of the data are described in the next chapter.
CHAPTER IV
RESULTS

This chapter describes the results of the study. It has been organized to be aligned
with the central research question, followed by both of the secondary research questions.
The research hypotheses are clearly stated in both symbolic and narrative forms. The
results of the Torrance Tests of Creative Thinking (TTCT) pre-test and post-test scores
along with differences among the three groups regarding the sub-scores will then be
presented. A discussion of the results of the questionnaires’ items will complete the
chapter.

The study’s central question asked: Given Vygotsky’s implication that formal
instruction improves one’s capacity for being creative, to what extent, if any, are there
differences between the pre-test and post-test creativity scores of the three groups? Two
secondary research questions extended this core question: (1) To what extent, if any, are
there relationships between preservice teachers’ TTCT pre-test scores and (a) select
demographic variables (i.e., gender, age, and size of high school which they attended)
and (b) their perceptions of their own experience with creative thinking (e.g., their own
preparation to teach learners about creative activity and their regard for the value of
knowing how to think creatively) prior to their participation in the study? (2) To what
extent, if any, are there differences among the three groups in the preservice teachers’
perceptions of creative thinking following participation in the study?

Any relationships between participants’ pre-test scores and select variables at the
beginning of the study were intended to be examined by the first of the secondary
research questions. These variables included three demographic factors—gender, age, and size of high school that each participant attended. The pre-study questionnaire’s items provided information about both the demographic variables and the perceptions of the participants as they started the study. The items regarding participants’ perceptions included their prior experiences with creative thinking, their own preparation to teach learners how to use creative thinking skills, and their attitudes regarding the importance of learning these skills.

The other secondary research question asked: To what extent, if any, are there differences among the three groups in the preservice teachers’ perceptions of creative thinking following participation in the study? This question attempted to examine the effects on the attitudes of each group’s participants following the three different conditions the individual groups experienced during the five-week period of the study.

Study Hypotheses

Primary Hypothesis

The central hypothesis is indicated as:

\[ H_0: M_{1A} = M_{1B} \quad \text{and} \quad M_{2A} = M_{2B} \quad \text{and} \quad M_{3A} = M_{3B} \quad \text{on TTCT (2 tailed).} \]

In narrative form this states that instruction in the use of creative thinking skills does not have an effect on a preservice teacher’s capacity to be creative \((M_1, M_2, M_3 = \text{means of pre- and post-test creativity scores for each of the three groups}), as measured by paired-samples t tests. A and B represent the TTCT pre- and post-test.

The alternative hypothesis is shown as:

\[ H_a: M_{1A} \neq M_{1B} \quad \text{and} \quad M_{2A} \neq M_{2B} \quad \text{and} \quad M_{3A} = M_{3B} \quad \text{on TTCT.} \]
In narrative form, this hypothesis states that instruction in the use of creative thinking skills ($M_1$) improves a preservice teacher’s capacity to be creative; instruction in general thinking strategies ($M_2$) improves a preservice teacher’s creative capacity to a lesser degree or not at all while no intervention ($M_3$) results in very little or no improvement, as measured by paired-samples $t$ tests. A and B represent the TTCT pre- and post-test.

Secondary Hypotheses

The two secondary research questions are reflected in the following ways. The first of the secondary questions is indicated by:

$$H_0: r (M_a \text{ and } M_1 \text{ and/or } M_2 \text{ and/or } M_3) = 0.$$ 

This hypothesis states that there is no correlation between the mean of the pre-test scores ($M_a$) of the preservice teachers and ($M_1$) select demographic variables and ($M_2$) the preservice teachers’ perceptions of their own experiences with creative thinking, ($M_3$) as well as their perceptions of their own preparation to teach learners about the use of creative thinking skills and their attitudes toward the value of knowing how to engage in creative thinking.

The alternative hypothesis is indicated by:

$$H_a: M_a \text{ and } M_b \text{ and } M_c \neq M_1 \text{ and/or } M_2 \text{ and/or } M_3.$$ 

Again in narrative form, this hypothesis is stating that there is a correlation between the participants’ pre-test scores in the three groups ($M_a, M_b, M_c$) and (a) the select demographic variables ($M_1$) and (b) the preservice teachers’ perceptions of their own experiences with creative thinking ($M_2$), as well as their perceptions of their own
preparation to teach learners about the use of creative thinking skills and their attitudes toward the value of learning creative thinking skills \((M_3)\).

The second of the secondary questions is reflected in this hypothesis:

\[ H_0: M_1 = M_2 = M_3 \]

This hypothesis states that there are no differences among the three groups regarding the preservice teachers’ perceptions of creative thinking after their participation in the study.

The alternative hypothesis is indicated by:

\[ H_a: M_1 \neq M_2 \neq M_3 \]

This hypothesis is stating that there are differences between the three groups \((M_1, M_2, M_3)\) in regard to the attitudes of the preservice teachers \((M_a, M_b, M_c)\) toward aspects of creative thinking as measured by the second questionnaire.

Sample Adjustments Prior to Analysis

Prior to analyzing the data collected for this study, the demographics and study characteristics of the participants were examined. It was found that Group 1 and Group 3 each included participants whose ages were over 25. Because Vygotsky theorized that age, and the life experience that accompanies it, impacts an individual’s creative capacity, the age of the study group was intended to span only the “traditional” college years—18 to 24. In order to avoid any confounding effect that may be due to these outliers over the age of 25, the nine participants (seven in Group 1, two in Group 3) were eliminated from the study. In addition, prior to determining the number of valid participants in each group, six participants who received both treatments or who received
one of the treatments and also happened to be part of the control group were excluded from the analysis—six students in the initial data set fell into this category. Therefore, the final groups whose data were analyzed for this study were: Group 1 = 30, Group 2 = 42, Group 3 = 41.

TTCT Scores for This Study

*Creativity Index Score*

In analyzing data from each of the individual participants, a single creativity index score (CI) was calculated for each of the three groups. Torrance claimed that this index provided the most useful measure to reflect an individual’s overall level of creativity (Torrance, 1998). The CI score developed by Torrance consists of the mean of the age-based CI and the grade-based CI, along with the addition of the creative strengths checklist for each individual. Based on Torrance’s 150 point scale, there was the possibility with the scoring of the TTCT of adding a total of 26 creativity strengths to the averaged score of age and grade-based CI scores for a total high score of 176.

The change variable for Group 1 showed that the treatment administered to this group had a significant effect (see Table 4). The central hypothesis, reflecting the primary research question, was analyzed using paired-samples $t$ tests, $p \leq 0.05$, 2-tailed, for detecting differences between the scores on the pre- and post-tests. Consequently, the primary null hypothesis was rejected and the alternative was accepted.

The results of this study indicated that Group 1 had a pre- to post-test CI difference of 12.45 points, Group 2 had a difference of 1.32 points, and Group 3 (control)
had a difference of 1.29. While the participants in all three groups showed an increase in their aggregate CI scores, Group 1 showed a very noticeable change between the pre- and post-test CI scores. Both Groups 2 and 3 showed a slight but similar increase in their change score. The change increase in Group 1’s score strongly suggested that the treatment given to Group 1 had at least a noticeable short-term effect.

Table 2

*TTCT Pre- and Post-Test, Paired-Samples t Test by Group.*

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Test Creativity Index (CI)Mean</th>
<th>Pre-Test CI StDev.</th>
<th>Post-Test Creativity Index (CI)Mean</th>
<th>Post-Test CI StDev.</th>
<th>Mean Difference</th>
<th>St.Dev Of Mean Diff.</th>
<th>t</th>
<th>Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>123.85</td>
<td>15.45</td>
<td>136.30</td>
<td>14.70</td>
<td>12.45</td>
<td>14.98</td>
<td>4.551</td>
<td>.000</td>
</tr>
<tr>
<td>n=30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>129.30</td>
<td>18.74</td>
<td>130.63</td>
<td>16.62</td>
<td>1.32</td>
<td>17.92</td>
<td>.478</td>
<td>.635</td>
</tr>
<tr>
<td>n=42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>134.10</td>
<td>16.62</td>
<td>135.40</td>
<td>14.57</td>
<td>1.29</td>
<td>15.88</td>
<td>.521</td>
<td>.605</td>
</tr>
<tr>
<td>n=41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Torrance's Creativity Index, based on a 150 point scale, is the average of the age-based creativity index and the grade-based creativity index plus the creative strength ratings which can total up to 26 additional points.

**National Percentiles**

One set of scores provided by STS scoring experts was the national percentile ranks. The comparison of the three groups’ scores to the national percentile (NP) ranks (the ranking of a group’s average raw score when compared with the scores of other
similar groups in the normative sample) provided the following results. The NP score indicated with which percentage point in the normative sample each group in the study corresponded. The normative sample used for the data set in this study consisted of 2,336 older adolescents and young adults (9th grade through age 25). The averaged standard score (SS) was computed by adding together each of the five sub-scores and dividing by five.

Using the table for the appropriate normative sample in Torrance’s *Norms-Technical Manual* (Torrance, 1998), the NP of each group’s raw scores was as follows: Group 1 had a NP of 48% in the pre-test and 67% in the post-test; Group 2 had a NP of 57% in the pre-test and 59% in the post-test; Group 3 (control) had a NP of 65% in both the pre- and post-tests. The raw scores for all three groups showed a similar pattern of change comparing the groups’ raw scores to the national percentile of raw score norms. Again the data from Group 1 showed significant differences among the groups as the change between pre-test raw scores and post-test raw scores were compared to the national percentiles (see Table 2).

