

WE TEACH WHO WE ARE: CREATIVITY AND TRANS-DISCIPLINARY
THINKING IN THE PRACTICES OF ACCOMPLISHED TEACHERS

By

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ABSTRACT

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Creativity is an essential factor in thinking and learning which cuts across all disciplines. There is a general conviction that creativity should be supported and developed educational settings (Williams, 2002). However there remains little understanding of effective applications of creative teaching in classroom teachers. This may be due to the complex nature of creativity, and the lack of a consistent definition of “what creativity is” or “what it means” in teaching or educational research (Marksberry, 1963; Sternberg, 1999; Baker et al., 2001; Friedel & Rudd, 2005).

Research has also demonstrated that the most successful and creative people in any discipline often have avocations or artistic pursuits, which enhance their thinking within their professional discipline (Root-Bernstein, 1996, 1999, 2003). It has also been suggested that talented or innovative thinkers in a variety of disciplines employ similar kinds of creative thinking skills (Freedman, 2003). These broad minded creative skills are known as “trans-disciplinary” thinking skills. They are used by both artists and scientists, and tend to fall into a few specific cognitive categories.

This qualitative study is an investigation of these issues among highly accomplished teachers. Specifically, in-depth interviews were conducted with individuals who have either received, or been a national finalist for the National Teacher of the Year award. These teachers have been noted as successful in the classroom, and the purpose of

this study was to examine how these teachers define creativity, and how they function creatively in the classroom. This research also considers how artistic interests and avocations inspire creative ideas, and the ways that this connects to creative thinking skills (trans-disciplinary thinking skills).

Findings of this study noted that while creativity has some generalizable elements, these are instantiated and evaluated according to context. In terms of how this creativity plays out in successful teaching practice, key themes included *real-world teaching and learning, cross-curricular connections, and taking intellectual risks*. It was also noted that accomplished teachers engage in a variety of avocations and creative pursuits in their personal lives; and that this creatively influences their teaching practices. Teachers frequently noted that “we teach who we are,” and it seems that those who engage creatively outside of teaching are able to usefully draw on this in their teaching practice. Finally, this study found that trans-disciplinary skills are highly valuable and frequently used in the practices of successful and accomplished teachers. All of the teachers in the study provided specific examples and discussion of how played out in different ways in their classrooms and teaching practice.

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DEDICATION

This dissertation is dedicated to the outstanding creative teachers that make education a worthwhile and exciting endeavor for their students. This includes the remarkable teachers in this study, and all of the educators throughout the field of education who meet the sizable challenges of teaching, using their own creativity to inspire it in their students.

Einstein famously noted that, “Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.” Creative and successful teachers walk in both realms – building knowledge, and cultivating imagination. In doing so, each creative teacher is in some small way a catalyst for all that we will ever know and understand. The struggles of the profession, particularly in this current day and age, do not make creativity in teaching an easy endeavor. Yet many still find ways to succeed, and are owed a debt of gratitude for keeping alive the spirit of discovery, playfulness and enjoyment in learning. This dissertation is dedicated to creative teachers, in the hopes that we may learn from and engage their practices.

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TABLE OF CONTENTS

LIST OF TABLES.....	xi
LIST OF FIGURES.....	xii
CHAPTER 1	
INTRODUCTION.....	1
Statement of the Problem.....	2
Significance of the Study.....	4
Purpose Statement.....	7
CHAPTER 2	
REVIEW OF THE LITERATURE.....	9
The Importance of Creativity.....	9
Definitions of Creativity.....	10
Origins of Creativity.....	12
Theories of Creativity.....	13
Creativity in Education and Teaching.....	17
“Effective Teaching” is “Creative Teaching”.....	20
Trans-disciplinary Creativity.....	21
Trans-disciplinary Thinking Skills.....	24
Observing.....	25
Patterning.....	26
Abstracting.....	26
Embodied Thinking.....	27
Modeling.....	27
Play.....	28
Synthesizing.....	28
Research Questions.....	29
CHAPTER 3	
METHODOLOGY.....	32
Purpose of the Study.....	32
Research Design.....	32
Characteristics of Qualitative Research.....	33
Instrumentation.....	34
Sampling and Participants.....	36
Rationale for “Teacher of the Year” as Research Group.....	37
Recruitment.....	39
Data Collection.....	41
Data Analysis.....	43
Developing Codes.....	44
Sample Excerpt from Coding.....	46
Final Code Listing.....	47
Reliability and Validity.....	49

Summary.....	52
CHAPTER 4	
RESULTS.....	54
Description of Participants.....	55
Mark.....	55
Sandra.....	56
Carrie.....	58
Jack.....	59
Julia.....	60
Adam.....	61
Mia.....	62
Marie.....	64
Research Question 1 Analysis: Creativity in Teaching Practices.....	65
Defining Creativity.....	66
Creativity as a Mindset.....	70
Real-world Learning.....	76
Cross-curricular Connections.....	82
Risk-taking.....	88
Research Question 2 Analysis: Avocations, Creativity & Success in Teaching.....	90
What Kinds of Creative Interests and Avocations.....	91
We Teach Who We Are.....	93
Music and the Arts: Translating Avocations into Teaching Practice.....	97
Athletic/Kinesthetic Pursuits: Mind/Body Connections.....	105
Research Question 3 Analysis: Trans-disciplinary Thinking Skills.....	109
Observation.....	110
Patterning.....	115
Abstracting.....	120
Embodied Thinking.....	126
Modeling.....	133
Play.....	137
Synthesizing.....	142
Summary.....	143
CHAPTER 5	
CONCLUSIONS.....	146
Discussion of Findings.....	147
Defining Creativity and What it Means.....	148
Avocations and Creative Interests.....	151
Trans-disciplinary Skills in Teaching Practices.....	155
Conclusions.....	159
Implications for Policy and Practice.....	160
Creativity in Context.....	160
Educational Policy.....	164
Higher Education.....	167
Recommendations for Future Research.....	169

Limitations and Delimitations.....	170
Summary.....	171
APPENDICES.....	173
Appendix A: Semi-Structured Interview Protocol.....	173
Appendix B: Instrumentation Cross-Reference.....	176
Appendix C: Creativity Notes/Evidence from Finalist Applications.....	177
Appendix D: Recruitment Letter.....	186
REFERENCES.....	187
References.....	187

LIST OF TABLES

Table 1	List of Participant Avocations.....	92
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LIST OF FIGURES

Figure 1	Sample Excerpt of Coding in HyperResearch [©]	47
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CHAPTER 1

Introduction

“Mere critical thinking without creative and intuitive insights,
without the search for new patterns, is sterile and doomed.”

- Carl Sagan

Creativity is an essential factor in thinking and learning which cuts across all disciplines. It is a central factor in driving the birth of new knowledge and innovation, and as such is a vital construct for the field of education. Over the past several decades creativity has become a trait of increasing interest in fields such as education and psychology (Plucker, Beghetto, and Dow, 2004). It is considered to be one of the most highly coveted qualities of thinking (Lewis, 2008), and is associated with social, emotional, cognitive and professional advantages and benefits (Sternberg & Lubart, 1996; Sternberg, 2006). There is a generally agreed upon conviction that creativity should be nurtured and supported in educational environments (Williams, 2002). Despite this, there remains little understanding of effective applications of creative teaching in classroom teachers. In part this may be due to the abstract and complex nature of creativity, and the fact that there is not one consistent definition of “what creativity is” or “what it means” in teaching or educational research (Marksberry, 1963; Sternberg, 1999; Baker et al., 2001; Friedel & Rudd, 2005).

Additionally research has shown that the most accomplished or creative people in any discipline often have creative avocations or artistic pursuits outside of their profession, which contribute to and enrich their thinking within their professional discipline (Root-Bernstein, 1996, 1999; 2001). Root-Bernstein (1996) showed that individuals who are successful in the sciences tend to have creative passions and interests in outside disciplines, and that they frequently

connect these creative interests and avocations with influencing their professional accomplishment. It has also been suggested that talented or innovative thinkers in a variety of disciplines employ similar kinds of creative thinking skills (Freedman, 2003). These broad minded creative skills are known as trans-disciplinary thinking skills, and they tend to fall into a few specific cognitive categories.

While this focus on personal life creativity and trans-disciplinary thinking has provided a useful framework for considering creative thinking and innovation in the sciences, similar research or creative thinking tendencies have not yet been studied in teachers. Given the need for the development of a creativity paradigm among successful teachers, creativity and trans-disciplinary thinking may provide a useful framework for studying effective teachers.

This qualitative study is an investigation of these issues – focusing on the creative pursuits and creative thinking modes of successful teachers and highly accomplished teachers. Specifically, in-depth interviews were conducted with individuals who have either received, or been one of the national finalists for the National Teacher of the Year award. As teachers who have been noted as creative and successful in the classroom, the purpose of this study was to examine what they think about creativity and how they function in the classroom, how their avocations inspire creative ideas, and how this connects to their creative thinking skills (trans-disciplinary thinking skills).

Statement of the Problem

The abstract, variable and complex nature of creativity makes it what Spiro, Feltovich, Jacobson, & Coulson (1995) define as an "*ill-structured* domain". These qualities of creativity also make it somewhat vulnerable to being marginalized at the level of educational policy, most notably in the current environment of high-stakes testing, standardization and accountability in

teaching. At the same time, creative thought processes are considered to be increasingly necessary as criteria for accomplishment in an increasingly complex and interdependent society. Globalization has meant that there has been an exponential increase in both knowledge and technology, as well as demographic and social changes in our world, which has implications for education at all levels. Our society is increasingly more competitive and global in nature, leading to diverse knowledge bases and multifaceted issues that demand creative thinkers and innovative problem solvers. Pink (2005) describes the significance of creative abilities in modern society:

Today, the defining skills of the previous era—the ‘left brain’ capabilities that powered the Information Age—are necessary but no longer sufficient. And the capabilities we once disdained or thought frivolous—the “right brain” qualities of inventiveness, empathy, joyfulness, and meaning—increasingly will determine who flourishes and who flounders. (p. 3)

In trying to respond to these creative demands, organizations such as the Partnership for 21st Century Skills have aimed themselves at infusing creativity and critical thinking and problem solving skills, among others, into the field of education for the 21st century. Cropley (2003) asserted that,

(Education) cannot limit itself to the transmission of set contents, techniques and values, since these will soon be useless to living a full life, but must also promote flexibility, openness for the new, the ability to adapt or see new ways of doing things, and courage in the face of the unexpected, in other words, creativity. (p. 136)

Unfortunately the field of education, particularly the U.S. system of education, has been slow to respond to these issues. In many ways in fact, over the past decade, the pendulum of educational policy in the United States has swung in the opposite direction of creativity. Instead

the ultimate focus has been increasingly on standardization and accountability - quantifiably measured through basic standardized tests. This educational climate has also compelled the work of teaching into a more rigid position, with standardized approaches sometimes referred to as “teaching to the test”, “drill and kill”, or “no child left untested” (Fusarelli, 2004). These approaches have been noted to have the effect of killing curiosity, creativity and enjoyment in learning and teaching (Giroux and Schmidt, 2004). They may diminish many of the things that stimulate intrinsic interest in learning in school and throughout life (Robinson, 2003; Jones et al, 2003)

However, the need to emphasize and better understand the dynamics of creativity in teaching is not lost on many the field of education. Creative teachers have a marked impact on the development of their students’ own creative thinking skills, as well as enjoyment and success in learning (Amabile, 1996). There is a definitive need to fill in the gap in our understanding of effective uses of creativity in the domain of educational research (Plucker, Beghetto and Dow, 2004). This mounting interest in creativity in education and teaching along with the current knowledge gap on this topic means that more work in educational research is needed to consider and understand examples of how creativity plays out in successful teaching paradigms.

Significance of the Study

The field of education needs research directed at understanding the nature of creative teachers. Sternberg (2006) stated, “To the extent that creativity is in the interaction of person with context, we need to concentrate as well on the attributes of the individual and the individuals’ work relative to the context” (p. 95). Esquivel (1995) asked, “Do teachers need to be creative themselves, in order to be creative as teachers”? (p. 190) Unfortunately, there are a lack of substantial, research-driven answers to such issues and questions.

Creativity is a vital avenue of study in educational research. It is one of the most highly regarded cognitive traits within the fields of psychology and education, and for good reason. The ability to think creatively has a long list of benefits, including social, intellectual, educational, emotional and talent-based achievement in school and in life (Guilford, 1950; Renzulli, 1994; Torrance, 1970; Blicbau & Steiner, 1998). In schools, promoting creative thinking helps students to discover and pursue their intellectual interests, as it tends to increase student engagement with ideas and learning, therefore maximizing success in learning (Amabile, 1989). Torrance (1981) found that improved concentration, curiosity, motivation, and achievement were seen in instances where creative learning occurred. And “thus, creative teaching can enhance learning” (Fasko, 2000-2001). Teachers who inspire creativity in their students have been found to model creative or divergent thinking themselves (Karnes et al., 1961). Educational researchers have noted that creative teachers advance students’ learning experiences, and heighten their potential and engagement (Renzulli, 1992; Hickey, 2001; Cropley, 2003; Fasko, 2001; Lilly & Bramwell-Rejskind, 2004).

Creativity is clearly a valuable trait that requires more understanding overall, but particularly with regard to the field of teaching. As a diffuse and abstract area of study, creativity has been plagued by a lack of solid agreement on *what* it is and *how* it should be defined. Most common definitions agree on some elements or version of “newness” or “value and/or effectiveness”, but from this point on definitions and meanings of creativity tend to scatter toward varied theories and different practices. But in order to really understand what creativity means and how it functions within a discipline such as teaching, we must investigate its definition and meanings among successful practitioners of that discipline. This begs the question

of: *What does “creativity” mean to successful teachers? In essence, how do they define creativity and how is it illustrated in examples from their classrooms?*

Since the ability to adapt, improve and grow throughout life relies on innovation and new construction, creative thinkers are often effective thinkers across professions. Most educational research on creativity tends to emphasize possibilities for increasing student creativity, or learning to enhance creative thinking. But given the central role that creative teachers have in influencing student thinking and learning, more research is needed to understand teacher creativity (Mack, 1987). In essence, where do creative teachers get their ideas from, what inspires them and how do they practice their creativity, in general and specifically in teaching?

Sternberg (2006) established some current views on creative thinking as he noted, “Creativity is as much a decision about and an attitude toward life as it is a matter of ability” (p. 93). In addition, Sternberg suggested creativity can be seen in all people. Along these lines, Root-Bernstein (1996; 1999; 2003) showed a strong correlation between personal creative tendencies, and professional accomplishment. Root-Bernstein’s (1996) study also demonstrated that the most successful and innovative scientists often engaged in a wide variety of avocations (artistic, subject matter, athletic, etc), which they felt had enhanced their professional accomplishment. This reveals the connection in thinking between subject matters as seemingly different as art or poetry and mathematics or science. Disciplinary boundaries are often more fluid than traditional views of subject matter would have us believe. Successful individuals in the sciences have been found to draw upon creative inspiration and enhanced thinking skills from their outside interests and avocations. This is not to say that the most skilled scientists are necessarily the most creative musicians or exemplary poets. But rather that they are thoughtfully influenced by drawing on ideas and modes of thinking between different areas of interest. So, in

considering how accomplished teachers generate effective or creative ideas, this leads to the question: *Do successful, accomplished teachers engage in creative interests and avocations, and if so, how do these avocations impact their thinking and teaching practices?*

Finally, in developing a detailed understanding of creative thinking among effective teachers, we must consider the effective thought processes and skills that they use. It has been asserted that disciplinary boundaries can be fluid, and successful creative people are able to transfer useful ideas between different domains. Therefore, a set of common cognitive skills must be important for effective thinking across different domains. Root-Bernstein (1999; 2001; 2003) and Mishra, Koehler and Henriksen (2011) have suggested that such trans-disciplinary skills are broad-spectrum creative thinking skills that are used by successful people across disciplines. These skills include: observation, patterning, abstracting, embodied thinking, modeling, play, and synthesizing. Since they have not yet been studied among teachers, it is essential to understand if and how these cognitive skills apply in excellent teaching practices, in essence: *Are trans-disciplinary thinking skills used by accomplished, successful teachers and if so, how are these skills important to teaching?*

Purpose Statement

The purpose of this qualitative study was to examine creativity among highly accomplished and successful teachers. The research focused on the connection between personal creative tendencies and avocations, and creativity in the classroom, as well as the overall creative practices of successful teachers and their trans-disciplinary thinking skills. Using in-depth interviews and qualitative methods, the creative pursuits, interests, and avocations of a group of “highly accomplished” (successful and creative) teachers, was investigated in terms of the influence upon their professional success and creativity as teachers. Additionally, the purpose of

this study was to explore the meaning and instantiation of creativity in the teaching practices of these successful and accomplished teachers. Finally, the study addressed if and how “trans-disciplinary” creative thinking skills are utilized among successful and creative teachers.