The CI of each group was also computed to find its level on the NP index. The CI of Group 1 compared to 53% of the corresponding normative sample for the pre-test (i.e., the CI of Group 1 was at the same percentile as 53% of the normative sample on the pre-test) and at 74% of the same normative sample for the post-test. The CI of Group 2 compared to 65% of the normative sample for the pre-test and to 63% on the post-test. The CI of Group 3 compared to 76% of the same normative sample for the pre-test and to 71% on the post-test.
These figures indicated that the raw scores of each of the groups for both the pre- and post-test showed a significant increase for Group 1 in the NP rankings between the pre- and post-tests. While Group 2 and Group 3 showed a small increase in their ranking on the national percentile scale, Group 1 showed a sizeable increase in its post-test ranking in the national percentiles. These results provide further evidence about the score differences among the three groups. The important differences here were the magnitude of change among the three groups between the pre-test and the post-test scores—i.e., raw scores, creativity index scores, and national percentile rankings.

Table 3

**TTCT Pre- and Post-Test Scores Compared to National Percentiles.**

<table>
<thead>
<tr>
<th>Grp.</th>
<th>Pre-Test raw score (Nat'l %)</th>
<th>SD</th>
<th>Post-Test raw score (Nat'l %)</th>
<th>SD</th>
<th>% of chge</th>
<th>Pre-Test CI (Nat'l %)</th>
<th>SD</th>
<th>Post-Test CI (Nat'l %)</th>
<th>SD</th>
<th>% of chge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>97</td>
<td>12.28</td>
<td>106</td>
<td>12.4</td>
<td>22%</td>
<td>111</td>
<td>13.75</td>
<td>122</td>
<td>12.4</td>
<td>11%</td>
</tr>
<tr>
<td>n =30</td>
<td>48%</td>
<td></td>
<td>70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>101</td>
<td>13.75</td>
<td>102</td>
<td>12.8</td>
<td>1%</td>
<td>116</td>
<td>16.72</td>
<td>117</td>
<td>13.9</td>
<td>-2%</td>
</tr>
<tr>
<td>n =42</td>
<td>57%</td>
<td></td>
<td>59%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>104</td>
<td>12.20</td>
<td>105</td>
<td>11.9</td>
<td>0%</td>
<td>120</td>
<td>13.34</td>
<td>121</td>
<td>12.6</td>
<td>-5%</td>
</tr>
<tr>
<td>n =41</td>
<td>65%</td>
<td></td>
<td>65%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Both the change score increase in the CI for Group 1 and the increase in the NP difference between the pre- and post-test CI scores for Group 1 indicated that the treatment which Group 1 received contributed a significant increase in the combined creative capacities of the participants in Group 1. As a result, the primary null hypothesis was rejected; the alternative hypothesis was supported.

**TTCT Sub-Scores**

Regarding the pre-test results, Group 1 scored the lowest of the three groups on each one of the sub-scores except “Fluency.” Group 3 (the control group) scored noticeably higher than Groups 1 or 2 on three of the five sub-scores—fluency, originality, elaboration—as well as on the score which served as the average of the five sub-scores. Group 3, however, scored slightly lower than Group 2 on “Title of Pictures” and on “Resistance to Premature Closure” sub-scores. See Table 6 for all pre- and post-test sub-scores for all groups.

On the post-test sub-scores, Group 2 consistently and noticeably scored the lowest of the three groups. Group 2 also scored the lowest on the post-test average score of the five sub-scores, as well as the lowest on the post-test checklist of 13 creative strengths. Group 1 and Group 3 scored very close to each other on all of the post-test sub-scores except on the “Originality” sub-score—Group 1 scored noticeably higher than Group 3 and even higher than Group 2. Also on the post-test scores, Groups 1 and 3 scored similarly on the checklist of 13 creative strengths and on the average score of the five sub-scores, as well as on the overall post-test creativity index score.

The results of the paired-samples t tests regarding pre- and post-test sub-score
differences, while interesting, did not contribute decisive information to the study's purpose. In spite of differences among the groups' sub-scores, there was no pattern or explanation regarding the effect of treatment one on Group 1 except in one area. The largest difference among the groups' sub-scores occurred with Group 1 and the increase of 17.64 points (raw-score difference between pre- and post-test, p=.002) in regard to the "Originality" sub-score. This difference, consequently, was not the result of sampling error or chance. This, in a less dramatic way than previously identified results, supported Table 4

**Summary of the 3 Groups' Sub-Scores for Pre-test (TTCT-A) and Post-Test (TTCT-B)**

<table>
<thead>
<tr>
<th>Group &amp; No.</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Paired Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>(1) Average Score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (m=30)</td>
<td>97.03</td>
<td>12.28</td>
<td>106.20</td>
</tr>
<tr>
<td>2 (m=42)</td>
<td>101.26</td>
<td>14.85</td>
<td>102.38</td>
</tr>
<tr>
<td>3 (m=41)</td>
<td>104.00</td>
<td>12.20</td>
<td>105.65</td>
</tr>
<tr>
<td>(2) Fluency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (n=30)</td>
<td>97.46</td>
<td>16.31</td>
<td>113.80</td>
</tr>
<tr>
<td>2 (n=42)</td>
<td>96.64</td>
<td>17.40</td>
<td>111.07</td>
</tr>
<tr>
<td>3 (n=41)</td>
<td>101.31</td>
<td>15.95</td>
<td>115.58</td>
</tr>
<tr>
<td>(3) Originality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (n=30)</td>
<td>92.43</td>
<td>15.52</td>
<td>106.53</td>
</tr>
<tr>
<td>2 (n=42)</td>
<td>92.88</td>
<td>19.93</td>
<td>98.19</td>
</tr>
<tr>
<td>3 (n=41)</td>
<td>97.12</td>
<td>15.24</td>
<td>100.46</td>
</tr>
</tbody>
</table>

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Table 4—Continued

<table>
<thead>
<tr>
<th>Sub-scores</th>
<th>Pre-Test</th>
<th></th>
<th></th>
<th>Post-Test</th>
<th></th>
<th></th>
<th>Paired Differences</th>
<th></th>
<th>t</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Sub-scores</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group &amp; No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Title of Pictures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (m=30)</td>
<td>104.43</td>
<td>15.98</td>
<td>111.40</td>
<td>21.63</td>
<td>-6.966</td>
<td>23.26</td>
<td>-1.64</td>
<td>.112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (m=42)</td>
<td>110.21</td>
<td>18.72</td>
<td>110.38</td>
<td>17.09</td>
<td>-1.666</td>
<td>19.82</td>
<td>-.054</td>
<td>.957</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (m=41)</td>
<td>110.04</td>
<td>13.36</td>
<td>111.68</td>
<td>18.81</td>
<td>-1.634</td>
<td>20.39</td>
<td>-.513</td>
<td>.611</td>
<td></td>
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</tr>
<tr>
<td>(5) Elaboration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (m=30)</td>
<td>106.73</td>
<td>16.43</td>
<td>97.43</td>
<td>17.40</td>
<td>9.300</td>
<td>14.46</td>
<td>3.521</td>
<td>.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (m=42)</td>
<td>108.47</td>
<td>15.86</td>
<td>96.26</td>
<td>17.59</td>
<td>12.21</td>
<td>14.79</td>
<td>5.351</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (m=41)</td>
<td>116.02</td>
<td>13.16</td>
<td>99.07</td>
<td>17.23</td>
<td>16.951</td>
<td>17.31</td>
<td>6.270</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Resistance to Premature Closure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (m=30)</td>
<td>84.26</td>
<td>12.89</td>
<td>101.90</td>
<td>12.90</td>
<td>-17.633</td>
<td>17.14</td>
<td>-5.633</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (m=42)</td>
<td>97.88</td>
<td>20.28</td>
<td>96.16</td>
<td>14.72</td>
<td>1.710</td>
<td>22.20</td>
<td>.500</td>
<td>.620</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (m=41)</td>
<td>95.17</td>
<td>17.34</td>
<td>101.31</td>
<td>16.53</td>
<td>-6.146</td>
<td>19.24</td>
<td>-2.045</td>
<td>.047</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The finding that treatment one had an important effect on the increased creative capacities of the participants in Group 1.

The one set of sub-scores that showed results which looked anomalous was that of “Elaboration.” Although the post-test showed all the sub-scores of each group to be higher than the pre-test sub-scores, the only exception was in the “Elaboration” sub-score. All three groups had post-test scores which were unusually lower than the groups’ pre-test sub-scores. Dr. John Kauffman of the Scholastic Testing Service, Inc., an expert in interpreting the TTCT scores, stated that this was not an irregularity in the scoring
process. He explained that with very young samples and with older samples the post-test “Elaboration” sub-score was often lower than that of the pre-test as a result of the participants’ experiences of having taken the pre-test. During those experiences, participants found out that if time was spent on adding details and extra elements to the concepts in the test, they did not get many ideas completed on the test. When taking the post-test, these same participants made an intentional attempt to get as many ideas finished as possible. They tended to ignore the instructions given at the beginning of each part of the post-test to make their visual ideas as interesting as possible, adding whatever detail it would take to tell as complete a story in the test’s item as possible.

Kauffman also suggested that the treatment given to Group 1 may have been weak in emphasizing the notion of detail and the addition of interesting elements to a concept. As a result the participants paid attention to the goal of completing as much of the assessment as possible in the allotted time. Participants, for example, found it satisfactory to give the title “Dog” to a picture and move on to the next idea rather than to add more lines to the previous picture and to give a more interesting title, such as “Dog Chasing a Boy Wearing a Hat” (personal communication, July 6, 2007).

There is a tendency to read substantive meaning into the results arising from the pre-test and post-test sub-scores of the TTCT. Although there were some differences in several of the sub-group scores that were significant at .05 and five of them at .01, the mean differences among the three groups were rather unremarkable. There was not a consistent pattern of differences to draw practically significant conclusions.
The major conclusion that can be drawn from Table 4 is that for each of the sub-groups, except in “Elaboration,” the amount of change between Group 1’s pre-test sub-scores and post-test sub-scores was considerably greater than the amount of change for Group 2 and Group 3. Even though the “Elaboration” post-test sub-score decreased for all the groups, Group 1 showed the least amount of decrease. This pattern for Group 1 with its sub-scores provides further support for the primary finding of this study that treatment one had a significant effect on the post-test scores of participants in Group 1.

In summary, the results connected to the primary hypothesis provided robust evidence that instruction in the use of creative thinking skills does increase the capacities of preservice teachers to think creatively. It must be added, however, that the study only supports this result over a short period of time. The design of the study allowed for a period of five weeks between the pre-test and the post-test, Forms A and B of the Torrance Tests of Creative Thinking. Without data to measure the creativity scores twelve weeks or six months or a year between the pre- and post-tests, the evidence supporting the primary research question of the study must be framed within the period of five weeks.

Observing the Three Groups

The attitudes of most of the study’s participants following the post-test were unresponsive. Unlike the general response following the pre-test (e.g., “Oh, I did not do well at all”, “The test was much different than I expected”, “I’m no artist; that’s for sure.”), the attitudes of the participants showed much less interest in the process of taking the post-test. The fact, though, that Group 2 and Group 3 showed little difference
between the pre- and post-test scores is somewhat puzzling. Their levels of interest and engagement in the study were generally much higher than the levels of interest and engagement shown by the participants in Group 1. This was the case for both the pre-test and the post-test.

A different dynamic existed during the administration of both the pre-test and post-test for the participants in Group 1 compared to that of Groups 2 and 3. The levels of interest in the study and the attitudes of the participants in this group seemed to the researcher to be low; there was an overall negative outlook toward having to participate in the study. The likelihood that this attitude would affect the results of Group 1’s scores seemed inevitable; the scores were apt to be inaccurately skewed.

However, the distributions of both pre-test and post-test creativity scores were similar for all three groups. The distributions were close to normal with moderate kurtosis. Consequently, it is fair to conclude that the treatment provided to Group 1 was the only variable that was different from any of the variables that affected the change variables for the three groups.

Questionnaire Results

The result of analyzing the data about the demographic items on the pre-study questionnaire for the entire sample of 113 preservice teachers shows a clear pattern of frequencies among the groups in regard to these three demographic variables. Age, gender, and the size of high school attended by the participants are all variables that were identified in the literature as factors that may affect the development of creative thinking. These variables were intended to account for any particular abilities of participants before
coming into the study (Lowenfeld & Brittain, 1970).

A majority of the participants in each group attended high schools larger than 500 students. Close to three-fourths of the participants in each group were female participants. In addition, since most of the participants in the groups were in the 18-20 year-old range and the rest were in the 21-24 year-old range, age did not seem to be a differentiating variable in this study (see Table 5).

Secondary Hypothesis: Number One

In analyzing any correlations between the participants’ demographic variables and their pre-test creativity scores, the Pearson Product Moment Correlation was used. It showed that the degree to which these variables are related to the pre-test (Torrance Tests of Creative Thinking, Form A) scores is extremely low. This was the case for all three groups. In analyzing the entire sample of 113 participants, no relationship between the demographic variables and the pre-test scores was greater than moderately low. None of

As a result, no data table is presented here. Age, gender, and size of high school attended the correlations was statistically significant at $p = .05$. In other words, the data showed that no significant correlation existed between the mean of the pre-test scores ($M_a$) of the preservice teachers and select demographic variables ($M_i$), by the participants were not correlated to any significant degree with the creative thinking abilities with which the participants began the study.

The second part of this hypothesis (b) asked about the association between the perceptions of the participants toward creative activity and the pre-test creativity scores (TTCT, Form A). This hypothesis was an attempt to establish a baseline of pre-study
perceptions about aspects of creative thinking to which the perceptions of the participants could be compared at the close of the study.

Table 5

Table of Pre-Study Demographics

<table>
<thead>
<tr>
<th>Group</th>
<th>Size of H.S</th>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under 500</td>
<td>Over 500</td>
<td>Female</td>
</tr>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 30</td>
<td>36.7%</td>
<td>63.4%</td>
<td>70.0%</td>
</tr>
<tr>
<td></td>
<td>[11]</td>
<td>[19]</td>
<td>[21]</td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 42</td>
<td>28.6%</td>
<td>71.5%</td>
<td>88.1%</td>
</tr>
<tr>
<td></td>
<td>[12]</td>
<td>[30]</td>
<td>[37]</td>
</tr>
<tr>
<td>Group 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 41</td>
<td>22%</td>
<td>78.1%</td>
<td>78.0%</td>
</tr>
<tr>
<td></td>
<td>[9]</td>
<td>[32]</td>
<td>[32]</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 113</td>
<td>28.3%</td>
<td>71.7%</td>
<td>79.6%</td>
</tr>
<tr>
<td></td>
<td>[32]</td>
<td>[81]</td>
<td>[90]</td>
</tr>
</tbody>
</table>

The results of bivariate correlation tests showed consistently low, non-significant correlations between the participants’ perceptions of creative thinking and their pre-test creativity scores. None of the relationships between the pre-test scores and the participants’ various perceptions toward aspects of creativity (e.g., their perceptions of their own experiences with creative thinking, their perceptions of their own preparation to teach learners about the use of creative thinking skills, and their attitudes toward the
value of knowing how to engage in creative thinking) was statistically significant. As a result, the null hypothesis for the first of the two secondary hypotheses was accepted; the alternative was rejected (and no specific data table is presented).

In summarizing the two parts of the secondary research question which this hypothesis reflected, there was strong evidence that the factors of gender, age of the participants, and size of the high school which the participants attended did not significantly affect participants' levels of creative thinking at the outset of the study. In addition, the perceptions of the participants toward aspects of creative thinking as stated in the pre-study questionnaire were not factors in the level of creativity as measured by the pre-test creativity scores. The answer that this study found in regard to this research question, then, is that no relationship exists between preservice teachers' pre-test creativity scores and (a) select demographic variables and (b) their perceptions of their own experiences with creative thinking.

**Secondary Hypothesis: Number Two**

The other secondary hypothesis stated that there were no differences among the three groups regarding the preservice teachers’ attitudes toward aspects of creative thinking as measured by the second questionnaire. Carrying out a between-groups ANOVA, the degree of difference between the groups regarding the participants’ perceptions of creative activity after participating in the study was determined (see Table 6).

Among the three groups, Table 6 indicates strong differences, significant at .05 level, between groups on the post-study questionnaire items. The mean squares for each
post-study questionnaire item were two unequal variance estimates and their ratio in each case was larger than 1. This result of the between-groups ANOVA, consequently, suggested that the differences were due to a treatment effect (i.e., there existed significant differences between the groups). The differences among the three groups appeared to be due to group membership (i.e., the treatment effect of the independent variable in the study).

Table 6

<table>
<thead>
<tr>
<th>Post-study Questionnaire Item</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question No. 1</td>
<td>11.990</td>
<td>13.085</td>
<td>.000</td>
</tr>
<tr>
<td>Question No. 2</td>
<td>4.218</td>
<td>4.743</td>
<td>.011</td>
</tr>
<tr>
<td>Question No. 3</td>
<td>15.412</td>
<td>23.291</td>
<td>.000</td>
</tr>
<tr>
<td>Question No. 4</td>
<td>2.697</td>
<td>4.183</td>
<td>.018</td>
</tr>
<tr>
<td>Question No. 5</td>
<td>22.660</td>
<td>44.182</td>
<td>.000</td>
</tr>
</tbody>
</table>

Each post-study questionnaire item indicated that there were significant differences among the study’s three groups. Because the Levene’s test of homogeneity of
variances showed that the last question on the post-study questionnaire was the only variable to be significant at .01, the assumption of homogeneity of variances was violated. Given that this was the only Levene test that was significant, the next step in the analysis was to proceed to conduct the post hoc multiple comparisons test. This was intended to identify what the differences were that existed among the groups. The Tukey HSD was used to provide further details about the differences shown by the ANOVA (see Table 7).

For the first item in the post-study questionnaire, at least 2 of the 3 groups differed significantly in their means—Groups 1 and 2, Groups 1 and 3. Group 1 had a lower mean than Groups 2 or 3 in regard to questionnaire item one (there was no evidence to draw any conclusions about differences between Groups 2 and 3). The second item indicated that Groups 1 and 2 had significant mean differences but this time Group 1 had a higher mean regarding item two than Group 2. There was insufficient evidence to determine differences between Groups 1 and 3 and Groups 2 and 3.

The third item indicated that Groups 1 and 2 and Groups 1 and 3 included significant mean differences in which Group 1 had a higher mean than either Group 2 or Group 3. There was insufficient evidence to contrast groups 2 and 3 in connection with item three. Groups 1 and 2 and Groups 1 and 3 had significant mean differences regarding the fourth item. The fifth item also showed that Groups 1 and 2 and Groups 1 and 3 had significant mean differences. The means for both Groups 2 and 3 were greater than that of Group 1.
The pattern that seems to be evident here shows that questionnaire items 1 and 5 addressed issues that were linked in some way, while questionnaire items 2, 3 and 4 showed a common connection in their content. The mean for Group 1 is noticeably less than the means of both Groups 2 and 3 in items 1 and 5. The mean for Group 1 is noticeably greater than the means of Groups 2 and 3 in items 2, 3 and 4.

Table 7

Tukey HSD Post Hoc Tests: Differences Among Groups.