Overall, the study affords a look at how creativity plays a role in the teaching philosophies and classroom practices of successful and creative teachers, and some ways that this is influenced by their creative interest and avocations, and modes of thinking. These inquiries shed light on how creativity and trans-disciplinary thinking is utilized by successful teachers, to create exceptional classroom practices and meaningful learning experiences for their students.

CHAPTER 2

Review of the Literature

The Importance of Creativity

Creativity is an essential construct in any conception of education and psychology (Starko, 2005). There are numerous advantages and benefits associated with creativity at the individual and group level (Sternberg & Lubart, 1996; Sternberg, 2006).

Creative thinking ability is highly regarded as a valued trait in contemporary societies (Lewis, 2008). For most people, it is among the most coveted of psychological qualities (Sternberg & Lubart, 1999). It is considered to be so important, that there is undeniable conviction in education that it should be nurtured both inside and outside of classroom contexts (Williams, 2002)

In recent years, researchers, psychologists, and educators have begun to take a deeper look into creativity in human thinking (Plucker, Beghetto, and Dow, 2004). Many have marked intellectual, educational, and talent-development benefits associated with creative thinkers in individuals of all ages (Guilford, 1950; Renzulli, 1994; Torrance, 1962; Blicbau & Steiner, 1998). The possibilities and advantages connected with creativity are almost immeasurable (Sternberg, 2006). Milgram and Hong (1993) demonstrated that creativity may be a better predictor of outstanding life accomplishment than conventional measures of intelligence or school grades. Educational practitioners and psychologists have observed the contributions of creativity in many areas including: life success (Torrance, 1970, 1981), leadership in the workplace (Williams, 2002), psychological functioning, and intellectual/emotional growth (Runco, 1997). Maslow (1968), Rogers (1962) and Gowan (1972) all noted that creativity was essential to beneficial human development, mental health and self-actualization. The most

creative individuals are often the best problem-solvers and innovators when it comes to everything from interpersonal issues to intellectual or artistic endeavor (Plucker et al., 2004).

Human creativity has been, and will increasingly continue to be, a key factor in shaping our society (Freedman, 2007). In the workplace and in our outside lives creativity is a force that is valued and encouraged more strongly than ever (Florida, 2002). It appears to be inextricably linked to innovation and accomplishment across a variety of different disciplines in both the arts and the sciences (Catterall, 2002). This attention to creativity would lead one to assume that there exists a clear and shared definition of creativity. It is to this challenge that we turn next.

Definitions of Creativity

The construct of creativity is an ancient one, with origins traceable to antiquity and the early Greeks (Starko, 2005). Formal research on the concept in fields such as education and psychology has been occurring for decades through the better part of the 20th century. Despite its historical basis as a concept, and increased research interest in recent years, theorists and researchers alike have found it difficult to concretely define creativity (Baker et al., 2001; Friedel & Rudd, 2005; Marksberry, 1963; Sternberg, 1999). In an investigation of more than 90 articles from top peer-reviewed journals on the topic of creativity, Plucker, et al. (2004) determined that only 38% of these articles offered a clear definition of the term *creativity*.

At a general level, creativity can be described as the production of useful solutions to problems, or novel and interesting ideas across domains, which create products and/or artifacts and impact thinking (Amabile, 1988, 1996; Oldham & Cummings, 1996; Zhou & George, 2001, 2003). A novel idea with no potential value to others cannot be taken as “creative” (Fox, J., & Fox, R., 2000; Cropley, 2001). The goal of creative performance is to solve problems, to create innovative ways of thinking or doing things, or to add to knowledge in an area (Guilford, 1950).

Cropley (2001) asserted that novelty and effectiveness were indeed essential criteria for determining creativity, and added ethicality to the mix for a three-part definition:

1. Novelty (a product/artifact or idea that is in some way(s) unique from others, or that diverges from the familiar);
2. Effectiveness (creative things “work well”, they have some use or purpose that may be aesthetic, artistic or spiritual, or even practically valuable);
3. Ethicality (“creative” is not generally a word that describes cruel or destructive behavior, crimes, warmongering, etc). (p. 6)

While novelty and effectiveness or value play a role in many versions of “creativity” definitions, Mishra & Koehler (2008) also note the necessity of the concept of “wholeness”. They cite an example from Dirkin, et al (2005), in which creative use of knowledge is also “whole”, or used in an ordered and aesthetic manner in a specific context. As they put it, “Creative solutions often go beyond mere novelty and functionality to include a strong aesthetic quality. Creative products and solutions are deeply bound to the context within which they occur; they are integrated, organic and whole. Thus creative solutions are *“novel, effective and whole”* spawning the definitional acronym for creativity, NEW (Koehler & Mishra, 2008, pg. 11). In this way, creative ideas are not just novel and effective, but they have a certain aesthetic sensibility, which is connected to and evaluated within a specific context or paradigm.

Koehler and Mishra (2008), among other educational researchers, have emphasized the problem of a lack of a common definition for creativity, and the difficulty of constructing one. At the same time though, they acknowledge that if we are to focus on creativity in the field of education, there needs to be a “more rigorous articulation of it” (p. 11).

This problem of defining creativity in the field of education, along with the requisite need to examine ways in which it is successfully exemplified in teaching, signals a need to understand *what creativity means to accomplished teachers, i.e. how they define it, and how it is practiced in the work of teaching.*

Origins of Creativity

As noted, research models of creativity began to develop prominence during the 20th century. In its earliest inception however, creativity was conceived of as a somewhat mystical or divine trait. This notion of creative ability as inspiration, or even madness, imparted by the gods, was a part of the philosophy of the ancient Greeks and Romans. This is embodied in Plato's conception of the Muse. There is still some persistence in this type of belief, as Sternberg and Lubart (1999) note that many people today continue to presume that creativity is spiritual in nature and cannot be studied scientifically. They also note that scientific studies and approaches have had difficulty in changing this view.

Ancient views diverged significantly from Renaissance or Enlightenment views, which put the focus of creativity back upon the individual and saw creative ability as a "highly developed form of intuition" (Kneller, 1965, p. 21). In this perspective, creative individuals were no longer seen as objects of luck, fate, or the fancies of the Gods, nor were they seen as mentally unstable, but rather as special, exceptional or singular people. With this, creative acts occur when such people intuitively see and understand what other people could not. It was at this time that the word "genius" developed as a descriptor for such extraordinary creators as Michelangelo or Leonardo da Vinci.

The commonality in all of these viewpoints lies in the fact that early views of creativity tended to emphasize it as a trait that was a given rather than something that could be developed –

in effect, nature was always the source. However, modern views of the topic have substantially evolved to consider different aspects of mind, and factors that influence creative thinking, along with creative process itself.

Theories of Creativity

As the field of psychoanalytic behavioral psychology began to consider creative thinking, creativity began to be perceived as a natural human behavior (Roweton, 1970). Freud, among others, pioneered such approaches to the subject by examining it in the context of case studies of renowned creators. At the time, many critics noted the limitations of case study approaches, such as issues of measurement and applicability, rather than allowing for the insights that could be collected from them. Piirto (2004) noted that psychoanalysis tended to view creativity as somewhat akin to madness, or unstable thinking. With this, research on creativity languished on the margins of psychology for some time.

Guilford's 1950 address to the American Psychological Association is frequently credited as the first notable call to investigate the concept of creativity more deeply in education and psychology. Guilford (1950) suggested that creativity should be studied among "everyday" people and contexts using scientific measures such as psychometrics. However, Sternberg and Lubart (1999) noted that while this appropriately broadened the scope of creativity to a wider audience and framework, psychometric approaches often fail to capture the complexity of the topic, and are sometimes thought to trivialize creative thinking.

In addition to highlighting creativity as an object of psychological and educational study, Guilford's address helped distinguish the difference between the terms "divergent" and "convergent" thinking, particularly in terms of creative thinking (Cropley, 2001). Cropley (2001) stated that convergent thinking supports classical definitions of intelligence, while divergent

thinking suggests novel and variable means of thinking. While convergent thinking searches for a singular and best answer to a problem or question and uses established techniques and knowledge for getting to the “correct” answer, divergent thinking entails considering different perspectives and multiple or unique solutions (Cropley, 2001).

Humanists, such as Rogers and Maslow, viewed creativity as an interaction between the self and the environment. Rogers (1976) asserted that creativity involved components such as 1.) flexible thinking and tolerance for ambiguity, 2.) internal locus of evaluation – or acceptance of others’ views without allowing those views to intrude, and 3.) ability to “toy” or “play” with ideas (Roweton, 1970). Maslow (1962) suggested that there were two types of creativity, 1.) “special talent” creativity, which is innate and independent of character or mental health, and 2.) “self-actualizing” creativity, which is developed by the individual. Maslow asserted that self-actualizing creativity was a part of good mental health, and that it occurred in the process of acquiring self-actualization. He noted that “a first-rate soup is more creative than a second-rate painting...cooking or parenthood or making a home could be creative, while poetry need not be; it could be uncreative” (Maslow, p. 136).

Vygotsky (1960) and Renzulli (1992) asserted developmental theories of creativity. Vygotsky believed that creativity developed in three stages that occur during childhood, adolescence and adulthood. Creative imagination begins in childhood, then proceeds into adolescence, where imagination comes together with thought, and finally moves into adulthood, where experienced creativity is directed and used with purpose. Along the way, the development of adult creativity is influenced via formal education, internal dialogue/speech, and conceptual thinking. Vygotsky’s theory is notable for the suggestion that children’s figurative play is a catalyst for creative imagination. In addition, Vygotsky supposed that creativity was a

intentionally acquired mental ability. Creative thinking people learned to modify and combine ideas within context in order to come up with unique, beautiful and useful discoveries (Vygotsky, 1960; 1978).

Cognitive theories of creativity have further attempted to explain different aspects of thought and processes behind creative acts, as researchers have sought after the cognitive style that accounts for creative thinking. Cropley (2003) stated that, “There is no single cognitive processing strategy that is uniquely favorable for creativity. The relationship has come to be seen not as a matter of which strategies lead to it and which do not, but rather of how various styles and strategies are connected to creativity” (p. 43). Within a cognitive paradigm, the dynamics that influence creativity are generally seen to be an interaction of cognitive, affective, and social/personal factors. Cropley (1992) described this interaction as follows:

Exposure to a rich variety of information lead not to anxiety and avoidance, but to increased interest and desire for more information; information is not blindly accepted (assimilated) and later regurgitated, but causes a reevaluation of the situation in question and the formation of expanded or enriched configuration (i.e., accommodation).

Fascination, openness, and a ‘nose’ for the incongruous lead to ways of coming to grips with the situation that are marked by attention to peripheral aspects of the information in question, willingness to try the unexpected, search for the novel and so on. (p.101)

Davis & Gardner (1992) linked creativity with a theory of multiple intelligences, emphasizing the importance of creativity to the domain of education. He proposed that creative individual have “inborn sensitivities” to specific kinds of information or ways of learning and operating (p. 434). Gardner (1993) suggested that within each of his different types or categories of intelligence (including linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic,

interpersonal and intrapersonal intelligences), creativity was an essential aspect of skillful thinking – a mental function in a specific area (Starko, 2005). Along with Gardner (1999), Csikszentmihalyi (1996) centered their creative research focus on the notion of “sublime” creativity, as opposed to “everyday” creativity. Both researchers viewed the impact of a creative product or idea upon a domain as “the acid test of creativity” (Gardner, 1999, p. 116) Csikszentmihalyi (1996) differentiated between sublime vs. everyday creativity by denoting them respectively as “Big C” creativity vs. “little c” creativity. Gardner and Csikszentmihalyi maintained that understanding and studying Big C creativity was essential for contributing to the field of creativity research as a whole, but that this was not necessarily the case for studies of little c creativity.

At the same time, process or person-focused approaches to creativity research stated that an exclusive focus on sublime creativity was problematic. Cropley (2003) remarked on such problems of variable standards and judgments about creative products, and missed opportunities for studying “undiscovered” creative products or solutions. Process or person-centered approaches acknowledge the importance of creative products, but also focus on “everyday” creativity in terms of abilities, personality or thinking traits, and ways of interacting with environments that spawn creativity.

A further issue in creativity theories is the debate over whether it is domain specific or more meta-level in nature (Marksberry, 1963). Researchers and theorists who focus expressly on the products/ artifacts of creative activity and their effect on a domain, tend towards a domain-specific view in which creativity is found specifically in certain subject matters, such as art or science (Davis and Gardner 1992, Gardner, 1993; Starko, 2005). Those who support a more meta-level or generalized theory of creativity note that while there are specifics in creative work

in terms of special knowledge or skills, those specific differences occur within a unified model of thought processes or creative thinking (Cropley, 2003). Root-Bernstein (1999, 2003) and Mishra, et al. (2011) suggest a trans-disciplinary model of creative thinking, one that upholds the importance of context in subject matter, yet also looks across the domains for commonalities in creative thought processes. This trans-disciplinary model is a part of the framework of this dissertation study, and this will be discussed in more detail in later sections of this chapter.

Creativity in Education and Teaching

The necessity of creativity in the field of education is a concept with far-reaching roots, as it was championed by early educators and philosophers such as Plato and Aristotle (Starko, 2005). In the more modern era of educational philosophy, John Dewey (1934) contributed immensely to the idea that the arts and creativity are deeply connected to all domains of human knowledge, such as teaching and learning (Dewey, 1900; 1916; 1934).

Sternberg (1999) claimed that creativity is found in everyone, but that it is most commonly obvious in young children. He remarked that creativity “may be harder to find in older children and adults because their creative potential has been suppressed by a society that encourages intellectual conformity” (p. 93). Robinson (2003) has also observed the tendency of conventional education to “crush” students’ natural propensity for creative and divergent thinking. He has noted that our current system of education continues to reward conventional wisdom and convergent thought processes, yet punishes certain legitimate modes of creative thinking. Sternberg (2006) similarly stated, “When student are taught in a way that fits how they think, they do better in school. Children with creative or practical abilities, who are almost never taught or assessed in a way that matches their pattern of abilities, may be at a disadvantage in course after course, year after year” (p. 94).

Fasko (2000-2001) believed that the influence of both intrinsic and extrinsic motivators upon creativity could be useful to any classroom and any grade level, and that students would be most motivated toward successful learning when given some flexibility in creating their own tasks. Intrinsic motivation supports creativity and people complete a task in thoughtful, creative ways because of that intrinsic motivation (Fasko 2001; Runco & Chand 1995; Ruscio, Whitney & Amabile, 1998).

Amabile (1983; 1996) noted that when all aspects that influence the development of a person's creativity are considered, many factors can be found in the classroom, with teacher characteristics and behavior being incredibly relevant. Creative teachers are energetic and knowledgeable, with a supportive, flexible, distinctive manner (Lilly & Bramwell-Rejskind, 2004). In their classrooms, students tend to be cooperative, enthusiastic, and engaged (Baer, 1993; Goodson, 1992; Hickey, 1999; Kiely, 1998; Rejskind, 2000; Starko, 1995). Creative teachers help students to reconstruct their knowledge and understandings through discovery and rediscovery (Lilly & Bramwell-Rejskind, 2004). Such teachers give way to innovative learners, encouraging students to produce and create, rather than to summarize and repeat (Piaget, 1973). Bateson (1999) maintains that everyday creativity is a critical component in education, because the ability to learn and grow throughout life relies on innovation and new construction.

Fasko (2001) suggested that creative teaching enhances students' learning experiences. Other research has shown that teachers are among the most principal constituents in developing student creativity, in their capacities as mentors and role models (Renzulli, 1992). Karnes et al. (1961) suggested that creativity is significantly related to educational achievement, and that the teachers who are best at motivating creativity in their students also modeled creative or divergent thinking themselves. Cropley (2001) maintained that, "creativity offers classroom approaches

that are interesting and thus seems to be a more efficient way of fostering learning and personal growth” (p. 28). Conventional teaching practices such as transmission-models, punishment, reward, competition, and evaluation, have been found to stifle students’ innate creativity (Ramey & Piper, 1974). On the flip side, classrooms that promote self-directed learning and autonomy seem to cultivate innovative or novel thinking tendencies (Amabile, 1996, 2001). Creative teachers support students’ creative abilities and promote comfortable environments in which students can experiment with ideas, explore possibilities and push boundaries (Bramwell-Rejskind, 2000; Hickey, 1999). Lilly & Bramwell-Rejskind, (2004) indicate that these teachers foster a positive learning climate, encourage curiosity, and model flexibility. They “view fostering their own creativity as a precursor to fostering it in their students.” (Lilly & Bramwell-Rejskind, 2004, p. 3).

The ability to enhance creativity in teachers has also been extensively promoted (Milgram, 1979; Davidovitch & Milgram, 2006). This is somewhat troubled by the fact that research measures to assess and analyze creative teachers are infrequent in the literature. It has been suggested that there is an increasing need for the teaching of creativity in schools, particularly in teacher education (Mack, 1987). Sternberg and Lubart (1991) note that it would be beneficial to empower teachers to give more long-term assignments to promote and improve students’ tolerance for ambiguity. They additionally support the concept of intellectual risk-taking and suggest that teachers encourage students to take more risks with their new skills.