<table>
<thead>
<tr>
<th>Post-Study Questionnaire item</th>
<th>(I) Group</th>
<th>(J) Group</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Mean Differences among grps</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question No. 1</td>
<td>1</td>
<td>2</td>
<td>-.69048*</td>
<td>.16181</td>
<td>1 less than 2</td>
<td>.000</td>
</tr>
<tr>
<td>Question No. 1</td>
<td>1</td>
<td>3</td>
<td>-.77642*</td>
<td>.16263</td>
<td>1 less than 3</td>
<td>.000</td>
</tr>
<tr>
<td>Question No. 1</td>
<td>2</td>
<td>3</td>
<td>-.08595</td>
<td>.14861</td>
<td>Insuff evdnce</td>
<td>.832</td>
</tr>
<tr>
<td>Question No. 2</td>
<td>1</td>
<td>2</td>
<td>.49048*</td>
<td>.15941</td>
<td>1 greater than 2</td>
<td>.007</td>
</tr>
<tr>
<td>Question No. 2</td>
<td>1</td>
<td>3</td>
<td>.30407</td>
<td>.16021</td>
<td>Insuff evdnce</td>
<td>.144</td>
</tr>
<tr>
<td>Question No. 2</td>
<td>2</td>
<td>3</td>
<td>-.18641</td>
<td>.14640</td>
<td>Insuff evdnce</td>
<td>.413</td>
</tr>
<tr>
<td>Question No. 3</td>
<td>1</td>
<td>2</td>
<td>.71905*</td>
<td>.13753</td>
<td>1 greater than 2</td>
<td>.000</td>
</tr>
<tr>
<td>Question No. 3</td>
<td>1</td>
<td>3</td>
<td>.91301*</td>
<td>.13819</td>
<td>1 greater than 3</td>
<td>.000</td>
</tr>
<tr>
<td>Question No. 4</td>
<td>2</td>
<td>3</td>
<td>.19396</td>
<td>.12628</td>
<td>Insuff evdnce</td>
<td>.278</td>
</tr>
<tr>
<td>Question No. 5</td>
<td>1</td>
<td>2</td>
<td>.35238*</td>
<td>.13573</td>
<td>1 greater than 2</td>
<td>.029</td>
</tr>
<tr>
<td>Question No. 5</td>
<td>1</td>
<td>3</td>
<td>.34715*</td>
<td>.13642</td>
<td>1 greater than 3</td>
<td>.033</td>
</tr>
<tr>
<td>Question No. 5</td>
<td>2</td>
<td>3</td>
<td>-.00523</td>
<td>.12466</td>
<td>Insuff evdnce</td>
<td>.999</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the .05 level.
Comparing Participants’ Perceptions

In comparing the means for each item in the post-study questionnaire among the three groups, there is solid evidence to claim that the treatment given to participants in Group 1 had an effect on their perceptions about creative activity. The between-groups ANOVA clearly showed that participants’ perceptions toward creativity-related experiences were influenced by the conditions established in each of the three groups.

The most obvious impact was evident in the means of each of the post-study questionnaire items for Group 1. For each of the five items on the post-study questionnaire, the mean of the 4-point Likert scale items was noticeably lower (i.e., items 1 and 5) or noticeably higher (i.e., items 2, 3 and 4) than the same means for Groups 2 and 3. In the case of each item, the means for Groups 2 and 3 were within .220 or less of each other. Meanwhile, the means for Group 1’s items ranged from .987 to .304 lower or higher than the next closest mean for the same item.

The results of post-study questionnaire item one showed that Group 1 rated college preparation for creative thinking lower than either Group 2 or 3. Item number two was rated slightly higher on the 4-point scale by participants in Group 1. This item dealt with perceptions about whether one can learn ways to act and think more creatively. Item three was rated noticeably higher by Group 1 than either Group 2 or Group 3. This item asked how important it was that students in K-12 learn how to use creative thinking skills. Item four which asked how important it was that people in all areas of employment know how to think creatively was rated noticeably higher by Group 1. Groups 2 and 3 rated this item lower and with the identical mean score. Item five was rated noticeably
lower by Group 1 compared to the ratings by either Group 2 or Group 3. This item asked to what extent one felt prepared to teach a future student how to use creative thinking skills.

Both practical and statistical significance were demonstrated in regard to the last of the secondary hypotheses, requiring the rejection of the null statement of the hypothesis and the acceptance of the alternative statement.

Chapter Four Summary

The fundamental question which this study set out to investigate was based in Vygotsky’s theory of the creative imagination, a developmental theory which was to be intricately connected to his overarching theory of cognition. Given Vygotsky’s view of the growth of creative activity over the human life-span, can formal instruction in the use of creative thinking skills add rich knowledge and experience to the imaginations of preservice teachers, thus improving their capacities for creativity? The results overwhelmingly confirmed that the sample group of preservice teachers who were given the intervention of training sessions which focused on the acquisition of skills used in creative thinking increased their capacities for creative activity. These results came in the form of a remarkable pre- to post-test increase in Torrance’s creativity index. They came in the form of a large increase in the corresponding national percentile (representing the normed sample for this group of participants) in comparison to the two groups that did not receive the creative skills training intervention. The results also came in the form of sub-scores that showed the treatment group to produce a majority of sub-scores that were statistically significant in their magnitude of improvement over the pre-test sub-scores,
with one exception, “Elaboration.” In addition, the impact of the intervention on the
treatment group as shown in the kinds of differences among the three sample groups
confirmed the “yes” answer to the primary research question. The hypotheses that
reflected this primary question further supported the “yes” answer when the rejection of
the null hypothesis (and therefore the acceptance of the alternative) was firmly
established. This occurred through the paired-samples $t$ tests which computed the
differences between the pre- and post-test scores in order to determine the change
variables.

Two secondary research questions extended this central question. The first one
asked to what extent if any, were there relationships between preservice teachers’ pre test
scores and (a) select demographic variables (i.e., size of high school which they attended,
gender, and age) and (b) their perceptions of their own experience with creative thinking
(i.e., their own preparation to teach learners about creative activity and their regard for
the value of knowing how to think creatively) prior to their participation in the study. The
data showed that no significant correlation existed between the mean of the pre-test
scores of the preservice teachers and select demographic variables. Age, gender, and size
of high school attended by the participants were not correlated to any significant degree
with the creative thinking abilities with which the participants began the study.

As they began their participation in the study, the perceptions of the participants
toward creativity-related experiences were correlated with their pre-test creativity scores.
Participants’ perceptions included their prior experiences with creative thinking, their
own preparation to teach learners how to use creative thinking skills, and their attitudes
regarding the importance of learning these skills. None of the relationships between the
pre-test scores and the participants’ various perceptions toward aspects of creativity was
statistically significant. As a result, the null hypothesis for the first of the two secondary
hypotheses, with both of its parts, was accepted; the alternative was rejected. The answer
to this secondary research question was clearly that there was no correlation between the
pre-test creativity scores and (a) the demographic variables and (b) the participants’
attitudes toward creativity.

The other secondary research question asked whether there were differences
among the three groups in the preservice teachers’ perceptions of creative thinking
following participation in the study. This question attempted to examine the effects on
participants’ attitudes toward creative activity at the study’s close. Although some impact
was anticipated in regard to the differences among the three groups as a result of the three
conditions each group experienced, the extent of those differences and the nature of the
differences were unexpected. Through a between-groups ANOVA and multiple
comparisons tests, there was robust support for claiming significant differences in the
preservice teachers’ attitudes toward creative thinking among the three groups. Not only
was the null hypothesis rejected but the alternative was accepted with solid confirmation.
CHAPTER V

DISCUSSION AND IMPLICATIONS OF THE RESULTS

This study attempted to demonstrate whether or not specific instruction in the use of creative thinking skills had a significant impact on preservice teachers’ capacities (or potential) for creativity. The results confirmed that instruction in the process leading to creative activity (treatment one) had a significant effect on increasing the participants’ potential, or for the sake of this study, capacities, for creative activity. Even though Vygotsky did not use the phrase, creative thinking skills, he referred to the “tools of the imagination,” the mental processes involved in thinking creatively. He is speaking of the classical mental abilities needed to engage in creative thinking (Vygotsky, 1930/1967), the same cluster of skills that Torrance refers to as that which can measure creative activity (Torrance, 1966).

Although the creativity research does not contain specific studies that address the question of whether teaching a set of skills affects individuals’ capabilities to be creative, there is a considerable amount of research linking increased intelligence to the instruction of creative thinking skills. The body of research dealing with intelligence and the instruction of creative thinking skills served to predict the results supported by this study. Even though the brief period of time between the pre-test and post-test along with the limited time used to carry out the instruction for treatment one limits the generalizability of the study’s results, the findings point to the need for further related studies.
Questions Driving This Research

The primary finding of the study gave strong support to the central research question: Given Vygotsky’s claim that formal instruction improves one’s capacity for being creative, to what extent, if any, are there differences between the pre-test and post-test creativity scores for the three groups within the sample set? The findings were not unlike the research findings by Renzulli, whose study made a strong connection between instruction in creative thinking skills and increased intelligence (Renzulli & Delcourt, 1986). Slavin, Lowenfeld, and Torrance, among others, held strongly to the belief that learning the skills used in creative thinking served students well in a variety of cognitive tasks (Lowenfeld & Brittain, 1970; Slavin, 2000; Torrance, 1986).

One of the unexpected findings of this study was the lack of significant relationships between preservice teachers’ pre-test scores and the three select demographic variables (i.e., the size of high school which the participants attended, gender and age). Previous studies indicated that each of these three variables played a role in improving the creative abilities of students (Lowenfeld & Brittain, 1970). The findings here, however, did not reveal strong connections of creative ability to any of these factors. The research question, attempting to isolate demographic factors that might influence the capacities of the study’s participants for creative activity prior to coming into this study, asked: To what extent, if any, were there relationships between preservice teachers’ pre-test scores and select demographic variables (i.e., size of high school which participants attended, age, and gender). Although the results bordered on making a connection between the size of the high school which the participants had attended and
the level of creative ability as measured by the pre-test scores, the connection was not statistically significant.

But perhaps even more unexpected was that there was no significant connection between the participants’ attitudes toward their own experiences with creative thinking and their pre-test creativity scores. This was the other half of the secondary research question described above. This secondary research question, in addition to asking about a connection between select demographic variables and the pre-test scores, also asked if there were relationships between preservice teachers’ pre-test scores and their perceptions of their own experience with creative thinking (i.e., their own preparation to teach learners about creative activity and their regard for the value of knowing how to think creatively) prior to their participation in the study. Again, there were no consistent correlations between participants’ perceptions of creative thinking and their pre-test scores.

The other secondary research question asked: To what extent, if any, were there differences among the three groups in the preservice teachers’ perceptions of creative thinking following participation in the study? Unlike the connection between participants’ attitudes toward creative activity as measured at the outset of the study and their pre-test creativity scores, the post-study questionnaire items about participants’ attitudes and the post-test creativity scores produced significant mean differences among the three groups. A between-groups ANOVA gave evidence of significant differences among the three groups in regard to the participants’ attitudes toward creative thinking as measured by the post-study questionnaire. In addition to producing a strong increase in its creativity index
change variable, Group 1 also produced results on the post-study questionnaire that showed strikingly different means for each post-study questionnaire item compared to the mean differences of Groups 2 and 3. Post hoc tests provided further detail about the nature of the mean differences.

The details of the significant mean differences on each of the post-study questionnaire items for Group 1, as described in Chapter 4, make clear that there was a treatment effect. But the nature of these mean differences leads to some interesting speculation. On the post-study questionnaire, following all testing and treatments, Group 1’s participants provided scores on the first questionnaire item that indicate their views of their college experiences as being much less helpful in preparing them to think creatively than the scores of the participants in either Group 2 or Group 3.

The experiences of having participated in the treatment and in the pre- and post-tests may have given Group 1’s participants a clearer idea of the nature of creative thinking and a more informed perspective on what it means to be engaged in creative activity. As a result, the perceptions of how their college experiences are preparing them to think in creative ways are much less optimistic than those of the other participants.

Group 1 rated item number four slightly higher than either Groups 2 or 3. Having received a treatment that provided the participants with a specific set of skills may have stirred the participants in Group 1 to feel more confident than the other participants in claiming that it is possible to learn how to act and think more creatively. In spite of having heard the phrase “creative thinking” frequently in the past, it is very likely that Group 1’s participants saw the complexity of creative thinking in a new way.
This may be the same dynamic that was at work in Group 1’s noticeably more positive view of the importance of K-12 students learning how to use creative thinking skills compared to that of either Group 2 or Group 3. Regarding the item about the importance of people in all areas of employment knowing how to think creatively, Group 1 responded with a noticeably higher score on the 4-point questionnaire than either of the other groups. Again, the exposure of the participants in Group 1 to the training in the use of a particular set of cognitive skills may have helped them to make concrete applications of these skills to a broader area of everyday activity.

The final item on the post-study questionnaire which asked about the preservice teachers’ preparation to teach future students how to use creative thinking skills was rated noticeably lower by Group 1 than either of the other groups. Having been exposed to a concentrated level of training in what creative thinking skills are and what is involved in applying these skills to creative initiatives was an intense experience for Group 1’s participants. This may have led many participants to view the teaching of creative thinking as a much more sophisticated mental process than those who were not part of Group 1’s treatment. As a result, one may perceive that more rehearsal and additional training are needed to adequately teach these skills to students.

Vygotsky’s Theory and the Interventions

According to Vygotsky’s theory of the creative imagination, the accumulation of knowledge and life experiences, no matter what the source, increases the imagination. It is from this ever-increasing imagination that individuals draw the material with which to engage in creative activity. The following matter, then, arises in connection with
Vygotsky's theory. Since both Group 1 and Group 2 participants were provided with new knowledge to add to their accumulation of knowledge and life experiences through treatments one and two, both groups ought to have shown an increase in creative capacities. But it is also true that the participants in Group 3, while not receiving an instructional intervention in regard to this study, were adding new information to their accumulation of knowledge and life experience during the period between the pre- and post-tests. While both Group 2 and Group 3 showed a similar increase in their creativity index scores, the increases were slight. Vygotsky would likely have responded that it was the degree of richness of new information that was different in regard to the treatment administered to the participants in Group 1. It is true that the content of treatment one contained more process-related material than the information-related material presented in treatment two.

Sustaining Vygotsky's Theory of the Creative Imagination

Without question, the study's results lend support to Vygotsky's theory of the creative imagination. Vygotsky claimed that the capacity for creative activity increases as people mature; this capacity can be promoted by increasing the accumulation of new knowledge and life experiences. The support of his theory, in turn, provides a compelling rationale for revisiting the ways in which preservice teachers are prepared to assist learners in tasks that involve thinking, particularly tasks that are best accomplished through creative thinking.

Vygotsky's ideas encourage learners to discern when thinking must generate multiple possibilities, search for many correct answers instead of one correct answer,
explore a number of ideas to address a single situation, or investigate seemingly unrelated areas of knowledge to produce new solutions to old dilemmas. This is teaching that goes beyond instilling knowledge; it is teaching that prepares students how to think (Harris, 1998).

This is the area of teacher preparation that might well be examined further as evidence supporting Vygotsky’s theory of the creative imagination is supported through studies similar to this one. His theory of the creative imagination, a parallel theory to his larger theory of the development of the mind, addresses the mental processes involved in creativity-related tasks. His emphasis on the influences that lead to the growth of learners’ minds and imaginations continues to need examination. This is of particular interest as preservice teachers are being prepared to enter a mainstream school culture in which measurement of knowledge through testing seems to be in conflict with Vygotsky’s view of teaching learners how to think.

The need for teachers to understand creative thinking, to think creatively themselves, and to be skilled in fostering creative activity in their students are crucial to the effective nurturing of creative activity by learners (Capossela, 2000; Donnell, 2004; Gardner, 1982, 1983; Slavin, 2000). Vygotsky’s views of creativity and imagination call for this need to be addressed through deliberate instruction (Vygotsky, 1933/1978). Exploring ways in which to implement this deliberate instruction, thoughtfully embedded in the curricula of today’s schools, is in order as teacher preparation is examined.
Implications for Future Study

The results of the study point to further exploration from which firmer conclusions can be drawn. One of those studies is to test the factor of the length of time over which the improved creativity index score is evident. The brief time of five weeks in this study suggests that a longer period of time for both the administration of the treatment used in Group 1, the rehearsal of the skills taught in that treatment, and the amount of time prior to completing the creativity post-test would strengthen the conclusions drawn from this investigation. There are pedagogical and curriculum matters that become of special interest if the impact of treatment one in this study is indeed effective over time.

The findings in this study lend strong support for replicating the same measures in other institutional contexts. The use of the same measures with similar sample populations resulting in repeated outcomes makes for a powerful conclusion. Such a conclusion makes possible wider generalizability of the repeated studies’ results. It also makes the development of direct applications practical and clearly based in research. More important, perhaps, than any other result, is the soundness of undertaking repetition of the study in similar institutional frameworks.

Further study also point to the use of sample sets of a variety of populations. A range of sub-groups characterized by disparate socioeconomic status, a wide age-range, diverse ethnicity, or varying degrees of intensive life experience (e.g., political refugees, immigrant children, survivors of terminal illnesses, self-made entrepreneurs, and international students studying in the U.S.) might be tested to more firmly support
Vygotsky’s claim. His claim is that the richness and abundance of one’s life experiences provide the imagination with material from which to draw in demonstrating creative activity.

Studies that directly test the belief that creative activity becomes mature in the adult would help to establish Vygotsky’s ideas as a viable developmental theory of creativity. Along with further research using a variety of interventions designed to promote the use of creative thinking skills, specific models of teaching creative thinking skills might strengthen the results of this study. In addition to using other instruments for teaching the use of creative thinking skills, utilizing assessment instruments other than the TTCT to measure the capacities of creativity (e.g., Guilford’s Alternative Uses Task, Wallas and Kogan’s Creativity Assessment) would serve as important variations to further validate the results of this study.

Conclusion

Learning to think creatively is one way in which to approach thinking tasks. It is a thinking process that is unlike critical thinking, analytical thinking or intuitive thinking; it is different from problem solving or brainstorming. It is distinct from productive thinking (Slavin, 2003). As a result of being a discrete thinking process, creative thinking requires a set of specific skills that foster creative activity.

The process taking place throughout this study demonstrated that instruction in the use of creative thinking skills had an effect on the creativity of the sample of preservice teachers. Since the treatment given to the preservice teachers made a difference for the time being, it would be hard to deny that Vygotsky’s theory of the
creative imagination was validated. Moreover, as the theory was held up by this study, a number of implications emerged, supporting the notion that there is a strong likelihood that creative activity can be fostered in learners (Vygotsky, 1933/1978). As this information-rich world grows even more complex for current students as they prepare to join a very diverse employment culture, knowing how to think in novel, inventive and divergent ways serves today's learners well.
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Appendix A

Pre-Study Questionnaire
Developed by Researcher
FIRST QUESTIONNAIRE: The CTS Perceptions Questionnaire

Identifier Number for this Study: __ __ __

CTS Perceptions Questionnaire 2007 (Form A)

<table>
<thead>
<tr>
<th>Gender:</th>
<th>(F)___ (M)___</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age:</td>
<td>18-20 y/o □ 21-24 y/o □ 25-28 y/o □ 29-39 y/o □ 40-49 y/o □ 50-50+ □</td>
</tr>
<tr>
<td>HS Size (# of students)</td>
<td>Under 250 □ 250-500 □ 501-800 □ 801 and above □</td>
</tr>
</tbody>
</table>

Please respond to each item by putting an X in one of the four boxes that most closely corresponds with your perception of or attitude toward the topic in each item.