Goodson, (1992), suggested that studying creative teachers lives via research measures, interviews, etc. can provide awareness of the process of creative teaching. Hocevar (1981) noted, “A useful way to measure creativity is to simply ask the subject” (p. 459).

“Effective” Teaching is “Creative” Teaching

The educational impact of creativity has been championed by many researchers (Anderson, 2002; Bleedron, 2003, 2005; Crockenberg, 1972; Cropley, 1967, 2001; Esquivel, 1995; Fasko, 2000-01; Gowan et al., 1967; Hocevar, 1981; MacKinnon, 1962; Plunker et al., 2004; Renzulli, 1992; Starko, 2005; Sternberg, 2006; Tan & Law, 2004; Torrance, 1995). The complexity of the domain of teaching makes it difficult to define “creative” teaching, and educational research has often designated “creative teaching” as “effective teaching” (Anderson, 2002; Bain, 2004; Davidovitch & Milgram, 2006; Esquivel, 1995)

Further highlighting the efficacy of creative teachers, some researchers have suggested that the study of creative teaching is essentially the same as the study of “teacher effectiveness” (Esquivel, 1995). In fact, there is a strong body of thinking in educational research, which either equates or tightly links effective teaching with creative teaching (Anderson, 2002; Bain, 2004; Bleedron, 2003, 2005; Chambers, 1973; Cropley, 1967, 2001; Davidovitch & Milgram, 2006; Esquivel, 1995; Fasko, 2000-01; Milgram, 1979; Newcomb, McKracken and Warmbrod, 1993; Renzulli, 1992; Torrance, 1981, 1995). Along these lines, Milgram remarked that, “although few studies of the relationship exist, creative teacher behavior probably makes for more effective teaching” (p. 125). Anderson (2002) stated, “...the most fundamental risk these teachers accept is found in their willingness to confront both success and failure in the interest of teaching better. They risk themselves in being responsible for their work. In this way, they are not so different from creative artists in other arenas.” (p. 35).

Torrance (1995) proposed that creative teachers are effective teachers, because they are willing to try new approaches and ideas varying from some traditional educational beliefs. Newcomb et al. (1993) suggested “effective teaching involves more than what the teacher does

in the classroom. Teaching that is creative, interesting, and challenging...begins with a course of study that make sense to students” (p. 26). Anderson (2002) suggested that creative work necessitates passion, as does effective teaching. Bleedron (2005) stated “teachers of excellence and insight who go beyond the established curricula are likely to recognize similar creative-thinking talents in students” (p. 26). Such assertions highlight the fact that teachers who are noted as successful and effective are also *creative* teachers.

The domain of teaching overall is considered to be a highly complex, ill-structured and multifaceted discipline (Spiro et al., 1995). It has been compared to the messy and “creative” field of design, in that teaching lies at the crossroads of many other disciplines (Mishra, Zhao & Tan, 1999). It may be argued that the very nature of teaching is “trans-disciplinary”. To be effective in teaching, one must have a strong current of creative thinking across disciplines, making it an area in which questions about creative, trans-disciplinary thinking are open for investigation.

Trans-disciplinary Creativity

The notion that creativity spans domains across the arts and sciences has been touched upon by important thinkers in education and psychology. Dewey (1934), Vygotsky (1978), Eisner (2004), and Bruner (1990), among others, have suggested ways that creative, artistic, or imaginative thinking are critical to learning and thinking across a variety of subject matters and domains. Root-Bernstein (1996; 1999; 2003) suggests a framework for understanding how the most successful people in the sciences are knowledgeable and creative across disciplines. This framework emphasizes a specific set of creative thinking skills.

While trans-disciplinary creativity is a relatively new framework for creativity (Root-Bernstein, 2003; Mishra, et al. 2011), it is an idea that relates to the historical notion of

“polymathy”. This term has been used to describe individuals who are outstanding performers across various subject-matter disciplines (for example, people such as Galileo, Michaelangelo, DaVinci, and Newton are historically outstanding polymaths...although successful polymaths need not be such landmark figures). “Polymathy” may be thought of as an informed enthusiasm for more than one field of knowledge or expertise, or excellence in several realms that might seem distant from each other. It has been suggested that what makes polymaths so successful and fluidly creative is an ability to cross-pollinate ideas and information. People who open their minds to, and who learn from, multiple knowledge areas can apply new information and unique ways of thinking from one discipline into another. The more everyday conception of this is “trans-disciplinary creativity”.

The ability to think effectively and creatively in any subject area is deeply connected to thinking in other, seemingly unrelated, subject areas. Hudson (1967) noted that there is a tendency to classify scientists as “convergent thinkers” and artists as “divergent thinkers”; this is a strict and standard definition of domain-specific creativity shared by others (Snow, 1959; Gardner, 1999; Larson, Thomas and Leviness, 1999). However, this conception has not shed much light on how innovative thinking and creativity manages to span domains. Weisberg (2006) noted that what brings these two groups together is a creative problem-solving kind of thinking. Creative ability may have common threads which connect talented thinkers across disciplines (Freedman, 2003). It has been noted (Root-Bernstein, 1996, 1999, 2003) that creative artists think in similar ways to creative scientists; and conversely, that scientists often indulge artistic avocations which affect their thought processes and insights. Although disciplines have obvious differences, critical similarities between successful thinkers exist. As Caper (1996)

noted, “Artistic creation and scientific investigation become hard to distinguish in their essence” (p.867).

To connect creative pursuits with accomplishment in the disciplines, Root-Bernstein (1996) conducted a study of forty scientists (including four Nobel Prize winners). This group of scientists, specializing in various areas of scientific endeavor, were initially surveyed and interviewed with regard to their modes of thinking or thinking skills, attitudes toward creativity, and creative pursuits, hobbies, avocations, etc. On a longitudinal basis, they were interviewed at several different points in time (between the years of 1958 and 1978) on these same issues. The study investigated their modes of thinking (e.g., verbal, visual, kinesthetic), trans-disciplinary thinking tendencies, creative pursuits/avocations. It explored how these factors connected to their success and scientific accomplishment over time. The degree to which the individual scientists in this group had met with different levels of professional creativity and accomplishment was compared to the data regarding their creative inclinations and trans-disciplinary creativity overall. The qualitative and quantitative data were analyzed to determine if correlations existed between success/accomplishment in scientific fields, in relation to creative avocations and preferred modes of thinking (verbal, visual, etc).

Significant correlations were established between scientific accomplishment/innovation and certain creative thinking skills (in particular “visual” thinking, or thinking in images), and creative pursuits and avocations (particularly music and the visual arts). An important part of the study’s conclusion was the notion that *accomplished people, within their respective scientific domains, have varied creative interests and avocations, which they specifically value for contributing to their professional creativity. In fact, participants frequently gave credit to creative pursuits for motivating and improving their scientific thinking, innovation, and insights.*

This underscores a link between successful endeavor in the sciences and creative pursuits in other “unrelated” disciplines (Root-Bernstein, 1996).

While this connection between avocations and professional creativity has been investigated among successful scientists, the concept has not yet been applied to teachers. One of the key issues of how creativity functions in the field of teaching is grasping where and how creative teachers get their ideas. Root-Bernstein (2003) notes limitless examples of exceptional professionals in art or science who succeed by transferring ideas between domains. Physicist Max Planck noted, “...the scientist needs an artistically creative imagination”. And composer Stravinsky believed, “The way composers think – the way I think is...not very different from mathematical thinking”. “We are poets” said Pythagoras, in the sense that mathematicians are creators.

A good many scientists and artists have noted the universality of creativity...What the scientist perceives as common problem solving, the artist understands as shared inspiration – but the “answer” springs from the same creative act (Root-Bernstein, 1999, p. 11)

In considering this framework, along with Root-Bernstein’s notable correlations between creative avocations and professional accomplishment, it suggests that similar inspirations exist for exceptional teachers. This connection between professional and personal creativity supports *the need to investigate this phenomenon among successful teachers. To examine what kinds of interests and avocations they pursue, and if and how these things impact their teaching?*

Trans-disciplinary Thinking Skills

This multi-modal notion of creativity includes the concept of “trans-disciplinary thinking tools”. These are cognitive tools found to emerge and recur through the research on

extraordinary thinkers (Root-Bernstein, 1999), and will be discussed in more detail. Despite the emotional, intuitional, pre-verbal nature of creative thinking, it can be analyzed in terms of its components. “Concrete” skills such as language, logic/mathematics, can be developed, so can the specific types of thought processes or cognitive tools that make up creative thinking.

The data noted by Root-Bernstein (1996, 1999), show that creative people generally use a subset of thirteen pre-logical, pre-verbal skills. A compressed, but representative, skill set has been suggested by Mishra, et al. (2011), which includes the following seven tools: 1) *observing*; 2) *patterning*; 3) *abstracting*; 4) *embodied thinking*; 5) *modeling*; 6) *play*; 7) *synthesis*. Along with an overall tendency towards creativity in avocations, pursuits, and interests, it is the first of these trans-disciplinary thinking skills (observing, patterning, abstracting, embodied thinking, modeling, and play) that this dissertation study deals with, with respect to effective and creative teachers. These tools are described in more detail as follows:

(1) Observing. *Observing* requires both observing and imaging. It is the first step to understanding anything. Observing involves paying close attention to information gathered through the five senses, with intent focus and curiosity. For example, bacteriologists use their sense of smell to observe bacteria, or an ornithologist might identify bird species by sound. Inventors and mechanics cultivate hands-on experience with tools and machines - relying on a sense of “feel” to understand their craft. Taking observation to the next level calls for *imaging*, which is the recall component of observation (“mental re-observation” if you will). Imaging is our ability to evoke or bring to mind the impressions/sensations we observe, without the presence of external stimuli. Individuals can image using a variety of senses: visual, aural, smell, taste, and tactile/kinesthetic. If you can close your eyes and visualize something you’ve

seen, or imagine something you've tasted, touched, smelled, or heard after the experience or the stimulus is gone, then you can image. Both observation and imaging can be honed with practice.

(2) Patterning. The *Patterning* tool works in two parts, including the act of recognizing patterns and forming them. *Recognizing patterns* is a fairly familiar mental act to most of us. It involves identifying a repeating form or a plan in a seemingly arbitrary arrangement of things or processes. It is certainly a skill that can be learned, as it is one that is clearly influenced by environment, e.g. “Western” thinkers are prone to seek out information in linear means (straight back and forth or up and down). *Recognizing* is the analytical part of Patterning, while *forming* is basically a creative act of innovation. *Pattern forming* starts when one combines components or processes in a regular way to create a pattern. For example, when an engineer designs a complex machine, they are utilizing pattern formation skills; because there is a finite number of “basic machines” (such as wheels, screws, levers, etc) – an inventor must rely on their understanding of existing patterns to form new ones. Creative writers or poets rely on their knowledge of linguistic patterns and structures in order to dream up a new story, poem, etc (Root-Bernstein, 2003; Gardner, 1983).

(3) Abstracting. *Abstracting* involves capturing the essential nature of a thing. *Abstracting* means concentrating on one feature of a thing or process, in order to boil it down to basics and grasp its essence. Scientists use abstractions quite frequently. For example they may eliminate all superfluous traits from a physical situation (i.e. shape, size, color, texture, etc.) to key in on features of interest such as boiling point or mass. One key aspect of this is analogizing or comprehending a practical similarity between the fundamentals of seemingly disparate things (i.e. extending abstraction into two different domains). For instance, Isaac Newton compared our own Moon to a ball thrown so hard that its descent misses the earth and passes into orbit –

this analogy diverged from the Aristotelian notion that a body could have just one kind of motion, and spawned the idea of a forward/falling composite motion of objects in orbit.

(4) Embodied thinking. The cognitive tool of *embodied thinking* involves two skills which feed into each other - kinesthetic thinking and empathizing. *Kinesthetic thinking* is thinking with the body. The sensations of muscle, skin and sinew, and the feelings in the body of movement, balance, tensions and so forth, are a few examples of this. For instance, Einstein described the thought processes behind his own creative breakthroughs as being partly “visual” and partly “muscular” (rather than purely logico-mathematical). In his thought experiments, he imagined himself as a photon, and described not only what he saw, but what he felt in his body (Root-Bernstein, 1999). Another element of embodied thinking is *empathizing*. This requires imagining oneself in someone else’s position, walking in their shoes, feeling what they might feel. Actors, poets or novelists empathize with others, to portray them in interesting and authentic ways. Even scientists must also sometimes apply empathetic thinking to understand other organisms, even non-living things and processes. Fox-Keller (1983) notes in her book “A Feeling for the Organism”, that this practice of empathetic feeling was integral to the work of famed geneticist Barbara McClintock; this exemplifies the notion of understanding concepts, even in science, via a feeling “in the body”

(5) Modeling. A tool that builds on information gathered through the use of previous cognitive tools is *modeling*. To create a model is to represent something in real or theoretical terms in order to study its nature, composition or purpose. Artists create and draw on models by preparing smaller views of a piece of art in advance of creating it. Scientists employ basic models of things or processes. Modeling requires the use of abstractions or analogies, and the facility of dimensional thinking, that is, our thinking with respect to space and time. Creative

people do this when they take two-dimensional information (blueprints, maps etc) and construct them in three dimensions; or vice-versa, when they plot things that occur in three dimensions into two dimensions. This can be either (or both) a scientific or an artistic aspect of thinking. In the arts, it is the very crux of drawing in perspective; similarly, engineers must constantly think dimensionally in order to toggle between blueprints/plans and actual structures. Dimensional thinking, paired with abstractions and analogies, help create models of things or processes that explain the real world.

(6) Play. *Playing* is something that we do just “for the fun of it”. It may involve creating new rules or breaking the existing ones of established procedures. Simply put, “play” is using knowledge, body, mind and abilities for the pure enjoyment of using them. When imaginative or innovative people play with things or concepts or processes, they may open doors to new ways of thinking via unexpected breakthroughs. Creative people in different disciplines all speak to the value of play. They play with distinctions, boundaries, unassailable truths and the limits of utility. Through this play they transform ideas into creative acts or new knowledge.

(7) Synthesizing. The final cognitive tool ties together all of the previous ones. *Synthesizing* entails putting different ways-of-knowing together, into synthesized knowledge. When we fully understand something our feelings, senses, knowledge and experiences come together in a multi-faceted and cohesive kind of knowing. A person feels what they know and knows what they feel. For example, Einstein noted that when he sailed, he felt and experienced mathematical equations which occurred via the boat interacting with the wind and the water. The creative process is often described by artists, writers and scientists as the joining of the five senses and the emotions, into an aesthetic and intellectual experience. When feeling and thinking

work together, creative and intellectual processes are far more powerful and are described as “synesthetic.”

These trans-disciplinary skills or thinking tools are derived from the work of Root-Berstein (1999; 2003); and they are described by Mishra, Koehler, and Henriksen (2011), as an essential component of teaching and learning. Theories of trans-disciplinary creativity deal with these specific thinking skills as universal modalities across different domains. Originality or creativity in the sciences is often depicted as if it were markedly separate from the arts. The hard sciences must be objective, analytical and replicable, to clarify the process of problem solving. The arts, literature, and music, however, are typically perceived as softer, more subjective, empathic, and inimitable. Despite this, many scientists and engineers frequently use the arts as scientific tools, and insights of the artistic kind have paved the way for successive scientific discoveries and their practical applications. If learning to think creatively in one discipline opens the door to creativity in other disciplines, there may be a unique structure of thought processes, or habits of thinking, that are generally shared by creative people and innovators. To develop a more detailed picture of successful and creative teaching, trans-disciplinary skills must be considered. Understanding if and how trans-disciplinary thinking applies to teaching offers a new and exciting paradigm for creative teaching. This leads us to ask are trans-disciplinary thinking skills used by accomplished, successful teachers, and in what ways?

Research Questions

Our U.S. educational policy has a narrow, linear focus on topics such as science, technology, engineering and mathematics. But by ignoring creative thinking and the arts, and how different disciplines fluidly connect to each other, we may be missing a key component. A central issue in creativity research is “where do new ideas come from?” The noted research and

existing theory on creativity, avocations, and trans-disciplinary thinking offers some possible insights. It suggests that creative ideas may come from that which makes us unique - our interests, and modes of thinking about ideas and concepts. That creative uniqueness is being considered among successful people in various disciplines. Scientists and artists alike both think in this way. Yet conventional educational practices are not teaching in this way. The charge then for educational research is to understand if and how these issues apply to teachers. Therefore, the guiding research questions of the study can be summarized as such:

Research Question 1:

Q1) Does creativity play a significant role in the teaching practices of accomplished teachers, and if so in what ways?

- Question 1a: What does “creativity” mean to these accomplished teachers? How do they define creativity? Is it an important part of effective teaching practice?
- Question 1b: What are some examples or elements of “creative” teaching in the classrooms of these successful teachers?

Research Question 2:

Q2) Do successful, accomplished teachers engage in creative practices and avocations, and do these avocations impact their thinking and teaching?

- Question 2a: What kinds of interests and/or creative pursuits do these accomplished teachers engage in?
- Question 2b: Do these successful teachers feel that their avocations and interests influence their teaching practice, and in what ways?

Research Question 3:

Q3) Are trans-disciplinary thinking skills used by accomplished, successful teachers?

- Question 3a: How do these accomplished teachers use trans-disciplinary thinking skills in their teaching practice and what are some classroom examples?
- Question 3b: Do these thinking skills help them to be more effective, creative teachers?
In what ways are these thinking skills important to teaching?

CHAPTER 3

Methodology

This chapter presents the research rationale and design for this study. The description of the methods for data collection and analysis in this study is given after an initial overview of the research approach.

Purpose of the study

This study is focused on the concept of trans-disciplinary creativity within the field of teaching, and is an examination of the connection between successful teaching and creative thinking. The creative pursuits, interests, and avocations of a group of “accomplished” (successful and creative) teachers were investigated in terms of the influence these interests and avocations have upon their professional success and creativity as teachers. I explore if and how “trans-disciplinary” creative thinking skills are utilized among successful and creative teachers. Overall, creativity is considered in terms of how it plays a role in the teaching philosophies and classroom practices of successful and creative teachers. These inquiries shed light on teaching practices and outcomes that are both highly effective and creative.

Research Design

A qualitative research design was used for this study, centering on in-depth interviews (supplemented incidentally by data collected on participants from additional sources and documents). These semi-structured in-depth interviews with accomplished, successful teachers sought to explore the construct of creativity in teaching, in terms of creative avocations/behaviors, trans-disciplinary creativity, and creative thinking modes. Broadly speaking, this research was qualitative in nature and design, and more specifically, it can be characterized within the qualitative umbrella as “grounded theory” research.

Characteristics of Qualitative Research

Qualitative research is an inquiry method that seeks a detailed understanding of ideas and human behavior. Its methods focus on exploration and understanding reasons behind certain phenomena or behaviors, rather than trying to prove or test a hypothesis. Because social phenomena don't have uncomplicated existences, they must be interpreted and ascribed meaning. Given this, the role of the researcher is often critical in qualitative work. Creswell (1998) noted that qualitative frameworks highlight multiple realities and social construction of knowledge, and thereby require the researcher to acknowledge personal beliefs or biases. Anfara, et al. (2002) note the importance of making the methods of research public, and assert that clarifying the details of procedure and the researcher's role serve to strengthen the quality, trustworthiness, and rigor of a qualitative study. While quantitative research focuses on objective, positivist approaches to data, qualitative work utilizes a more subjective lens to explore and describe distinct themes and emergent ideas. This is done through the collection of verbal or narrative information from subjects or cases, which are interpreted through the framework of the study and the lens of the researcher.

Qualitative research provides a broad umbrella for numerous and varied types of descriptive and interpretive inquiry. The research design of this study falls within the qualitative branch of *Grounded Theory*. This is simply an approach to qualitative research that focuses on a specific phenomenon, attempting to describe and analyze a certain "subjective reality", or a certain reality as perceived by the study population (Creswell, 1998). Moustakas (1994) observed that phenomenology provides a description of the experiences of individuals, and also investigates the meanings of those experiences. The interpretation of a phenomenon (such as creative thinking) is considered with regard to the experiences of the individuals in the study, as

well as to other concepts or phenomena. The initial assumption is that the essence of a particular phenomenon does exist, and that it can be explored in the experiences and thoughts of individuals. The researcher goes beyond distilling the data to analyze and interpret it, in a quest to produce new knowledge.

Instrumentation

Due to its divergent nature, creativity is frequently noted in research and literature as a complex subject matter to investigate both quantitatively and qualitatively (Klein, 1982; Plucker et al, 2004). Hocevar (1981) suggested, “A useful way to measure creativity is to simply ask the subject. This is not a profound position, but yet the procedure is rarely used” (p.459). The interview process and instrumentation used in this study did this by collecting data from the subjects regarding their own ideas on and experience of creativity issues. A semi-structured interview protocol (Appendix A) was created specifically for this study to guide the framework of the interview, and cover issues of creative avocations/inclinations, teaching beliefs and ideas on creativity, and examples of trans-disciplinary thinking among successful teachers. The protocol was flexible and unique to this study. I developed this instrument to ensure that at least one or more interview questions directly address each of the essential research questions of this study, and to provide a sense of consistency among all of the interviews. The design of the protocol was shaped to begin with more open-ended or “warm-up” questions, to encourage conversation and familiarity and provide an emergent and open tone at the outset. The protocol questions narrowed in progression, ultimately focusing more on the specific creative and trans-disciplinary issues, so as to ensure that the key topic of the study were covered during the discussion. Despite these pre-determined questions, the protocol was intended and used as an open and adaptive guide to permit exploration of any emergent, pertinent areas of interest.

One key aspect of qualitative research suggests that the researcher try to identify and clarify personal biases. Creswell's (1998) suggestion is that the interviewer should consider and answer the questions themselves, and/or consider them from multiple viewpoints. To this end, the interview guide went through several iterations, in order to ensure that it not only addressed the research questions clearly, but also provided an open and unbiased opportunity for participants to speak to these issues from their own experience. The protocol was first considered and reviewed by two faculty/committee members with experience in the topics of creativity and teaching. As the researcher and interviewer, I also did a trial of answering the questions and considering them from an interviewee's standpoint. These iterations allow for revisions that ensured that the questions were specific to the subject matter yet still open to participant's ideas and experiences. With this the pilot-study draft of the protocol was ready.

Before actual data collection, three separate in-depth pilot interviews were conducted to test the interview protocol/guide, as well as the process itself. The pilot study interviewees were selected as teachers noted by Michigan State faculty (in two instances), or by my discretion as researcher (in one case), as effective and creative classroom teachers who could speak to the topics and questions at hand. These three pilot interviews, of approximately 90 minutes each, helped to establish the interview guide/protocol as a valid means of exploring the overall research questions. A few minor edits were made to the questions based on the pilot interviews. Additionally, the pilot interviews revealed the need for me as the interviewer to give each participant a clearer description of each trans-disciplinary skill in real-world terminology. Based on this I created note-cards for each trans-disciplinary skill to help me provide a basic and consistent definition with examples of each skill. At this point the protocol and process were established for the purpose of data collection.

Additionally, to provide an instance of internal validity and qualitative reliability, Anfara, et al. (2002) suggest a cross-referencing of the research questions with the instrumentation. Mapping the research questions of the study onto specific questions from the interview guide ensured that the interview questions investigated the issues that they were supposed to. This cross-referencing was done and is provided in Appendix B.

Sampling and Participants

This study used a purposeful sampling approach in order to use participants who could best speak to the larger questions of this research about creativity among accomplished teachers. A specific sample of selected individuals allowed for participants who could provide detailed information and enough data in interviews to paint a rich picture of creativity among skilled teachers. Both Patton (2002), and Creswell (1998), advocate such as approach as this ensures that all participants actually have experienced the phenomena or concepts of interest.

In order to address its research questions, this study required participants who were describable as “effective”, “accomplished” and “creative” teachers. Given this, the participants selected for this study were teachers who have received the Teacher of the Year award for their state and been selected as a Teacher of the Year finalist or winner nationally (more description of this group will follow).

In selecting a participant sample, I needed to designate teachers deemed to be uniquely “successful”, “accomplished” or creative in the field of teaching. Defining this underscored the question of “how do we identify a creative teacher?” There was no formal, established or consistent guideline or set of rules to answer this question. This study utilizes a measure for success or teaching accomplishment as being individuals who have both received the “Teacher of the Year” award at the state level, and been finalists for the award at the national level.

“Teacher of the Year” awards are generally given to classroom teachers who have been noted on multiple levels for excellent and innovative teaching. Teachers who receive this award have been singled out of thousands of their peers based on a record of teaching accomplishment. But what does this mean and is that relevant to this study?

Rationale for “Teachers of the Year” as Research Group

Defining “accomplished” and “creative” teachers was difficult, given the complex and ill-structured nature of the domain of teaching. However, it was determined that state and/or national “Teacher of the Year” award winners ably fit into this grouping as both “accomplished” and “creative” in their field. The very nature of the award is for excellence and thereby “effectiveness” in teaching. One teacher per state, every year, is selected based on criteria that invariably reflect “effective” teaching. For example, the State of Michigan website notes their criteria, among others, as, “exceptionally *dedicated, knowledgeable and skilled*”, “*inspires students*” and “*acts as a role model for innovation*” (Michigan Department of Education Website, Teacher of the Year Program Guidelines). While these generic criteria vary slightly by state, they are generally quite similar, and are kept somewhat open to allow for a scope of different types of teachers. The selection processes for all states however, are rigorous and consistent. Applicants must show: 1) a clear record of substantial positive classroom outcomes and student learning (i.e. a verifiable track record of teaching results), 2) examples of original, effective teaching, 3) high recommendations (in written form) from peers, principals, students/parents. Winners have been vetted and selected by a state education panel, as the best in the field in the noted areas of qualification and teaching accomplishment. These criteria indicate that “Teacher of the Year” award winners can be considered “effective” teachers.

Furthering the rationale for this group, and as noted previously (in a subheading of the Literature Review), there is a body of educational research which considers “effective teaching” to essentially be the same as “creative teaching” (Anderson, 2002; Bain, 2004; Bleedron, 2003, 2005; Chambers, 1973; Cropley, 1967, 2001; Davidovitch & Milgram, 2006; Esquivel, 1995; Fasko, 2000-01; Milgram, 1979; Newcomb, McCracken and Warmbrod, 1993; Renzulli, 1992; Torrance, 1981, 1995). In fact, it has been suggested that “creative teaching” can be subsumed under the heading of “effective teaching” (Esquivel, 1995). Within these parameters, the state or national “Teacher of the Year” award winners who are classified as “*effective*” may also be deemed “*creative*” teachers.

Taking this a further step to ensure the efficacy of this group selection for this dissertation study, I additionally conducted a brief review of a subset of individual applications, portfolios, or other available online data for 15 of the recent Teacher of the Year finalists at the national level. From among the 50 state-level Teacher of the Year award winners in the US every year, four are selected (based on accomplishments, recommendations, etc) to be finalists for the National Teacher of the Year award. From these four, one is selected to receive the award for the entire U.S. Application data for these four individuals is available on the National Teacher of the Year website, for all of the finalists of recent years. This includes information such as teaching philosophy statements, lesson examples, etc, for these award-winning teachers. After reviewing information from fifteen of the recent National Teacher of the Year award finalists, there was clear evidence of “creativity”, both implicitly (examples of creative teaching) and explicitly (specific mentions of “creativity” in teaching philosophy, etc). Appendix C includes a general overview, in bulleted selections, of some of the teaching philosophy statements, comments, lessons, and other evidence of creative teaching, from a sampling of this

group. (This is a rough sampling of available information, but it provides a sense of some overall creative teaching ideals of the group.) All but one of the 15 teachers made specific references to, and mentions of, “*creativity*”, in their stated comments about their own teaching. All fifteen provided examples of classroom teaching or lessons which can be construed as “*creative*”, in that they were original and innovative as well as valuable in the classroom (i.e. unique but effective examples of teaching). With 14 of the 15 teachers in the sample explicitly referencing creativity or creative teaching, and all 15 of them providing implicit examples of creative teaching, it was reasonable to assume that the National Teacher of the Year finalists/winners could be considered research sample that was representative of teachers who are not only effective, but creative.

An initial sample size of approximately 5-10 interviewees was deemed appropriate for in-depth interviews. This is supported by standards of qualitative research design, as Creswell (1998, p.65) suggests that “long interviews, with *up to* 10 people” are beneficial for this type of descriptive study. This allows for information-rich data sources, targeted to specific participants who can speak to the topic in question.

Recruitment

Since ten or fewer participants would be interviewed, I determined that recruiting from the relatively small, elite, group of National Teacher of the Year finalists and winners would allow for a selective and ideal sample. While contacting all statewide winners would undeniably provide a pool of excellent teachers, it could potentially provide too great a response. Also, the availability of data in the online applications for the national finalists provided extra, pre-interview information on participants and allowed for a more detailed focus. For instance, I purposely targeted the award-winning teachers who were not in disciplines such as music or the

arts, since creativity is already a given in these teaching professions. My sample of teachers was drawn specifically from those in the sciences, mathematics, language arts or English, and elementary education.

In order to recruit from this group of teachers, the e-mail contacts for award winners and finalists from the past four years were gathered from the National Teacher of the Year program website. A recruitment e-mail was drafted by the researcher to give potential participants some details of the study, and request an interview with them via telephone. As a thank you and compensation for their time, a \$50 gift card to amazon.com was noted for participation in an in-depth interview. The recruitment letter was revised in two drafts per suggestions from faculty committee members, and a copy of the final e-mail/letter that was actually sent out is provided in Appendix D.

Prior to any actual contact with participants, this research study was sent through Michigan State University's Institutional Research Board for review. Due to the nature of the study's design, its selection of participants based on excellence and accomplishment and issues/questions which posed minimal or no risk, it was determined to be of Exempt status and able to commence recruitment.

A first round of recruitment e-mails were sent on my behalf as the researcher, by my dissertation director Dr. Punya Mishra, who had overseen this project as academic advisor, and who as a faculty member was the initial representative from MSU to participants. Participants were directed to contact me, as the interviewer, if they opted to participate, to schedule an interview. In a first round of e-mails that were sent, several affirmative replies were received from National Teacher of the Year finalists agreeing to an interview. Dates and times that were convenient to their schedules were scheduled for in-depth interviews, and the collection of

interview data commenced. Four interviews were set and conducted based on this first round of recruitment e-mails. Because several more interviews were required to meet a sample size target of 5-10 participants, there were two more rounds of e-mails, drafted by me and sent by Dr. Mishra on my behalf. In the second round, reminder e-mails were sent out to potential participants who had not yet replied to the first e-mail, and initial recruitment e-mails were also sent to National Teacher of the Year finalists from earlier years prior that had not yet been contacted in the first round of e-mails. In the third round, reminders went out to the initial contacts from the second round of recruitment, and to yet a few more initial finalist contacts from prior years. By cycling this process of e-mail recruitment in several rounds, the research simultaneously conducted new interviews and collected data, while also seeking out new data sources. A total of nine in-depth interviews were conducted by phone, lasting approximately 90 minutes to 2 hours each. Ultimately eight of these nine interviews were actually used in the data for this study. One interview was eliminated when it was determined that the teacher/interviewee's position almost exclusively involved directing a community service program at his high school, and that his experience or background with regard to the issues of this study, and as a classroom teacher, were somewhat narrow.

Data Collection

On the arranged dates and times, in-depth interviews with the noted National Teacher of the Year finalist participants were conducted. Long interviews (approximately 90 minutes each) provided rich and descriptive data on the subject matter of creativity and trans-disciplinary thinking among accomplished teachers.

As recommended by Creswell (1998), the interviews were audiotaped with the expressed informed consent of each interviewee, and were transcribed prior to analysis. Recording was

done via a digital audio recorder device linked to a telephone handset control, which provided optimal recording quality for transcription. To ensure quality and accuracy of transcripts, the audio files were sent out for professional transcription. Each transcript was further read and reread by me upon completion, not only to check for quality or minor editing/proofing issues, but to again familiarize myself with the text.

In the course of data collection, a relatively consistent pattern or structure for interviews allowed me to cover the subject matter at hand and explore related comments as well. After beginning with greetings and pleasantries, some very open-ended initial questions from the guide helped to establish rapport, as well as a background/perspective for each participant. While the use of a flexible protocol meant that the order of the questions necessarily shifted slightly in some cases to allow for a meaningful flow of discussion, all of the questions in the guide were ultimately covered. Upon commencement of the interview, and after verbal thank you and goodbyes, I e-mailed each participant to again extend appreciation of their time and comments and send a \$50 gift card as a small gesture of appreciation. In order to collect my thoughts, I also took some separate post-interview notes on each person, to ultimately separate some of my personal impressions from the actual interview data itself.

Data Analysis

It has been noted that interview analysis of this type can reveal the “phenomenological aspect” of an experience that can not be found in the form of a quantitative instrument, i.e. a deeper understanding of certain experiences or phenomena (Creswell, 2003). In order to make sense of the complex and diffuse textual data produced, it was necessary to “horizontalize” the data (or thoroughly review all text/statements and consider them equally), and group it into “meaning units” by reflecting on the most significant types of statements (Moustakas, 1994).

It is essential for a researcher to become familiar with the totality of the data in order to approach it objectively and create “meaning units”, or coding schemas (Cresswell, 1998). To further these ends, the interviews were listened to in audio format, and read and re-read in text format multiple times, by me as the interviewer and researcher.

The coding of data is intended to organize patterns and themes that emerge from the data, and ultimately help to explain it. According to Anfara et al (2002), such analysis brings “meaning, structure, and order to data; approaching the process of coding through several iterations is generally considered a viable way to categorize it in meaningful ways. Data that are not useful, or that are repetitive or immaterial can be eliminated. Throughout the process of coding, the perceptions of the researcher are critical, in searching for the underlying themes of significance to derive “meaning units” or codes to organize and make sense of the data (Moustakas, 1994).