<table>
<thead>
<tr>
<th></th>
<th>Not at All</th>
<th>Very Little</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent do you feel that your high school experiences have prepared you to think in creative and imaginative ways?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. To what extent do you feel that your college/university experiences so far have prepared you to think in creative and imaginative ways?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. On a weekly basis, to what extent do you approach a situation by thinking of all the possible ways to handle it prior to actually handling the situation?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. To what extent do you feel that you can learn ways to act and/or to think more imaginatively and creatively?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. How important do you feel it is that students in K-12 are taught how to use creative thinking skills?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. How important do you feel it is that people in all areas of employment know how to think imaginatively?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. To what extent do you feel prepared at this time to teach a future student how to use creative thinking skills?</td>
<td>□ □ □ □</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Post-Study Questionnaire
Developed by Researcher
**SECOND QUESTIONNAIRE: The CTS Perceptions Questionnaire**

*Identifier Number for this Study: __ __ __ __ __*

**CTS Perceptions Questionnaire 2007 (Form B)**

Please respond to each item by putting an X in one of the four boxes that most closely corresponds with your perception of or attitude toward the topic in each item.

<table>
<thead>
<tr>
<th>Question</th>
<th>Not at All</th>
<th>Very Little</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent do you feel that your college/university experiences so far have prepared you to think in creative and imaginative ways?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. To what extent do you feel that you can learn ways to act and/or to think more imaginatively and creatively?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. How important do you feel it is that students in K-12 are taught how to use creative thinking skills?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. How important do you feel it is that people in all areas of employment know how to think imaginatively?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. To what extent do you feel prepared at this time to teach a future student how to use creative thinking skills?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix C

Treatment One
Developed by Researcher
A Creative Thinking Skills Training Model

A brief instructional module in the use of thinking skills that leads to creative problem solving. This model is based on strategies described by Beyer (1997), Frederiksen (1984), and Slavin (2000).

I. Session One

A. Recognizing the various ways to think when faced with a situation (defined as a problem to be resolved, a concept to be applied, a decision to be made, or a task to be undertaken and completed)—explore the “Julia” example.

B. Understanding the characteristics of means-ends analysis, critical/logical thinking, strategy building, and creative thinking—examine examples of each.

C. Identifying the nature of creative thinking:
   1. To look at a situation and generate multiple solutions or ways in which to proceed—practice with 3 or 4 scenarios
   2. To think of novel responses to a situation—provide an example.
   3. To organize several possibilities in planning how to handle a situation—provide an example.

D. Focusing on the first skill: to look at a situation and generate multiple solutions or ways in which to proceed.
   1. Provide 4-6 situations in which a response (action or idea) is required—practice 3 in whole group and then some in small groups.
   2. Demonstrate with objects: show whole group a small tin box with cover (“Let’s name all the ways this tin box could be used.”)

Follow with these objects, asking for all the ways each could be used (give 30 seconds each time before taking responses):
   a. a 12” piece of wooden dowel
   b. an eye drop device
   c. a hoola-hoop

Follow with these objects, asking for ideas about what we could imagine each object to be (give 30 seconds each time before taking responses):
   a. an aluminum pie plate
   b. a small woolen-like blanket
   c. a clear, empty CD case
   3. Conclude by distributing a sheet of paper with the description of an everyday problem (e.g., “How can you change or end an unsatisfying relationship you are in without hurt feelings?”). Ask each participant to write down 5 or more things he or she could do to resolve the problem temporarily or permanently.
      a. after no more than 10 minutes, ask for volunteers to give one of their solutions.
      b. discuss how this is an example of creative thinking.
c. Describe the concept of fluency and how it is evident in each activity during this session; fluency is a way to measure an aspect of creative thinking.

II. Session Two
A. Creative thinking is a type of problem-solving process.
   1. A process that utilizes specific skills—one of which is the ability: *To look at a situation and generate multiple solutions or ways in which to proceed.*
   2. Review this first skill by responding as a whole group with possible ways to proceed regarding these situations (give 30 seconds before taking responses):
      a. “A tenant in your off-campus apartment building takes over all the washers and dryers for several hours each week as he does the laundry of several of his 5 children who live elsewhere. You have been inconvenienced by this on 3 different occasions.”
      b. “After many years of wanting to go into commercial architecture, you start to have doubts about your real interest. You’ve started taking courses that are required for a post-graduate degree in architecture. You don’t want to continue taking these classes if you change your major; you’re not sure about another major; and you don’t want to quit college temporarily.”
      c. “You are scheduled to give a 10-minute presentation as your final exam in one of your major required courses. Your study-abroad class for the next semester is scheduled to leave a few weeks early on a specially-chartered flight the week of exams, prior to the start of the long-planned schedule of presentations.”

3. A second skill is: *to think of novel (or original) responses to a situation.*
   a. Discuss what conditions need to be in place for this skill to be nurtured.
      1. Incubation: avoid rushing to a response or solution; pause and reflect on the situation; thinking through several alternative courses of action from which to choose.
      2. Suspension of judgment: consider all possibilities before trying out a solution.
      3. Appropriate climate: stay in a relaxed, even playful environment, where others who are engaged in creative problem-solving will feel that your ideas will be accepted.
      4. Analysis: carefully consider the major characteristics of the situation; this kind of analysis is different from the analytical, step-by-step process in a logical approach to problem solving.

   b. Formulate a response to these situations (show each on screen while participants write out their own solutions):
      1. “Two ends of a broken speaker-system wire are hanging from the basement ceiling. The thin, limp wires are of such a length and distance apart that you cannot reach one wire while holding..."
onto the other. You have a scissors, a paper clip, a pencil, and a piece of chewing gum in your pocket. You are alone and you need to, using only these available materials, attach the thin, limp wires together.” (adapted from Maier, 1930)

2. “You are getting tired of the 2 outdoor neighborhood cats curling up during the night on your cushioned porch chairs, leaving white cat hair all over the attached cushions. You like cats but you don’t like to clean the hair off every time you sit on your porch; also, you don’t like the idea of bringing the porch chairs indoors every night.”

c. Respond with an unusual simile or metaphor to complete each phrase:

1. “The sudden rain felt to me like_____________________________”
2. “The bride’s dress looked like_____________________________”
3. “Peace in the world is as_____________________________”
4. “The foundations to a democratic society are clearly stated in the Bill of Rights. But today, freedom is often seen to be like________”
5. “Equal educational and employment opportunities in our society are_”

d. Conclude with this visual exercise:

1. Hold up an 8 ½ X 11 inch piece of poster board with an irregular shape (about 2” in diameter) cut out just off center.
   a. Ask each participant to jot down one unusual phrase or sentence in response to seeing the piece of poster board.
   b. Ask as many participants as time permits to read their phrase out loud when each item is reviewed.
2. Briefly review how original, novel or unusual responses to a situation are aspects of creative thinking.

III. Session Three

A. Review by giving each participant a pipe cleaner, a fine-tip black marker, and a 6” X 6” piece of white poster board.

   1. “Use the pipe cleaner as a major part of your project; find a way to attach it to the poster board. Use your marker to add as many details as possible (no words) so that we have a clear idea what your picture is showing. Take about 10 minutes.”

   2. The third skill specific to creative thinking is: to organize several possibilities in planning how to solve a problem.

B. Take the following situation and describe what steps you would take to resolve it.

   1. “As part of a service project for your dormitory complex, you have been assigned to plan an entertainment program of about 1 hour for the residents of a local retirement home (to which none of the students have ever been). Several students in the group ask you if they can take part in it. Before you leave the
meeting, 1) a group of 5 guys in a band asks to perform some rap and some hip-hop for the program, 2) one girl offers to play a classical piano solo, 3) a couple offers to bring their line-dancing group to perform, 4) one man asks if he can do his standup comedy routine, 5) four women ask if their dance group can do a dance to Madonna's song "Physical Attraction," 5) a women asks if she can sing a gospel song that she wrote for her mother's birthday, and 6) a group of 3 men want to do a gumboot dance, an old folk dance of southern Africa using the rhythm of the sound of the boots as the dance tells a story.

2. How will you go about putting this program together?

3. Explain how this process is one of flexibility and involves creative thinking.

4. Discuss why this task involves creative thinking?

5. Ask for volunteers to briefly summarize what steps he or she would take to accomplish the task.

C. Show examples via video streaming of the 3 major creative thinking skills.

1. Using PowerPoint® slides, identify the situations in which fluency, originality, flexibility, or elaboration are each being demonstrated.

2. Demonstrate how these 4 characteristics fit into this discussion.
   a. Each is existent in the 3 skills of creative thinking
   b. They serve as the quantities of thinking which can be measured.
   c. They measure the key aspects of creative thinking.

D. Closure: invite comments and questions about creative thinking.
Appendix D

Treatment Two
Developed by Researcher
USING MIND-MAPPING AS A THINKING STRATEGY

This training module consists of 3 one-hour sessions. They are designed to teach adult learners a way to organize their thinking in such a way as to optimize productive thinking—thinking that leads to concrete results. The approach that is being used to optimize one's thinking is referred to as mind-mapping, a concept that has existed for centuries but has recently been reclaimed by the popular psychology author Tony Buzan. The scholarly research of Allan Collins, however, provides the theoretical base for the mind mapping process.