I used HyperResearch[©], a qualitative data coding software, which facilitated the process and management of textual data, and coding schemas. Using this software, I conducted three separate iterations of coding, with increasingly narrowed code lists, scaling down to a final set of codes, or themes, with the most significant themes discussed in the final analysis/conclusions of this study.

A first iteration of data brought the set of data into manageable chunks, gathered around over 40 codes, or ideas. This first set of codes was a mixture of pre-determined codes (which were driven by the research questions of this study – e.g. the trans-disciplinary skills, etc), and emergent themes of creativity and teaching that appeared interesting at the outset. The second iteration of coding reduced the code list by eliminating superfluous codes and condensing others into broader critical themes (Anfara et al, 2002) that make sense of and unify some key themes

of creative teaching and trans-disciplinary thinking. At the level of the third iteration, the code list was further tightened to themes most salient to the study. These broader significant themes provided theoretical points for discussion and theory in the analysis and conclusions of the study.

Developing Codes. I approached the task of developing codes by coming up with some initial codes which were determined by my research questions. Since my questions consider whether and how certain issues of creativity exist in excellent teachers, it was important to have a way to categorize these themes from the data. So I began by looking at my research questions and my interview guide (since this was designed based upon these), and asking what themes I wanted to identify in the data. Since the trans-disciplinary skills are paramount to this study, it was clear that those skills should each become a code. That way, whenever an interviewee talked about the importance of “observation” or “analogies/abstract thinking”, I had a way to classify it (as the code “observation” or “abstracting”). Because of the research question aimed at the creative interests/avocations of excellent teachers, it was important to have codes to designate any specific mentions of hobbies, interests, etc. Therefore, under the master-code heading of “avocations”, separate codes were created to classify these interests in art, music, etc. Also a code for “creative avocations influence teaching” was created because of the fact that I am interested not only in what their avocations are, but in why and how they influence creative teaching practices. That way, any comments or discussion of how a teacher’s interests in the arts, or music, or reading/writing, etc, affect their views and practices as a teacher could be coded under this theme. By going through the research questions of this study and the interview guide in this way, I was initially able to identify several themes that I wanted to investigate within the data to be able to answer my research questions, and thereby create some initial codes for them.

Beyond having these initial codes (such as the trans-disciplinary themes, avocations, philosophy of creativity, etc), it was also important to allow important ideas to emerge from the data and create codes to help classify these. These “emergent themes” were arrived at both through the several initial readings that I did of the interview texts (to familiarize myself with the data), and the first two iterations of coding. The aspect of qualitative research that is interpretative is important here (Anfara et al, 2002). Part of becoming familiar with the textual data means recognizing themes that seem to recur and persist between the different data sources, and distinguishing which of these might be important to the research questions.

Being quite familiar with my topic and my data, I would notice and make note of interesting similarities in certain comments or types of statements between the interviewees. For example, in talking about examples of creative teaching in their classrooms many of the teachers would mention how their lessons and practices always tried to make connections to the real-world, perhaps relating to the students own experiences or giving them a realistic or “real-world” scenario for learning about a new topic. Many similar ideas or examples from their classrooms seemed to fall under this same category, so I created the “real-world connections” code to demarcate any examples or statements about how these teachers tried to connect real-world learning to their teaching in creative ways. Similarly, many of the teachers noted the importance of “calculated risks” in the classroom, or the willingness to go out on a limb and try new things in their classrooms. The “risk-taking” code was created for these types of statements or discussion. These are just a few examples that show how emergent codes come to light in the process of reviewing the data, and doing the first round or rounds of coding. During these first and second iterations, some codes appear and disappear, if it seems that they are not being coded frequently enough to make them noteworthy, if they are quite similar in essence to another code

(and can be condensed), or if they ultimately are interesting but not applicable enough to answering the study's research questions. By the third iteration, I was able to look at each code as a useful and distinctive theme in the data.

Sample Excerpt from Coding. The example that follows is a brief text excerpt (in a screen capture from HyperResearch[©] with codes from one of the interviews, to provide a sample of how some of the codes can be applied in the data.

In this following example, the teacher (“Adam” as described in the Results section), discusses several examples of creative teaching from his classroom. Each different teaching example he mentions is coded separately for “Examples of Creative Teaching”, two are also double coded for “Real World Teaching/Learning”, because they are examples that connect learning to real-world examples for students (i.e. realistic or authentic scenarios that they can understand in real-world terms, such as a socio-economic example that relates to their lives – 90% of his students are Hispanic/Latino - or an example of popular culture like Justin Bieber on youtube); towards the end of the section we begin to talk about cross-curricular connections, adding another code. Most of the coded sections through all the transcripts have at least several codes layered within them, to account for multiple related themes being discussed at any given time.

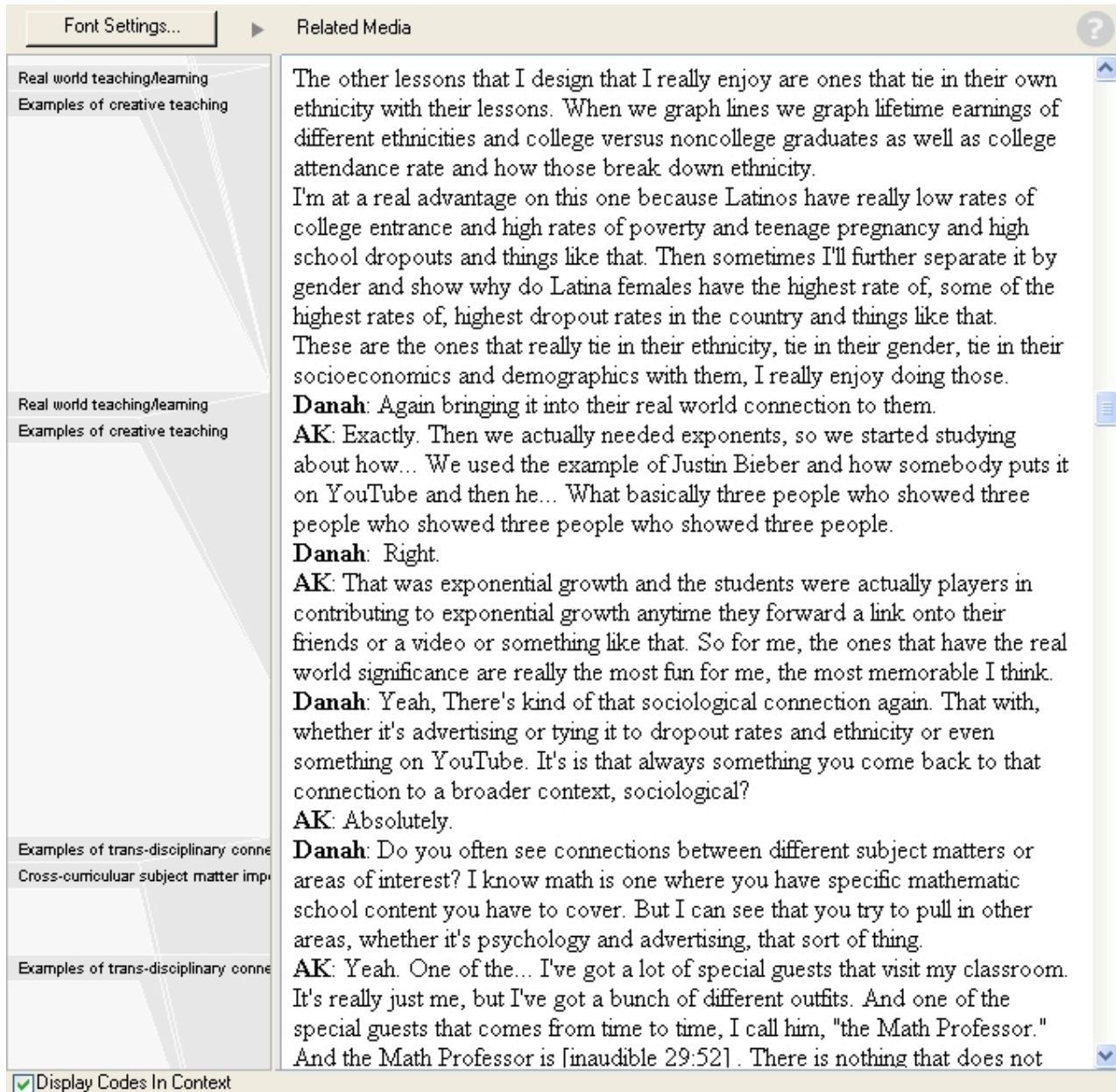


Figure 1: HyperResearch[©] Example of Coding

Final Code Listing. The final code list for this study includes the following codes (and code-groups or sub-codes):

- Avocations
 - o Arts
 - o Misc
 - o Music
 - o Physical activity

- Reading
- Subject matter interests
- Creative avocations influence teaching
- Creative thought processes
- Creativity as a mindset
- Cross-curricular subject matter teaching
- Curiosity/Lifelong Learning
- Definition or philosophy of creativity
- Diverse and varied background
- Diverse subject matter interests
- Empathy
- Examples of creative teaching or creative lessons
- General trans-disciplinary thinking statements/tendencies
- Real world connections
- Risk-taking
- Teaching with the arts
- Trans-disciplinary Skills
 - Abstracting
 - Embodied Thinking
 - Modeling
 - Observation
 - Patterning
 - Play
- Where and How Creative Ideas Arise
- We teach who we are

Each of the codes in this list represents a theme viewed in this study, and was either driven by the research questions and determined up-front, or decided upon as they emerged through reading and analysis of the data. This is the final code list from which the themes discussed in the analysis/conclusions were organized and discussed. Ultimately this organizes ideas and text from the interviews into themes/categories, which are referenced and discussed as pertinent in the Analysis and Results of this study.

Reliability and Validity

The terms reliability and validity, sometimes referred to as “standards” and “verification” in qualitative work, speak to how trustworthy and credible a study is. Howe & Eisenhardt (1990) note that ultimately the methods of a study must be evaluated based on how effectively they enlighten the research goals, rather than how well they conform to a set of conventions. They propose a fundamental set of standards that should be met, including: Does the methodology provide data that can answer the question(s) of a study? Are the background assumptions reasonable? Does the application of methods provide results that are credible? (Howe and Eisenhardt, 1990)

In meeting the first issue of whether the methodology/data can appropriately answer the research question, I followed the suggestion of Anfara et al (2002), and from the outset of the study design, created a cross-referencing table of the research questions and the instrumentation, mapping the questions of the study onto a specific question or questions from the instrument/interview guide. This cross-referencing lends internal validity, ensuring that the research questions drove the data collection (rather than the reverse) – this table is provided for reference in the appendices.

To provide a check of the other standards for reliability and validity (the noted issues of background assumptions and application of methods), Cresswell (1998) describes eight different verification techniques for qualitative research and suggests that any researcher should engage at least two of these techniques: 1) prolonged engagement or persistent observation 2) triangulation 3) peer-review or debriefing 4) negative case analysis 5) clarification of researcher bias 6) member checks 7) rich thick description 8) external audits. I engaged not only two, but four of these techniques: clarification of researcher bias, peer-review or debriefing, member checks, and rich thick description.

“Clarification of researcher bias” occurs during the earliest stages of phenomenological research, in which the researcher identifies and clarifies personal biases. I did this partially through answering the interview questions myself, as well as by piloting the study with several other, non-participant teachers, to identify any built-in conclusions, problems or biases in the interview methods. As a result, the interview guide went through several iterations to ensure that questions were phrased clearly and directed toward the research goals – several were also re-phrased to become more open and not “leading” in nature. Further clarification of bias required reflecting on any past experiences or personal orientations that might otherwise bias my interpretations (Cresswell, 1998). I have no previous experience as a K-12 classroom teacher, and therefore no direct/personal experience or bias with regard to creative thinking as a K-12 teacher. However past and present experiences are always significant, as I designed and conducted this study with a given knowledge of, and educational experiences, with issues and topics involving creativity as a university instructor and graduate student. Moustakas (1994) suggests that it is important to acknowledge this point, because qualitative research frequently links reliability and validity to the researcher’s interpretations.

“Peer-review or de-briefing” is part of a credible qualitative research process, in which the researcher arranges a colleague or another appropriate individual to act as a critic or auditor for the study. This person can help detect a point has been over-emphasized, or if another critical point has been missed, and in general acts as a reviewer and editor of the research process. I had several people serve as reviewers and de-briefers throughout the research process of this study. My graduate advisor, Dr. Punya Mishra, served as a thorough reviewer and research critic, from the inception of the research questions to the final conclusions. Another education faculty member, Dr. Janine Certo, also provided consistent and valuable critique on

methodological design and research processes. I met or spoke with both of these individuals to provide details and updates on, and received advice and feedback on aspects of design, data collection and analysis. Additionally, the teachers who served as participants in the pilot version of this study were peer-reviewers to the data collection process. I did a debriefing session after each pilot interview to ask about their reactions/responses to the questions, and whether they accurately captured their experiences of teaching and creativity.

“Member checks” also serve as a useful way to add reliability to the process of research (Lincoln and Guba, 1985; Anfara et al, 2002). As noted in the section on data collection, each participant was given a copy of their transcript, to confirm that it accurately reflected their comments and ideas. I had e-mail responses with greetings or positive comments from half of the interviewees, or no responses from the others. Since there were no issues or problems raised by anyone, the process ensured the accuracy and authenticity of the data and participants’ experiences of the phenomenon.

“Rich, thick description” is considered one of the most valuable techniques for allowing the reader of the study to judge the phenomenon and make an assessment of how well the researcher has interpreted the findings (Cresswell, 1998; Patton, 2002). A thorough and detailed description, “takes the reader into the setting or phenomena being described” (Patton, 2002, pg. 437), and thereby allows them to evaluate the analysis and conclusions. This is achieved through extensive use of direct quoting woven throughout the analysis and descriptions of participants. Direct quoting in particular is necessary for reliability/validity in qualitative work, because the research audience is provided a candid look at actual data alongside the interpretations and findings (Patton, 2002). This offers transparency in the process, and an understanding of how the data connects to the results.

As an additional measure to the techniques noted, inter-coder reliability was also determined to provide additional verification for these methods. Another graduate student from the MSU College of Education, who had similar research interests in themes of creativity and trans-disciplinary thinking, served as a secondary coder. I met multiple times with this doctoral student to train her on the meaning of the codes and the overall system/approach of coding. After she was trained in the meanings, definitions and applications of these codes, she did several practice sessions to ensure that she understood and felt comfortable applying the codes applied to the data. This process of training and practice coding helped to ascertain that the coding process was understood and logical in advance of ultimately reaching inter-coder reliability standards. At this point, she did a final, thorough coding of 2 of the 8 transcripts, so that approximately 25% of the data would have an inter-coder reliability measure. Anything above 70% is generally considered acceptable reliability for qualitative coding, and our approximate agreement in matching up coded sections (allowing for a sentence or two of variation in how we chose and selected text and passages to code) was 76%.

Summary

A qualitative research design, within a grounded theory framework, made the use of in-depth interviews the most appropriate means of studying creativity and trans-disciplinary thinking among successful teachers. The highly effective and accomplished teachers in this study were drawn from a sample of National Teacher of the Year award winners and finalists. They were interviewed in-depth with regard to the research questions outlined previously in this chapter. Textual data from these interviews was collected and analyzed through coding and interpretative, descriptive research processes. The final chapters of this study discuss the data

analysis results and discussion of this research, and report on creativity and trans-disciplinary thinking in the experiences and classrooms of excellent teachers.

CHAPTER 4

Results

The results of this study were generated using qualitative research methods; specifically through the analysis of data gathered through in-depth interviews with successful and accomplished teachers. This research focused on the creative tendencies and creative thinking modes of exceptional teachers. Eight nationally award-winning teachers were interviewed with regard to creativity in their teaching practices, as well as their overall creative avocations and interests, with an emphasis on how these things connect. Along these lines trans-disciplinary thinking skills are considered, as well as their role in the creative thinking of successful teachers.

This results are divided into three sections, the first being the Description of Participants, followed by the more lengthy and detailed analysis of the research questions (subdivided for the three overall questions). The description of participants supports the qualitative research principle of “rich, thick description”, in which a detailed description of the participants “takes the reader into the setting or phenomena being described” (Patton, 2002, pg. 437). In a qualitative research paradigm, elements of “rich, thick description” contribute to the reliability and validity of the study.

Some pertinent teaching and background information is given for each interviewee along with a brief description of how the person related to the themes of this study. Following the description of participants is the discussion of the research questions. Throughout these sections of my analysis, I engage the technique of direct quoting. Direct quoting furthers the goal of rich, thick description, thereby promoting reliability and validity, in giving readers a candid look at data alongside the findings, and allowing another means of judging the interpretations (Patton, 2002; Anfara et al, 2002).

Descriptions of Participants

The eight teachers interviewed for this study were: Mark, Sandra, Carrie, Jack, Julia, Adam, Mia, and Marie (all pseudonyms). The following are brief initial profiles to provide a perfunctory introduction to each participant. This is to give a sense of each teacher, before entering into their comments during the analysis of the research questions.

Mark. Mark is a middle school science teacher. He teaches in a relatively rural, small town community, where poverty rates are high and in recent years, unemployment has usually been above 20%. His school has approximately 700 students, and he teaches mostly 7th grade science. It's a fairly traditional setup in terms of regular class periods and the structure of the school day. He is one of two 7th grade science teachers at this school, and though they do collaborate to some extent, recent budget cuts have reduced available collaborative time; so he is often on his own in planning and teaching science lessons.

Professionally, Mark started out as a forester, receiving his undergraduate degree in Forestry Management, where he worked for several years before becoming a teacher. Mark's philosophy of teaching is inherently creative and in fact a passion for creativity and the arts was a key motivation for him in entering the field of education. He noted,

I guess that I felt that it (teaching) was not only a way to have an influence on real people and on the future, but, that also I get the chance to use a lot of the skills that I didn't feel like I was using very much as a forester. A lot of the things that I love to do include things like music and art... My classroom and my students are really what I work with as an artist, I guess. I consider myself, even though I teach science, I obviously try and do it in a very creative and interesting way, and I guess I kind of see that almost as living performance art in a sense.

His definition of creativity is of a broad-minded thinking skill which applies across a wide array of disciplines spanning from math or science to art, or as he stated,

Creativity to me, I think, is the ability to really produce something new that has value. Most people tend to just simply equate it with a particular art form. If you can draw, you're creative. Or if you're musical, then you're creative. But I think it's much more broad than that. It can, of course, occur in any field, in any discipline. The best scientists are highly creative. The best mathematicians are extremely creative. It really comes down to being innovative, taking risks, and actually coming up with something that has some value.

This is a philosophy that he has actively tried to instill into his practice and his student's learning through a variety of creative lessons that bring the arts into his lesson designs for middle school science.

Mark's creative personal interests and avocations play a major role in his thought processes, both within and outside of the classroom. He is a musician who plays guitar and piano, a serious photographer who has worked both in his own darkroom and with digital photography, and is also a visual artist (before forestry and then teaching, he was originally interested in studying graphic design).

Sandra. Sandra is a high school English teacher, teaching a range of students from 9-12 graders and a broad range of courses with different kinds of emphases and ability levels. She teaches everything from honors or advanced placement courses to at-risk courses, and from required to elective courses. Sandra has had an extensive array of teaching assignments within her discipline and a variety of leadership roles across the school, district, and the state levels. Her high school is in a fairly large suburban community with a mixture of socio-economic

backgrounds and is headquarters to a large international company, which has recently given rise to a growing population from Bosnia, Serbia, and Eastern Europe and thereby more ESL students at her school.

Her wide range of subject matter interests originally led her to academically pursue careers in at first broadcasting and journalism, then philosophy, then psychology, until she realized that teaching was a profession that could satisfy her extensive topical curiosities and interests, as she described it,

I realized one day that all of those skills, all of those things that I loved about each of those choices are in a classroom. And if I'm going to be an effective teacher, I am a philosopher everyday and I'm a psychologist - I don't analyze my students but I do need to be empathetic, I have to be observant about them as whole people. And most certainly some of my broadcast journalism skills have been important in introducing some critical thinking in current affairs to my curriculum. So I think everything that I loved manifested itself in the work of the classroom.

Sandra's philosophy of creativity and teaching focuses on cognitive skills across disciplines. She commented on the importance of seeing creativity as an inter-disciplinary boundary-breaking construct, saying, "What creativity really means to me is that you know how to think." She frequently incorporates the teaching of cognitive skills such as observation or pattern-recognition into her curriculum, and provides lessons or problems with enough "constraints" or guidelines to scaffold and prompt student learning toward creative problem solving.

Sandra is an avid reader on an eclectic range of topics, which is something that she credits with improving her teaching practice. But she also notes that her other hobbies are

continually influential on the way that she thinks and teaches. Her interests include games, film, writing and wordplay, and technology, as well as physical activities such as running and kickboxing.

Carrie. Carrie is a middle school language arts teacher, who has taught both reading and language arts for grades 6-8, as well as for high school. At the time of our interview, she was in the position of serving as “teacher on loan” - still a teacher, but one who is loaned as a result of her Teacher of the Year award to her state’s Department of Publication Instruction. She also works with teacher recruitment and retention initiatives and professional development, training and assisting new teachers for example, on our Teacher Evaluation Instrument, as well as mentoring training and serving on local and state educational committees and commissions.

Though Carrie is temporarily involved with educational commitments outside of her classroom, she observed that teaching was her lifelong passion, both based on a love of the subject matter and her own empathetic ways of viewing the world. These issues were also expressed as her most important reason for entering the profession of teaching, as she commented,

Without a doubt, the fact that I'm able to have relationships with people that wouldn't take place to this amount in any other setting. For example, the obvious relationships with students, and knowing that I make a difference in a life, it may sound cliché, but it's so true. You just caught me (just prior to the interview) on the phone with a kid I haven't taught in many years. And I'm trying to change his life right now - keep him functional, moving forward and on-track. And those are the kinds of opportunities that I have that other people in other professions don't always get to have.

In terms of her avocations and creative interests, Carrie noted that she had several, including reading (on a variety of different topic and among many genres), creative and non-fiction writing (she has published a book, and frequently writes for pleasure - short stories or fiction to share with students, friends and family), writing poetry, and any kinds of verbal games, word puzzles, etc; all of these are strong influences on her cognitive skills and teaching practices.

Jack. Jack is currently working as a teacher recruiter and mentor since receiving the Teacher of the Year Award, where his focus has primarily been on retention and advancement initiatives and providing quality support for beginning teachers in his state. He also works with his state's District Teachers of the Year to mentor and assist them. For most of his educational career however, he has been a third-grade teacher in a Title One public school working with many at-risk students in a very rural district.

Jack described a strong passion for teaching with the arts as a core aspect of his teaching philosophy stating,

I think we have to, as teachers, fight the urge to say, "They're taking away my creativity."

No. They're giving us a standard and it's up to us to use our creativity to make that happen. So it's so important that you try to look for those opportunities to exercise your teaching creativity on a daily basis.

Jack cited various examples from his own classroom practice in which he regularly used music, dance or drama to teach a variety of different subject matters. He brings this cross-curricular inclination to the work that he does with new teachers and teacher development initiatives.

He is involved with several creative interests or avocations that connect deeply to his teaching practice. Music has been a longtime interest as he is an avid singer/vocalist (in his

church and around his community); he also enjoys any kind of travel, and is quite committed to a variety of community service activities. These things have become melded to his teaching practice as he regularly incorporates music and movement to class activities, and seeks out opportunities for his students with community service work or opportunities for local travel (museum field trips or chances to see more of their community).

Julia. Julia is a middle school science teacher with a current focus on 7th grade (she has taught both 7th and 8th and some high school in the past). She teaches in a micro-district just adjacent to a large urban school district, and encompasses a range of different topics into her teaching of science, including: botany, astronomy, geology, taxonomy, microbiology, interactions of living things, and reproductive health. She frequently also teaches an exploratory class in Multicultural Literature Circles, leading students through books and reflective activities that explore themes of justice, friendship, conflict and prejudice.

Julia noted that a passion for learning across various topics and subjects inspired her decision to become a teacher. Having entered college to pursue medicine or vet medicine, she focused on the sciences but also elected to take a range of different classes to suit her natural curiosities,

Because I was on scholarship at Wayne State, I took a very eclectic background. I have a minor in English...I'm also certified for social studies and pushed to have as much math just because of interest in math. I pursued a lot of different, interesting things and did a lot with the Detroit Institute of Arts. I see value in value in the arts. I see value in dance and music, so I took dance and music courses. I took fashion, sewing, a lot of history, a lot of literature, public speaking, economics. All things that did not at all relate to my biology degree, my degree in biological sciences because I found them interesting. So

that when I decided I wanted to teach, I think that background has always informed my teaching, that kind of an outlook of bringing in all of the subject matters.

As might be expected from expansive view of learning, Julia has a wide variety of creative interests and passions. She loves nature walks and hiking, is an avid reader and loves to engage in artistic crafts including sewing, drawing and sketching. She noted that all of these things have not just informed her view of the natural world as a science teacher, but also contributed to how she physically designs her classroom and how she structures (or sometimes purposefully un-structures) her lessons and teaching practice.

Adam. Adam is a middle school math teacher, who has taught mainly eighth grade (and recently seventh grade) at a large urban middle school. It's a traditional middle school located in an urban neighborhood with one of its state's fastest growing rates of poverty. In the middle of that neighborhood is his school, sandwiched between two apartment complexes. The student population is approximately 90% Latino-Hispanic, with Caucasians, African-Americans, Asians and other minorities comprising another 10%. A majority of students there receive or qualify for free and reduced price lunches, and about two thirds of the parents themselves have not finished high school. So, as he describes it "it can be a pretty tough place to work".

Adam's passion for teaching is fueled by a deep interest in a variety of other subject matters such as sociology, socio-economics, world affairs, advertising and media and culture. His undergraduate background is in sociology, and he spent time - before entering the profession of teaching - traveling around the world and studying cultures. After which he worked in restaurant and hospitality management for some time, before deciding he wanted to act on a lifelong interest in the profession of teaching.

Adam brings all of these life experiences creatively into his math teaching, he commented that he tends to “think sociologically, and so it's a challenge for me to observe, and to try out and then test out different sociological theories, or read something about it and see it unfolding in front of me.” When his students are applying math concepts to a problem, he uses problems and examples that directly linked to the lives of his students and their circumstances of socio-economics and education.

Adam also actively brings arts and culture into his math classroom. Because many of his students have an interest in rap music (which he has interest in also), he began creating rap songs and rapping about mathematical concepts such as decimal placements and exponents for his students. With these techniques he has had enormous success in improving the academic performance and test scores of students. He now also creates rap/math CDs and does workshops for other teachers about bringing this kind of creativity to their classrooms.

Adam has a wide variety of subject matter interests, as well as a love of music and rhythm and rap. Additionally he is an avid competitive swimmer and surfer, and he credits the calm and focus he receives from these physical activities with helping him to relax and mentally focus or as he noted, to “process an idea”, which can later translate into his teaching work.

Mia. Mia is an elementary teacher with eight years of teaching experience, at an urban elementary school in a large metropolitan area. It's a Title I school with approximately 97% of kids receiving free and reduced lunch. Her teaching experience is primarily with fourth grade, though she has also had some experiences with teaching in grades 1-3.

Her original professional background did not involve teaching, and she actually worked for several years in the field of law before deciding that she wanted to become a teacher. Mia initially studied engineering, and has a degree in Language and International Trade as well as her

law degree. Her interest in teaching was inspired by a desire to do something more creative with her life and be an influence on kids “who someday had the potential to become engineers, scientists, teachers, doctors”.

Fun and innovative applications of the arts to the teaching of varied subjects are a key feature of Mia’s approach as a teacher. She noted that teaching any topic in a creative and cross-disciplinary way - from her teaching of geometry with music and rhythm to teaching reading with podcasting and internet research – was something that she viewed as an opportunity to draw students more deeply into the subject matter, or as she stated,

I think anytime you can spark creativity in a child, it gets them motivated and excited to learn. A lot of times in education, we're talking about higher order thinking. When you're using different creative aspects of subject in your teaching, it is the purest form of higher order thinking. It gets the kids so excited and engaged. It gets them to really enjoy the learning process and to drive learning themselves, which is essential so they can continue learning once they leave our classrooms.

Not only is teaching with creativity and the arts something that she views as improving student excitement and motivation, but it allows her to bring different modes of learning to an active and diverse group of young children, as she noted,

Our students all learn in different ways and taking that to a challenge at the beginning of the year and throughout the year and using that to drive your instruction really helps ideas stick with your students and really helps them understand the concepts better.

Mia is a creatively driven individual in her hobbies and avocations as well. She is a musician who plays both the piano and the violin. She loves to cook, and is an avid gardener with a passion for landscape architecture. She also counts running as a critical part of her

everyday life (she trains for long distance races), as something that she says is an “excellent motivator for the brain”, and a place where “you come up with a 1000 good creative ideas for school or home projects”.

Marie. Marie is an elementary teacher, who has primarily taught fourth grade in a suburban setting, but at various times in her career has taught any of grades 1-5 in several different school districts around the country. She currently runs a multi-district educational lesson program, which provides inter-disciplinary immersion learning experiences for teachers and students.

Marie has a teaching philosophy which focuses on creative teaching and learning in a very real-world context. She described how she sees it as an imperative for students to explore learning experiences in quite in-depth and interdisciplinary ways. Giving them real world or realistic scenarios for learning any topic is a cornerstone of her teaching style, and she noted that this inspiration stemmed from her earliest undergraduate learning experiences, she said

I had some outstanding experiences as an under-grad in which the instructors had us out into the community, out into the real world, out into doing different things rather than the four walls of the classroom kind of experience. That made me realize even before I ever really had a classroom about how critically important it is that the learning that we do with our students has to be connected to the real world. Here I am all these years later and I remember that those instructors brought us to a planetarium in order to understand the nature of learning about the stars and the planets, or we visited a mushroom farm one day just to see how it could be exciting to learn about how mushrooms grow. One day just to learn about Economics, we went to where the farmers bring in all of their goods in order to be able to sell them. That kind of real world learning, I think it really charged me up

early on to want to be able to be a teacher that could do that sort of experiential learning with my students.

Through many years of teaching experience Marie has built an extensive repertoire of creative and cross-curricular real-world lessons. So much so that it has become an intrinsic part of her thinking about teaching itself. Notably, Marie has extended this to a wider audience of teachers and students. She currently runs a real-world lesson program/model for classrooms and schools which now encompasses several districts and growing. In her lesson model, students, teachers, and parents use community resources as their classroom for a week. The program focuses on changing the concept of a traditional field trip into a week-long interdisciplinary study trip. Teachers receive lesson training and resources, in an experience for students that includes: investigations, behind-the-scenes tours, presentations by community experts, and groups of students working cooperatively on research. Culminations of the week are service learning projects, research projects, and community action plans.

In terms of hobbies and avocations, Marie loves music and reading; she also enjoys the creative aspects of cooking, and is a devoted practitioner of yoga.

These general descriptions of each teacher provide a very basic sense of who they are as a teacher, as well as their school and teaching setting. The next section following this cursory introduction leads us into the analysis of the research questions, beginning with an examination of their definitions of creativity and examples in teaching practice.

Research Question 1 Analysis: Creativity in Teaching Practices

Q1) Does creativity play a significant role in the teaching practices of accomplished teachers, and if so in what ways?

- Question 1a: What does “creativity” mean to these accomplished teachers? How do they define creativity? Is it an important part of effective teaching practice?
- Question 1b: What are some examples or elements of “creative” teaching in the classrooms of these successful teachers?

The major findings of this study with respect to this research question showed that these successful teachers defined creativity both broadly and contextually. The teachers all incorporated some universal definitions of what creativity is. Additionally though, they also defined it in context-driven ways specific to teachers and classrooms. This included a student-centered focus on creative teaching, the fact that creative thinking is accessible to everyone (not just people deemed “special” or “creative”), and an ongoing mindset cultivated toward creativity in their classrooms. In terms of how this creativity plays out in their classrooms, the teachers discussed creative lessons and examples from their own practice that clustered around several themes: 1) Real-world or “authentic” learning; 2) Cross-curricular connections; 3) Taking intellectual/educational risks. All of these findings are discussed as follows.

Defining Creativity. Since the notion of how creativity is defined by successful teachers was the focus of one of the research questions of this study, “Definitions of Creativity” was one of the pre-determined codes in the HyperResearch[©] software. In examining all of the textual data coded as “Definitions of Creativity”, there were some commonalities and interesting features in the way the teachers talked about this.

In discussing how he defines creativity in teaching, Adam noted some core components of the classic creativity definition, but he situated these in a classroom focused context:

Well, I think being creative has to be taken into consideration from the students’ perspective. So, if it's something that the students have never seen before or if it's

something they latch onto or really like, that's the first cornerstone of creativity. Whoever you're trying it out on has to like it. Usually it's something where they're like, "Whoa! I've never seen that before"...That's the first part of being creative. Then the other thing part of that is that it's got to be a little bit entertaining, to where it makes somebody laugh or cry or at least experience an emotion that they don't normally experience. Then, it's got to be effective for learning...Otherwise its just entertainment.

The relevant factors of "novel" or "interesting" are present in this definition, but Adam specifically ties it to the idea of his audience or students. The notion of designing specifically for your audience is also a construct of effective design processes, in which attention is given to what works for the audience or "users" (Mishra et al, 1999). The fact that Adam mentions the importance of emotional connection from the experience, relates to the notion that educative experiences have an aesthetic or emotional quality that makes them powerful (Dewey, 1934; Wong & Henriksen, 2008).