I. Session One: Basic Thinking Tools
   A. The human mind is driven to detect patterns in order to make sense of the world.
      1. Our search for patterns often misleads us to ignore new connections.
         a. Use examples of: the January, 1994, U.S. National Figure Skating Championships, the historical account of the attack on Pearl Harbor, the story of the man walking down the street, and ABC-TV’s *Prime Time Live* incident.
      2. Hidden biases are prime movers of our recommendations, assumptions and analysis
         1) Example of research team at Johns Hopkins
         2) Example of ranking 7 risks of dying
      3. The analog mind: does not test the logic of all new information
         1) Example of the power of “mind-set”—President Reagan’s view of the Soviet Union.
         2) Example of newspaper columnist William Raspberry
      4. Needing to find explanations, regardless of accuracy.
         1) Once a pattern is identified, we have no need to know why.
            a) Example of Mary’s lateness for work
            b) Example of the “I walked to the bank”
            c) Example of “the rest of the story”
            d) This need to explain all things leads to faulty thinking
               *Philadelphia Zoo story
               *Northwestern University story
               *Noise during the night story
      B. Focusing is a cognitive process by which humans are enabled to do everything.
         1. Discussion of “The Riddle”
         2. Examples of humans’ tendency to focus in thinking about a problem-solving task
            a. Example of “making a case” incident
            b. Example of *The People v. Clarence Darrow*
      3. How the tendency to focus is an obstacle to thinking about alternatives
   B. Holding onto a set of beliefs that make meaning about the world

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1. Tendency to regard beliefs like material possessions—"We have beliefs," "we adopt, inherit, acquire, hold, cling to beliefs."

2. Recognizing when we hold untrue beliefs in the face of contradictory evidence
   a. Example of 2 different visual images of the same procedure
   b. Example of an account of the key facts in a situation from 2 sources
   c. Our set of beliefs are the navigational aids of analysis—they tell us where our analysis of a situation should be headed

3. Embracing untrue beliefs impacts our ability to analyze and to engage in effective exploration of alternatives and in problem-solving
   a. Example of 2 different visual images of the same procedure
   b. Example of an account of the key facts in a situation from 2 sources
   c. Our set of beliefs are the navigational aids of analysis—they tell us where our analysis of a situation should be headed

II. Session Two: Mind-Mapping as an Approach to Problem-Solving
A. Mind-Mapping organizes our use of basic thinking tools (show examples)
   1. Provides a way to see the patterns with which we look at a situation
   2. Considers on what we tend to focus
   3. Makes room for our set of beliefs with which we make meaning of the world

B. Mind-mapping reflects each mind-mapper’s own way of handling information
   1. Starts with the focus of our thinking—described with 1 or 2 words in the center of a piece of paper
   2. All elements of the situation are identified before showing which element is the key one that will lead through the most productive thinking process
      a. Demonstration: a dormitory situation involving a thoughtless roommate
      b. Show the procedure: ideas that flow out from the center focus
      c. Demonstrate the use of symbols as a sort of shorthand
      d. All ideas must be included on the map—no editing of “good/bad” ideas

3. Rehearse with 3 focal thoughts (allow no more than 5 minutes for mind-mapping each focus chosen from a list of 10)
   a. Discuss how 2 or 3 participants proceeded as their minds made connections and associations
   b. Show a finished mind-map on screen and briefly review it

4. Discuss what mind mapping accomplished and how it showed:
   a. that focusing does not have to limit consideration of alternatives
   b. that our need for seeing patterns is present but does not have to exclude ideas outside of the expected pattern
   c. that our set of beliefs is visible but does not have to prevent seeing the truth when our beliefs cling to inaccuracies
III. Session Three: Applications of Mind-Mapping

A. The generation and organization of many thoughts in a writing task.
   1. Demonstrate with entire group by doing a map with a writing assignment
   2. Individuals take a current writing assignment and make a detailed mind-map
   3. Review key elements of mind-mapping process

B. The formulation of a strategy for dealing with a problem-solving task
   1. Recognizing project resistance
   2. Breaking a project down into manageable pieces—memory device is WWWWH$.

C. Organizing and implementing group projects through team mind-mapping
   1. Example of the Sheraton Hotel in Long Beach
   2. Break group into teams of 4; provide each with a relevant group project to mind-map (allow about 10 minutes).
   3. Discuss what the process was like, were any unexpected associations or thoughts surfacing, how easy and fast was the process, was there a feeling of accomplishment?

D. In pairs, complete a mind-map of one of the provided projects.
   1. Use color and symbols along with words
   2. Discuss the helpfulness or lack of it that mind-mapping provided
   3. Identify the strengths that the participants recognize in this approach to problem-solving
Appendix E

HSIRB Approval Documents
Date: September 21, 2006

To: Andrea Beach, Principal Investigator
   Stephen Worst, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 06-09-13

This letter will serve as confirmation that your research project entitled “Vygotsky’s Theory of the Creative Imagination: An Experimental Study on the Influences on Preservice Teachers’ Creative Thinking Capacities” has been reviewed under the expedited category of review by the Human Subjects Institutional Review Board.

The goal of the proposed project is investigate the impact of formal instruction in creative thinking skills on preservice teachers’ creativity. The project proposes to randomly assign participants to one of three groups (training in creative thinking skills, training in general thinking skills, and a no training control). Pre-post differences on tests of creative thinking will be examined across groups.

Before final approval can be given please address each of the following concerns. We expect that you will find the revisions requests to be productive and that you will revise your protocol according to our suggestions or in similar ways. If you think a particular revision is not in the best interest of the human subjects in your study, or you think an entirely different approach to the issue is best, please provide a written explanation and/or call us for consultation.

1. Subject Recruitment section of the protocol outline:
   - Please revise language in this section to indicate that persons who are interested in learning more about participating will be asked to respond to email. Individuals cannot choose to participate prior to the informed consent process. Please make this consistent throughout this section (e.g., do not refer to “volunteers” until after they have consented to participate).
   - Please provide a rationale for asking potential participants to respond by email to the administrative coordinator rather than to the researcher. Is this administrative coordinator considered a research collaborator? If so, this person needs to complete appropriate HSIRB training and be added to the protocol. If not, then it would be most appropriate to remove them from the loop after their initial involvement in identifying your subject pool. The researchers, not the administrative coordinator should be prepared to be contacted directly to answer questions, arrange a meeting, etc.
1. Coordinator could still be responsible for sending reminder emails to the population pool until your participant pool is complete.

2. Informed Consent Process section of the protocol outline:
   - Please assure us that no information will be collected from individuals prior to them consenting to participate in the study. Again, individuals cannot agree to participate until after this process is complete. Please revise language in this section of the protocol. Also, randomization should not occur until individuals have consented.
   - Please make it clear that even though participants start the project they may choose to discontinue at any time without penalty.

3. Research Procedure section of the protocol outline:
   - Given that informed consent will occur in group sessions, please explain how you will handle the randomization issues. How and when will you inform participants about what group they have been assigned to?
   - Who will be present during the training sessions (i.e., how many participants, etc.)? Who will conduct the trainings?

4. Methodology section of the protocol outline: Please provide more detail about the procedural pilot to which you refer. Who are the participants for this pilot? How will they be recruited? What is the consent process? This appears to be another separate procedure and participant pool and we need more detail about this portion of your project.

5. Confidentiality of Data section of the protocol outline: Consistent with previous comments, please explain the rationale for having the administrative coordinator maintain the master list. The risk of breach of confidentiality seems to be greater by having people un-involved with the study know who has and has not participated. Please consider revising this procedure so that you maintain a master list that allows you to link pre-post data that can be destroyed at the end of the study.

6. Appendices: Please revise recruitment email so that it is consistent with changes made to the protocol.

7. Consent form: Please revise the consent document to reflect other changes that have been requested to the protocol.

In a cover letter to the HSIRB, indicate whether you have made the requested change; addressed the issue in a different way than the one the reviewers suggested; are directing the reviewers to the pages in your protocol that address the issue; or are providing a justification for not making the requested change.

Please submit your cover letter and one copy of the revised protocol with the changes highlighted within the document to the HSIRB, 251W Walwood Hall (East Campus). Remember to include the HSIRB project number (above).

Conducting this research without final approval from the HSIRB is a violation of university policy as well as state and federal regulations.

If there is anything you don’t understand about these comments, you are welcome to call the research compliance coordinator (387-8293) for consultation.

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Even though a printed letter and the revised protocol with highlighted text are being mailed to you, I am also sending this e-mail letter in response to your prompt review of my proposal. This letter is intended to address the concerns of the Human Subjects Institutional Review Board which have been provided for me under the expedited category of review.

First of all, I thank the HSIRB for the thoughtful comments you provided in your review! The time it took to review my proposal and the time you took to present the suggestions for revision are much appreciated! Secondly, I want to give you a description of how I revised my protocol in light of your recommendations. (The actions I took in response to your recommendations are italicized.)

And thirdly, I want to assure you that no research has been conducted in connection with this project nor will there be any research conducted until I receive final approval from the HSIRB board.

Gratefully,
Stephen J. Worst, Student Investigator for Dissertation
55 Fitch Place SE, Grand Rapids, MI 49503-5912
(616)-742-0147 (h), (616)-331-6227 (o)
worsts@gvsu.edu

1. Subject Recruitment section of the protocol outline:
   • Please revise language in this section to indicate that persons who are interested in learning more about participating will be asked to respond to email. Individuals cannot choose to participate prior to the informed consent process. Please make this consistent throughout this section (e.g., do not refer to “volunteers” until after they have consented to participate).
   
   *I have revised all language in the main text according to this recommendation. I have also revised all language in the appendices to be consistent with the revisions in the main text of the protocol.*

   • Please provide a rationale for asking potential participants to respond by email to the administrative coordinator rather than to the researcher. Is this administrative coordinator considered a research collaborator? If so, this person needs to complete
appropriate HSIRB training and be added to the protocol. If not, then it would be
most appropriate to remove them from the loop after their initial involvement in
identifying your subject pool. The researchers, not the administrative coordinator
should be prepared to be contacted directly to answer questions, arrange a meeting,
etc. The coordinator could still be responsible for sending reminder emails to the
population pool until your participant pool is complete.