Carrie also suggested the importance of trying out new things to come up with original solutions. She mentioned the importance of novel teaching approaches that related to the students' lives and are relevant,

Creativity is when you step out of the textbook definition of anything. If in a classroom, a teacher can take a concept that is written in a sentence in a textbook or on a curriculum standard and make it relate to a student's life, something that's a connection and something that is usable for them, then that's being creative.

While she again noted standard creativity components of making something "new" and "usable", she also situated it specifically in a teaching context, in highlighting the relevancy of lessons and topics to students.

Mark noted the importance of a willingness to deal with multiple possibilities and problem solutions within a creative paradigm. Within his definition of creativity, there are several key concepts for creativity in a learning setting. Having an ability to recognize and deal with complexity has been noted as an integral part of effective thinking, as an aspect of cognitive flexibility theory (Spiro et al, 1992). Mark also reflected on the fact that even disciplines that we consider more rigid and scientific actually are open with possibilities for creativity and flexible thinking, stating

A lot of times what I really strive to do is allow my students to exercise their creativity and stress that there isn't necessarily one right answer...even in something that's considered a hard discipline, like science, where there are certain facts that need to be understood...Yet how you interact with that information, how you present that information and what you do with it is really what creativity is all about.

Mia highlighted the importance of innovation that springs from background knowledge and the ability to take something that exists and alter it into something new and useful, as she stated,

Creativity means to use your background knowledge... when you are creative you are creating something new with something that you already have. Taking something that already exists and putting your own spin on it, your own way of thinking about it.

Mishra and Koehler (2003) similarly talk about creative design as being the ability to “twists the knobs slightly” on something that already exists, to transform it into something new. In “Metamagical Themas”, Hofstadter (1985) speaks of “variations on a theme” as being the crux of creativity. Mia’s description of creativity was somewhat akin to this in that she described it as “your own spin” on something that exists. In essence what she spoke about was a propensity

to refine, to add to or subtract from, or to change something so that the end product is new, different and better. This is an important point because it helps to illustrate that everyday forms of creativity are accessible to those that are willing to “twist the knobs”, and to those that are observant about which ones to twist and how. As Hofstadter (1985) reflects, “knobs, knobs everywhere, just vary a knob to think”; yet he also cautions that, “the crux of creativity is not just in twisting knobs, but in spotting them.” (p. 251)

Going back to the “little c” vs. “Big C” issues of creativity set forth by researchers such as Csikszentmihalyi (1996) and Gardner (1993) helps us to distinguish “little c” or everyday, subtler, smaller acts of creativity from “Big C” or more grandiose, “sublime” creativity. Big C creativity may involve “extreme forms of originality” that dramatically change thinking within a discipline, but the subtler kinds of little c creativity may be just as crucial to improvement or innovation within a discipline. Particularly within the local context of a classroom or a school, everyday creative acts are critical to effective teaching and can involve trying something new based on an existing idea, or trying something that is just a bit different than the current norm.

Corresponding to some of the more problem-solving kinds of research definitions of creativity (Cropley, 2003), Sandra considers it to be a complex cognitive skill that can be learned, as she stated,

I don't believe that people either are, or they aren't creative. I really believe that it's something that we can learn if we want to. I think that there is this myth about creativity...I know a lot of my students believe that they either are creative or they aren't. What it really means to me that you know how to think...You have to be able to move from the concrete to the abstract, and back again. You have to be able to synthesize.

The notion of creativity as a thinking skill, with the ability to think abstractly and to synthesize, is directly associated with the cognitive skills of the trans-disciplinary thinking framework. Both abstraction and synthesis are key parts of this cognitive tool kit (Root-Bernstein, 1999). One interesting aspect of Sandra's comment above is that she brought up these issues of "abstraction" and "synthesis" early in our conversation, even before I as the interviewer ever mentioned trans-disciplinary thinking skills or described/asked her about them. The fact that she initiated this mention of abstract thinking or synthesis before ever being asked about them speaks to the power of trans-disciplinary thinking. It indicates that these thinking skills have an important place both in the repertoire of an effective teacher's practices, and in her view of creativity.

Overall, in examining the definitions that these teachers gave about creativity, several factors are present. While the features of "novelty" and "effectiveness" were consistently mentioned, there were also some very contextual aspects specific to the field of teaching. These include, considering the relevancy to and opinions of the audience/students, and belief in the creative potential of all students – which are characteristics also referred to in some teacher effectiveness literature as qualities of effective teachers (Smith et al, 2005). The features of "newness" and "effectiveness" in their definitions, paired with the contextual or "whole" elements they discussed, suggest that Mishra and Koehler's (2008) NEW (novel, effective and whole) framework is a useful way to think about creativity in teaching.

Creativity as a Mindset. This was not one of the initial codes selected for organizing themes and ideas in HyperResearch[©]. Rather it emerged in the data, as it became apparent in successive coding rounds that many of the teachers' comments on their beliefs about creativity indicated that it was a way of thinking or an ongoing mindset.

Most of the creative teachers in this study described creativity not as a process or skill that is discrete or separated from other thought processes, but as an integrated aspect of their thinking. Julia described it as a habit of mind and an openness of thinking:

It's crucial in the success of an educator to be creative... It's a mindset more than anything and it's a priority...I don't exactly do interpretive dance in my classes because I'm not that much of a smooth mover. But, if a kid wanted to dance in my class and they felt they were going to do the dance of the cytoplasm, I'd say "Go for it buddy!"

Similarly, Adam talked about his own creative processes as something that are ongoing. In many ways, creative lessons are not something that he necessarily sits down to work on, but rather that he is constantly thinking about and open to:

I'll often just be places doing something else. I'll see something happen, and I'm always thinking, 'Well, how can I relate that to teaching?' What I do is basically, I just go through life and always - I'm always on the lookout for, 'How can I apply that to teaching?' I've trained my mind to look at something and think about how it applies to teaching. And then, I don't know, it just makes sense. It pops into my head.

By actively cultivating a creative mindset, Adam has found ways to continually be open to creative inspiration. He noted how he would sometimes get ideas for teaching, while reading a book on a totally different subject matter (such as classroom management ideas, while reading Malcolm Gladwell's "The Tipping Point"). In this way, creative inspiration can arise when a person is actively engaged in a completely different subject or activity. This openness of mind was described by the teachers in this study as a means of promoting creativity and keeping open to new ideas wherever they may come from. On another level it connects to trans-disciplinary thinking in that good ideas are drawn upon from a variety of different subject matters and a

certain amount of “cross-pollinating” of knowledge can take place. If one keeps an open and alert mind and as Alex put it, “trains the mind” to always be on the lookout for new ideas and inspiration, the propensity for creativity and trans-disciplinary thinking necessarily increases.

For Jack, creativity arises from an openness of mind and a willingness to gather inspiration from others. He described the importance of keeping alert to creative opportunities, and of collaboration in the classroom:

Creativity is something that...you are just always open to it, always looking for new ways of thinking in the classroom. Just always keeping that open ear and that open eye to look for new ways. I don't think we can expect to just stand and deliver and close our classroom doors. I've found really reaching out and learning from and sharing with my colleagues helps my creativity.

The significance of opportunities to collaborate, and gather and bounce ideas off of other educators was something that Mia also highlighted,

Another important thing with being creative is collaboration amongst teachers and other staff members. Anytime you have brains focusing in on one idea or one goal, the potential is exponential. You can start brainstorming ideas and bouncing them off one another. There's a lot of creativity to be found in collaborating with one another. The difficult part with that is making sure that you have time for collaboration with educators.

Jack and Mia both noted the value of collaboration for inciting their creative thinking. This is something that several of the other teachers also referred to at one point or another as well, and while it is an important point, it also denotes how “creativity” in teaching can become tangled with “effectiveness” in teaching. As Smith (2004) notes, collaboration and openness to the ideas of others is frequently found among “expert” teachers. A willingness to share ideas and

learn from others is a behavior of effective teachers overall. Open-minded thinking and ongoing learning has a place in both creativity research and effective teaching research, suggesting as noted in prior educational research, that creative teaching often equates to effective teaching.

Mia discussed the manner in which creativity is often something that comes very innately and naturally to students and young people. Robinson (2003) has also described the fact that creative thinking is often quite proficient and profound among children and young people. He has suggested that some of the more rote “drill and kill” strategies of learning from traditional schooling tend to damage this instinctual creativity. Mia views her role as a teacher as requiring a willingness to ask about students’ ideas for learning a topic and to indulge and recognize their creativity:

I think something that also helps with creativity is letting loose the reins in your classrooms and opening it up to the students. As a 32 year old, my brain has been taught to think a specific way with different things. Their eight or 10 year old brains are a lot more open. Sometimes having a discussion with your class, asking, “Hey...what are some ways that you can think of that we can learn the steps to multiplication or long division?” Getting the kids to take some ownership for that creativity leads to a lot more creativity on the teacher's part.

Mark also described the importance of a student-focused lesson design. He puts himself in the position of his students to consider what might make a topic interesting to learn about. This notion of “putting oneself in someone else’s position” to imagine what they might think or feel, is directly connected to the trans-disciplinary skill of “empathy”, or proverbially “walking in someone else’s shoes”, which falls under the trans-disciplinary skill of abstraction. He describes this technique:

I usually come at it from a perspective of, if I was a student, and realizing that all students are all very different from each other, how would I want to learn this? How would I want to approach this topic? Realizing that not all students enjoy science, not all students have had good experiences with science.

These student-centered approaches to lesson plans have many overall qualities of creativity associated with them – such as purpose-centered design processes, a focus on the “audience” response, and trans-disciplinary thinking (through abstraction and empathy). At the same time however, it must be noted that some of these qualities also exist expressly in teacher education literature, as components of effective teaching. For example, Smith et al (2005) note a variety of cornerstone pieces in teacher education literature that define excellent teaching as having a focus on the learner; or that note how effective teachers key in on what would be interesting or relevant to students and their lives. The interests and feelings of the students (or in design thinking, the “audience”) play an integral role in how the lessons and teaching activities are structured.

Marie also has a student-centered view of lesson design, and she discussed the importance of background knowledge and comprehension on any subject that one wants to teach creatively. She blends this subject matter knowledge with her pedagogical knowledge about her students to come up with effective lesson design. This relates to Schulman’s (1986) notion of Pedagogical Content Knowledge (PCK), as well as Mishra & Koehler’s (2006) conception of TPACK (which introduces technology to the interaction). She stated:

If it is a lesson that I want to teach with my students, I will saturate myself with as much information as I can...I have my mind open and waiting for the ideas to come through from gathering of information and content. So just keep learning all you can about it and

keep open to that moment of inspiration that says, “This is the way that my students could learn this effectively.” It changes with every design based on not just the content that my students need, but also what do my students need on a personal level

Her student-centered view of creative lesson design takes into account what her specific group of students need, and reflects a somewhat constructivist way of teaching (Posner, 2004), which has also been linked to environments that foster creativity (Plucker et al., 2004). This reveals again that untangling the differences between “what is creative?” vs. “what is merely effective?” in teaching is more complicated than one might imagine. In certain places, as noted, there is significant crossover between aspects of creative thinking and aspects of effective teaching.

Sandra’s notion of how creativity arises can be considered quite similar to Mishra, et al’s (1999) depiction of how constraint influences creativity in the design process:

I think that, for me, a lot of creativity emerges because of constraint. If somebody says to me “create something” or “write”...it's a little bit too open, and sometimes we think that this fuels creativity. But I think what really fuels creativity is when we impose a series of constraints that forces us to go beyond what we already know and rely on and beyond sameness. When we do that, I think that's when we dive into innovative, creative thoughts and experiences.

This somewhat design-based view of creativity in education is significant in that design as a subject matter, has often been viewed as a “crossroads” for many other subject matters. This web of disciplinary connectedness again seems to highlight the importance of a trans-disciplinary framework for teaching and learning.

Real-world Learning. The theme of “Real World Learning” was also not one of the pre-determined codes, since there was nothing in the research questions to indicate this idea. However, it emerged throughout the process of coding in HyperResearch[©], and all of the teachers mentioned the importance of teaching with a focus on real or authentic learning. Essentially, these creative teachers all had a tendency to design or create lessons that had a focus on real world applications, examples or scenarios for their students. In asking them about lessons or classroom examples that they felt were especially creative, all of the teachers cited examples that they had taught using a real world framework or application (i.e. authentic as opposed to theoretical). .

As a middle school science teacher, Mark taught the topic of alternative energy sources and utilized the real world implications of the subject, to situate it in a real context for students:

One such lesson would be around the topic of energy sources, or alternative energies. I have students conduct a town-hall style meeting where small groups of students represent energy industries, like solar, wind and fossil fuels. Then having candidates for office that represent various political parties choose a mix of energies that are going to work. The students are basically responsible to do what I think really happens in the real world...

And they're not only understanding the material, but really understanding how the real world works. That's an exciting moment when that kind of thing happens.

Jack also stressed the need for realistic modes of teaching and learning, which connect to students' lives. He described an example of how, in teaching his third graders about letter writing, he sought a more realistic and meaningful way for the students' to learn and practice the skill,

We started a pen pal program with the college students and my third graders, so they could see that yes, they too could go to college. We visited the campus, and the college students came out and visited us - so my students got to meet their pen pal. I look for opportunities to really *show* my kids that you can do these things... these successes.

The “real world” component of the lessons that many of these successful teachers engage in is quite often found as an integral component of excellent or “effective” teaching practices. Purcell-Gates et al. (2007) has noted the importance of “authenticity” in teaching. The authors note how in the realm of literacy, it is critical for students to have opportunities to engage in reading and writing of real-life texts for real-life purposes. “Real” here means real in the lives of children, so that the work students do in the classroom is relevant and connected to their own lives. So, it is clear that some of the “real-world” classroom activities that these teachers utilize fit into the framework of authentic teaching suggested by Purcell-Gates et al. (2007).

As an elementary teacher, Marie noted that she always tried to ensure a real-world opportunity for her students to learn a topic. She described how she often started the school day for her kids, with an approach that brought them out of the classroom and started them thinking about science in an authentic way:

One of the things that I've always done with my fourth graders was a sky watch....My students had their very first lesson before they even came in the building. When the first bell would ring, they would spread out on the school courtyard. We'd talk about the clouds and the humidity and the weather and the wind direction. We did this every single day unless it was really storming outside, and we'd collect this scientific data. As soon they got into the class, the kids would go online and send the data to the scientists at NASA. It was a project that was going on all over the world, where kids were sending

sky watch information to scientists. So in their very first 10 minutes of every school day, my kids had a sense they were doing something for the greater good...and they centered themselves on a day of learning before they even walked into the building.

Like some of the other teachers discussed here, Marie seems to naturally draw on the notion of “authenticity” in teaching and learning, by giving a learning activity with precedence in the real world (the work of NASA), a place and a context in her classroom and a relevancy in her students lives.

In a similar way, Sandra gave an example in which she brought a lesson on writing and research out into a more authentic and realistic context for her students as well:

I teach a literature course, so we read a lot of different texts, a lot of different genres...But we also go beyond that to a lot of different genres, to a variety of types of writing and real research. My students do a grant project where they create nonprofit organizations that have to meet the needs of a demographic group that cannot meet their “American dream”. The students do interviews with people from nonprofit organizations in the community. They compete with the other groups in the classroom to fund their grants for their nonprofit. The grant panel is comprised of actual community members...these adults have actually read through all of their materials ahead of time and then they ask students unpredictable questions on their topic. Students have to support their ideas and be persuasive. It's a wonderful experience - very intense and rewarding.

Sandra’s real-world learning activities are perhaps even more deeply connected to the “authentic” learning discussed by Purcell-Gates et al, (2007). In making her students responsible for creating realistic texts in a realistic context, they engage in much of the work that anyone writing an actual grant would do, interviews, research, outside review, etc. Having community

members' review their grant writing and research provides a relevancy for her students. This raises the stakes and makes the learning experience more powerful and significant.

Mia described how when she was able to find ways to connect to students with lessons that they enjoyed and found to be relevant in their own lives, even her struggling students became engaged and excited:

I had a really difficult summer school class a couple of summers ago. They were fifth graders - struggling readers about two or three levels below, about 12 or 13 years old. They realized that they were reading below their grade level and they were frustrated. I did everything that I knew to get them to start to reading and failed miserably. So I opened it up to the class with a meeting, and they came up with a podcast idea... They got to pick their own topic and research it. So they are reading all different topics, and doing different research inquiry skills. They had to write a written retelling...and timed their words per minute every week and used their fluency graph. Then we filmed the podcast series and did reflections, where they set new goals for themselves. They were just so open to create their own show from what they read, and it was such a cool thing.

Julia noted an example of teaching a science unit, in which she was able to create a real world application for her students within the environment of the school building. The real-world nature of a lesson is something that she felt created a more vibrant and exciting experience for her students:

With a food safety unit that I did, I gave everybody a Petri dish and we talked about how to take a sample, and then the students have to go around and do that. I ask them what are they interested in the building that might have germs on it. They swab it and they grow it, and then they analyze it and count the colonies. Basically they analyze the microbes in

the world around them. So, they're doing the work of a real microbiologist...I had them do a tour in our school kitchen. The food services person spoke about what they have to do for food safety and why it's important.