Revisions have been made to comply with your recommendation that the
coordinator only be involved in completing the participant pool. All students who
may be interested in learning more about participation in the study will be directed
to respond to the researcher.

2. Informed Consent Process section of the protocol outline:
   • Please assure us that no information will be collected from individuals prior to them
     consenting to participate in the study. Again, individuals cannot agree to participate
     until after this process is complete. Please revise language in this section of the
     protocol. Also, randomization should not occur until individuals have consented.
   • Please make it clear that even though participants start the project they may choose to
discontinue at any time without penalty.

   Please be assured that no information will be collected from individuals prior to
their consent to participate being completed. Revisions make clear that the random
assignment of individuals to 1 of the 3 groups will not occur until after the
individuals have consented to participate in the study. During the process of
informing individuals about their consent, it will be made clear in the copy of the
consent document as well as in the spoken comments leading individuals through
the consent process that participants starting the project may choose to discontinue
at any time without penalty or prejudice.

3. Research Procedure section of the protocol outline:
   • Given that informed consent will occur in group sessions, please explain how you
     will handle the randomization issues. How and when will you inform participants
     about what group they have been assigned to?

   The revisions clearly state that the 3 initial sessions (the same session scheduled at
   3 different times to accommodate students' schedules) will begin with the consent
   process, followed by the administration of the creativity pre-test to those who have
   consented to participate. After all 3 initial sessions have been held, preservice
   teachers will be informed via e-mail message regarding the random assignment to 1
   of the 3 groups. This will occur within 1 day after the last of the initial sessions
   and will be carried out by the researcher.

   • Who will be present during the training sessions (i.e., how many participants, etc.)?
     Who will conduct the trainings?

   The revisions state clearly that the training sessions for treatment groups 1 and 2
   will be open for participants to attend in random fashion. They can choose which
   of the 3 training sessions offered each week is most convenient in regard to their
   schedules. So the answer to “How many participants?” will not be known. The
revisions also clearly state that the researcher will conduct the training sessions. The researcher will also administer both the creativity pre-test and post-test.

4. Methodology section of the protocol outline: Please provide more detail about the procedural pilot to which you refer. Who are the participants for this pilot? How will they be recruited? What is the consent process? This appears to be another separate procedure and participant pool and we need more detail about this portion of your project. *This revision was the most difficult. My interest was mainly in looking for content validity (not really construct validity) in the locally-made instruments—the questionnaires and the 3 training sessions for both treatments 1 and 2. Since none of the items of the questionnaires will be combined to create larger constructs, construct validity is not necessary to address. But the content of the questionnaires and interventions is, I think. So, instead of a procedural pilot, my revisions describe a review of these instruments by 6 doctoral students who volunteer to examine the content of both the questionnaires and the 2 treatments. I hope that the revisions indicate the reasons for having these locally-made instruments reviewed. The reviewers will not be taking the pre- or post-test. I have removed any reference to establishing construct validity through this review process.*

5. Confidentiality of Data section of the protocol outline: Consistent with previous comments, please explain the rationale for having the administrative coordinator maintain the master list. The risk of breach of confidentiality seems to be greater by having people un-involved with the study know who has and has not participated. Please consider revising this procedure so that you maintain a master list that allows you to link pre-post data that can be destroyed at the end of the study. *The revisions modify the role of the administrative coordinator to one of completing the participant pool; that is all. The researcher will maintain a master list that allows him to link pre-post-test data to participants’ identifiers. All of this will be destroyed at the end of the study.*

6. Appendices: Please revise recruitment email so that it is consistent with changes made to the protocol. *Revisions have been made that make all of the appendices consistent with the changes made to the protocol.*

7. Consent form: Please revise the consent document to reflect other changes that have been requested to the protocol. *The consent document has been reworked to reflect the other changes made throughout the protocol as recommended by the HSIRB.*

In regard to all of the recommendations, I have made the requested changes because I think those changes make for a stronger and less-convoluted process of collecting data. The attached revised protocol includes highlighted text where these revisions have been made.
Date: October 3, 2006

To: Andrea Beach, Principal Investigator
Stephen Worst, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 06-09-13

This letter will serve as confirmation that your research project entitled “Vygotsky’s Theory of the Creative Imagination: An Experimental Study on the Influences of Preservice Teachers’ Creative Thinking Capacities” has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 3, 2007
October 8, 2007

Proposal No.: 07-58-H Category: Expedited
Proposal Title: Vygotsky's Theory of the Creative Imagination: An Experimental Study of the Influence on Pre-service Teachers' Creating Thinking Capacities

Dear Dr. Beach and Mr. Worst,

In response to the closed protocol form submitted on October 1, 2007, your research entitled Vygotsky's Theory of the Creative Imagination: An Experimental Study of the Influence on Pre-service Teachers' Creating Thinking Capacities has been closed by the Human Research Review Committee.

Please be advised that you must resubmit a new proposal if you intend to do further research relating to this protocol.

If you have any questions regarding the closed protocol, please contact the HRRC as indicated below.

Sincerely,

[Signature]
Paul J. Reitemeier, Ph.D.
Human Research Review Committee Chair
301C DeVos Center
Grand Rapids, MI 49504
Phone: (616) 331-3917
E-mail: reitemep@gvsu.edu
October 24, 2006
Proposal No.: 07-58-H
Approval Date: 10/20/2006
Expiration Date: 10/19/2007
Title: Vygotsky's Theory of the Creative Imagination: An Experimental Study of the Influences on Preservice Teachers' Creative Thinking Capacities

Dear Dr. Beach:

Grand Valley State University, Human Research Review Committee (HRRC), has completed its review of this proposal. The HRRC serves as the Institutional Review Board (IRB) for Grand Valley State University. The rights and welfare of the human subjects appear to be adequately protected and the methods used to obtain informed consent are appropriate. Your project has been APPROVED. Please include your proposal number in all future correspondence. The first principal investigator will be sent all correspondence from the University unless otherwise requested.

The protocol is approved pending a minor adjustment in the Informed Consent Letter. Please add a sentence in the Consent letter advising participants the resource of money for the lottery.

Revisions: The HRRC must review and approve any change in protocol procedures involving human subjects, prior to the initiation of the change. To revise an approved protocol including a protocol that was initially exempt from the federal regulations, send a written request along with both the original and revised protocols including the subject consent form, to the Chair of the HRRC. When requesting approval of revisions both the project’s HRRC number and title must be referenced.

Problems/Changes: The HRRC must be informed promptly if any of the following arises during the course of your project. 1) Problems (unexpected side effects, complaints, etc.) involving the subjects. 2) Changes in the research environment or new information that indicates greater risk to the subjects than existed when the protocol was previously reviewed and approved. 3) Changes in personnel listed on the initial protocol, e.g. principal investigator, co-investigator(s) or secondary personnel.

Renewals: The HRRC approval is valid until the expiration date listed above. Any project that continues beyond the expiration date must be renewed with a continuing review form that can be found at http://www.gvsu.edu/forms/research_dev/FORMS. A maximum of 4 renewals are possible. If you need to continue a proposal beyond that time, you are required to submit a new protocol application for a complete review.

Closed: When your project is completed or if you do not anticipate the study to extend past the one year approval, please complete and submit a closed protocol form. You can find this document at http://www.gvsu.edu/forms/research_dev/FORMS.

If I can be of further assistance, please contact me at 616-331-3417 or via e-mail: reitemep@gvsu.edu. You can also contact the Graduate Assistant in Faculty Research and Development Office at 616-331-3197.

Sincerely,

Paul J. Reitemeier, Ph.D.
Human Research Review Committee Chair
Date: October 31, 2006

To: Andrea Beach, Principal Investigator
   Stephen Worst, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 06-09-13

This letter will serve as confirmation that the changes to your research project “Vygotsky’s Theory of the Creative Imagination: An Experimental Study on the Influences of Preservice Teachers’ Creative Thinking Capacities” requested in your memo dated 10/30/2006 (minor changes to consent document) have been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 3, 2007
To: Andrea Beach, Principal Investigator
   Stephen Worst, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 06-09-13

This letter will serve as confirmation that the changes to your research project “Vygotsky’s Theory of the Creative Imagination: An Experimental Study on the Influences of Preservice Teachers’ Creative Thinking Capacities” requested in your memo dated 03/05/2007 (modifications to recruitment process; modifications to consent form) have been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 3, 2007
March 15, 2007

Proposal No.: 07-58-H
Approval Date: March 14, 2007
Expiration Date: October 19, 2007
Proposal Title: Vygotsky's Theory of the Creative Imagination: An Experimental Study of the Influences on Pre-Service Teachers’ Creative Thinking Capacities

Dear Professor Coe:

We have received the following changes in your research protocol entitled Vygotsky’s Theory of the Creative Imagination: an Experimental Study of the Influences on Pre-Service Teachers’ Creative Thinking Capacities. Your change in protocol form has been approved. However, please note that this approval is pending one minor change on your part: Please add Grand Valley State University’s HRRC contact information. (616-331-3197).

This approval of changed protocol does not change the original expiration date of October 19, 2007.

Closed: If you do not anticipate the study to extend past the one year approval, a closed protocol form must be submitted. You can find this document at http://www.gvsu.edu/forms/research_dev/FORMS.

If you have any questions, please contact the HRRC as indicated below.

Sincerely,

Paul J. Reitemeier, Ph.D.
Human Research Review Committee Chair
301C DeVos Center
Grand Rapids, MI 49504
Phone: (616) 331-3197
E-mail: reitemep@gvsu.edu