With the statement, “they’re doing the work of a real microbiologist”, Sandra illustrates an important aspect of the philosophy that these teachers generally seemed to have. That it is important to give their students a real-life context for learning and ideas. Taking knowledge out of a vacuum and infusing it into a more relevant experience is a critical aspect of authenticity and of effective teaching overall. This component of teaching is not necessarily one that falls directly into a “creativity” paradigm so much as it does an “effective” teaching paradigm. However, these types of real-world learning experiences were often voiced by the teachers in this study, when they were asked about some of their creative lessons and examples. The fact that they often viewed “real-world” learning as “creative” indicates that perhaps it is something that often feels fresh and unique in any learning activity. These types of activities are also sometimes lacking in some of the more standards-based or “teach to the test” approaches which prevail in U.S. education policy today. If these kinds of activities are somewhat different from the norm in practice (if not in the research/literature), then they may be considered a form of “little c” teaching creativity.

Adam offered an example of a real-world relevancy in a lesson that he did with his students, where he used math concepts to explain a basic situation that his students could all relate to:

I try to relate the math that I'm teaching to my students and to the wider world. I was at a Chinese food buffet last month, trying to figure out what to start with. As I'm staring at all these different combinations...I was standing there and I realized, “This is a great

math lesson on combinations and possibilities and data and statistics.” The next day I had my students grab a paper and a pencil and we went to the cafeteria line. We calculated the possibilities if they grabbed a different drink, a different main dish, and a different bag of chips every day. We calculated it out and realized that they could go through the entire school year never eating the exact same meal twice. It blew their minds and of course, it all started with me trying to decide on chow mein or sesame chicken in a buffet line.

Other lessons that Adam designs tie in his students’ own ethnicity with their lessons (he teaches middle school math in a lower income 90% Hispanic population). When his students are learning graphs he has them graph lifetime earnings of different ethnicities, and college versus non-college graduates, as well as college attendance rate and how they break down by ethnicity. He noted that this usually gets their attention because as he says

“Latinos have really low rates of college entrance and high rates of poverty and teenage pregnancy and high school dropouts. I’ll further separate it by gender and show them why Latina females have the highest dropout rates in the country. These are the ones that really tie in their ethnicity, tie in their gender, and tie in their own socioeconomics and demographics.”

Adam’s lessons are interesting examples of “authentic” learning in that he finds things that are naturally and easily relatable to the lives of his students. They are relevant not just in a real world sense, but to the students as individuals. He noted that finding things that his students can connect to in popular culture is fair game for a real world type of lesson; such as using the example of how Justin Bieber started his career with viral videos, in order to teach exponents (i.e. how somebody puts it on YouTube, ...with three people who showed three people who showed three people who showed three people), and to reveal the concept of exponential growth.

He noted how the lessons with real world significance are really the most fun and memorable for students. This student-centered approach is found not only in authentic approaches to literacy (Purcell-Gates, 2007), but has certain critical foundations in aesthetic, creative approaches to education laid down by Dewey (1934).

The idea of “authentic” learning is nothing new in the field of education, and it has long been touted as a significant way to help students become motivated about learning. Yet it was noteworthy to discover it as such a persistent and important theme in the teaching practices of successful and creative teachers. The theme of real world learning was not one of the questions directly covered in the interview protocol, yet it recurred through the discussions and in most of the creative teaching examples that the participants provided. The notion of bringing creativity into the “real world” thereby was one of the crucial means by which these teachers helped make learning relevant for their students.

Cross-curricular connections. This theme of “cross-curricular connections” in teaching, emerged early in the coding with HyperResearch[®]. While it was not an initial code, since it is not overtly signaled by the research questions, one of the interview questions does ask about connections between subject matter. This notion of subject matter connectedness has a strong association with trans-disciplinary thinking, because in this framework subject matters are not discrete or disconnected, but fluidly related to each other. This was a significant theme in that each teacher spoke or gave examples of teaching subject matters with the arts or music, or of simply using one subject matter in order to teach another.

Mark gave numerous examples in which he used various other subject matters, such as the arts, to teach science concepts to his students:

We do a lot of theater and kinesthetic movement, where students might represent different creatures in an ecosystem or they might represent different elementary particles in an atom... Ultimately that's my real goal is to show them some of these creative ideas that I might come up with, and let them create their own. I've created a natural selection simulation, and we'll do that. But then they'll have a chance then to create their own simulation, their own game about natural selection, organisms, species, their own environmental changes and traits that are going to change. So they're doing the creation based on what something new they've learned. And that's ultimately my goal is... to inspire them to then get creative and demonstrate and process what they've learned.

For Mark, these cross-curricular connections are not just a part of many of his creative lessons, but are how he inspires his students to tap into their own creativity. This is an important thing to note, because an argument could be made that cross-curricular connections are valuable in teaching overall, irrespective of “creative” teaching. Yet as Mark noted, practicing these different and divergent modes of learning and teaching subject matter helps students to tap into their own creativity.

As a middle school science teacher, Julia is a major proponent of the connections of other subject matter to the teaching of science. She described how she even created a special course at her school, meant to give science into a more social dynamic:

For those who want to be involved in a few more field trips or real-life connectedness things, I created a special class, called a “Future Think Class”. We do science related community service, like the Adopt-a-Beach activity, or we talk about life or conditions for people in other cultures. Being involved in a lot of public service, that's something that I've always felt was important. It's my desire to reach out from a position of, “We are

so blessed, we have so much and there are so many who do not. Let's move and mobilize and empower.” It helps students’ develop gratitude about their own lives when they see that, ‘Wow, we have a classroom here. Some people have dirt floors and they carve the letters in the dirt floor.’” I try to connect kids to larger causes outside of their lives; to bring a whole other social dimension into the sciences.

Adam gave several examples of how he brings different subject matters into the teaching of math. For example, he often teaches his students a little about advertising and psychology in order to make a math concept more vivid:

I think one of my favorite lessons is where we talk about advertising. We talked about company slogans and advertising and how there are different types of advertising. And one type of course, is with math and with numbers, such as “save fifty percent”, percentages off and things like that. So the students get really engaged in advertising and how advertisers try to target them as young adults. Then we go into percentages and decimals and things like that. They get into it and that's really a fun one.

Adam even has created special classroom characters who help him relate to the students some of the different ways in which math connects to other subject matters:

I've got a lot of special guests that visit my classroom. It's really just me, but I've got a bunch of different outfits. And one of the special guests that comes from time to time, I call him, "the Math Professor." His tagline is “there is nothing that does not have something to do with math.” If you can stump the Math Professor, you can win a prize. The kids bring up language arts or science. They bring up things from different subjects, and the Math Professor takes the opportunity to explain and somehow relate it to math.

The importance of math in relation to other disciplines and topics is something that Adam feels strongly about, and he talked about this with regard to his own classroom as well as the US system of education:

I'm always trying to relate other things to math. I'll bring up number lines and the timelines that students use in history, or...we work a lot with variables, which are really just letters and things learned in Language Arts. And of course, science has all sorts of connections to math that can be made.

The criss-crossing of topics and subject matters is not necessarily something that is always easy to do, as some of the teachers noted, in the more rigid schedules and standardized curriculums of current education policy. Yet these exceptional teachers find ways to do this, and work cross-curricular learning into their practice. The fact that it may be seen as something different and more effective than the norm is another argument for considering it to be a “creative” aspect of teaching practice. While this willingness to blend disciplines may not be a reinventing of the wheel in teaching and learning theory, it is still something rather different and unique in the practices of U.S. education.

Like the other teachers in this study, Carrie has actively practiced cross-disciplinary modes of teaching for her Language Arts courses, by collaborating with teachers of other subject matters in order to draw links between topics for her students:

I often worked with the other core teachers, math, language arts, science, and social studies, and we came up with some creative stuff interdisciplinary-wise. As a language arts teacher I worked with the social studies teacher to see what continent she was on at that time, and that helped me to choose which novels we read. Or when the 7th grade social studies curriculum centered on Africa, we'd integrate our lessons around a given

topic. In science, they did a lesson on the cheetah and the adaptations that the cheetah has for living in the jungle, like the tear lines down the front of the face to hide them in jungle grasses. The math teacher had math problems that she wrote herself on cheetahs. In my classroom, we wrote all kinds of poetry about cheetahs, and stories. In social studies they looked at maps and talked about the places where the cheetah lived. She'd pinpoint on the map the places in Africa where they could find cheetahs and the habitats and so forth.

Carrie described her reason for doing this type of curriculum crossing activities, noting that they promoted an engagement and interest that her students seemed to exhibit for the subjects that they were covering. She described how students seemed to make more connections between different ideas and pay attention to how what occurred in one subject related to another.

Sandra described an example in which she used musical concepts to teach a complex Language Arts text. This teaching example was derived when she recognized the connection between movements in music and movements in text:

One time, I was watching an interview on The Actors' Studio, with Billy Joel. He was talking about his music and the craft of making music, and these different genres that he's explored over his career. I remember thinking about the movement he was describing, and some of the songs that he had written. It sounded very much like movements that writers use when they are oftentimes writing a short novella. So I was thinking about the book that we teach "The Metamorphosis" by Kafka and how there are these very definitive movements in the text and how it resembles the movements in Billy Joel's music. And then I started to consult some music teachers that I know, and I asked them to tell me more about this aspect of music and how it impacts the song. The next time I talked about the book, we had a day where I had my students who were musical speak

about these movements in music before we discussed Kafka. This helped everyone to see this connection between the movements in music, and in the text and to understand both.

Sandra's example above is particularly interesting because it takes the notion of cross-curricular teaching to the next level of creativity. What she describes is more than just creative in the local context of the classroom (i.e. something relatively new and effective). Her example actually uses the content from one subject, music, to examine and illuminate a totally different topic in another genre of literature. This recognizes the way that seemingly different subject matters are often more deeply connected than we realize. Her example is not only cross-curricular but is truly trans-disciplinary, in that she upholds the content of both subjects, using one to enlighten the other, so that both are more deeply understood. This has helped her to connect her English course subject matter to different subjects that her students may be interested in, as she relates,

I definitely emphasize cross-curricular connections, and I look for them. One thing that I have learned...is that at very high levels of any discipline there's just this incredible connectedness to ideas. So I would have students who'd be very talented in math or science; and by the end of my English course we would be able to have a conversation about how math is similar to English. In seeing the disciplines at high enough levels they can notice the comparisons and synthesize them. We might typically think of math as more structured than English. But I have discussions with students who can talk about how math is more ambiguous than we give it credit for at higher levels, and language is more formulaic than we give it credit for at some levels. I learned early on...that we could definitely synthesize all disciplines. It doesn't really make sense to separate them.

Without a doubt, one of the most integral themes of this study and these interviews was in the subject of cross-curricular teaching and learning. Fundamentally this is really the essence of what trans-disciplinary thinking and learning is all about. It involves recognizing the ways in which different subjects relate to each other, and emphasizing those connections in a teaching and learning paradigm. All eight of the award-winning teachers in the study commented on the importance of cross-curricular connections in subject matter, and more significantly, all eight provided examples of how this plays out in their classrooms. In this way, it seems that successful and effective teaching is not only creative in its nature, but it is inherently trans-disciplinary as well.

Risk Taking. Another key theme that emerged in the process of successive rounds of data coding with HyperResearch[®], was the notion of intellectual “risk taking”. Again, risk taking was not a theme necessarily indicated by the research questions, but most of the teachers spoke of a willingness to take risks a key element of creativity for them. This is not framed in the sense of haphazard or risky teaching, but in the sense of a willingness to try out new ideas and approaches in their classrooms. This openness to trying things differently allowed them to come up with new and interesting approaches to teaching.

Marie included this notion in her definition of creativity, highlighting the fact that something good always comes out of this, in that this is how powerful teaching practices develop and teachers find approaches that work well (or they come to understand what doesn’t work):

It is the whole thing of considering possibilities and then taking a risk to try to do something that might enhance or deepen that experience... it is that little voice inside me that will say, “Hey, give it a try and, you know, what is the worst that is going to happen.” Sometimes, if it is a cool thing in the classroom or in whatever work that I am

doing, if it is successful, it feels like, “Wow! That really worked.” Or if it doesn’t, you think, “What did I learn from this?” So it’s about risk taking, but it is also forgiving yourself when things don't go as you might have hoped.

Over the course of our interview, Adam described a multitude of creative teaching lessons and approaches that he has developed (many of which are described in previous sections). When asked about how he initiated his creative ideas, he noted that they always came about from an enthusiasm for trying new things:

I just absolutely love solving problems, any kinds of problems and coming up with solutions - especially solutions that are common sense things, but creative at the same time. I like trying out new things. For me, teaching has always been an opportunity to really try out new things - to see how they go, and see what effect it has on other people.

Adam further stressed the fact that he considered this divergent manner of thinking to be an integral component of quality teaching:

I would be willing to bet that many of the really good teachers are not rule followers. I consider myself not a... I follow the guidelines, but I've never been stressed out or fearful of bending or breaking the rules for the sake of the bigger picture of learning.

Sandra also likened creativity to the idea of intellectual risk taking, and noted how she actively tried to cultivate this factor in her classroom environment:

As a teacher in a classroom, I need to create the kind of environment where students feel able to make mistakes and know that making mistakes is part of our work and our process. I would call it intellectual risk taking, absolutely, that willingness. It's also a willingness to think in a new way or to try out different ideas or be able to manage ambiguity. That's really important if you want to be creative, because if you can't hold

two thoughts at once without judgment, it's really hard to get past either of them. So often as people in society and in the classroom we rely too often on dichotomy and spectrum.

This kind of willingness to think complexly and without fear of trying out new things or breaking from convention is a key component of creativity, as Sandra summed it up, saying “Most certainly, I think you have to be willing to make mistakes if you want to be creative. You just have to...you can't be afraid of that.”

For Mark, the notion of intellectual risk taking and trying out new things in his teaching practice was the most critical aspect of his teaching philosophy; and was a subject that he returned to throughout the interview. Creativity is a process that he actively cultivates not just in himself, but for his students as well, as Mark noted,

It needs to be about the ability to try new things, to make mistakes, to learn from them, to collaborate about what happened, not only with your colleagues, but also with your students. For them to see that kind of risk taking and iterative process – I think it helps them to understand how to do things well. Ultimately what students will gain from your class is not necessarily all content knowledge. Often times it's how you approach it, that's how students' will pull away those bigger lessons that they'll take into the real world, which I think is pretty essential in this day and age.

Mark, like many of the teachers in this study, ultimately likened these creative risks, successes and mistakes to one of the core constructs not just of teaching, but of learning.

Research Question 2 Analysis: Avocations, Creativity and Success in Teaching

Q2) Do successful, accomplished teachers engage in creative practices and avocations, and do these avocations impact their thinking and teaching?

- Question 2a: What kinds of interests and/or creative pursuits do these accomplished teachers engage in?
- Question 2b: Do these successful teachers feel that their avocations and interests influence their teaching practice, and in what ways?

One of the major findings of this second research question is that people who are accomplished and recognized as successful classroom teachers also have a variety of avocations and pursuits in different creative, kinesthetic and subject matter realms. More importantly, they observed the influence that these activities had in impacting their creativity overall and as a teacher. The majority of the teachers had interests which tended to fall into categories of 1) music or the arts, and/or 2) physical or kinesthetic realms. They noted that their avocations and interests impact their professional work because creative teachers “teach who they are”. Creative hobbies in music or art worked their way into the teaching of subject matter or classroom activities. And physical or kinesthetic hobbies were noted as significant for clearing the mind and stimulating mental processes among creative people. All of these themes of this research question are discussed as follows.

What Kinds of Creative Interests and Avocations. All eight accomplished teachers in this study described the importance of multiple creative interests or varied avocations in their lives, which they explicitly credited with improving and informing their practices inside the classroom. Any of their comments on avocations or creative interests were coded in HyperResearch[®] under Avocations, and subcode groups as: Arts, Miscellaneous (hobbies such as travel or cooking), Music, Physical activity, Reading and Subject Matter Interests. A more specific list of avocations by individual is listed below.

Interest in the arts and music were among the most popular, with six of the eight teachers noting that they personally engaged in musical or artistic hobbies, which they actively integrate into their teaching practice in a variety of different subject matters. In addition to music or art, physical/athletic pursuits were equally popular, with six of the eight teachers also engaging in these types of kinesthetic avocations. These teachers noted having multiple avocations which featured prominently in their lives, ranging widely from interests in cooking, photography, writing/poetry, gardening, travel, and particular subject matter interests, among others. Each of the teachers' personal interests and avocations are briefly mentioned in the section on participant descriptions, and the following listing summarizes many of the activities or creative avocations that they each discussed during our interviews:

Table 1

Participant Teacher Avocations

Mark	Music (guitar, piano, composing); Visual Arts (drawing, sketch, graphic arts); Photography (digital and darkroom); Physical/Athletic (rock climbing)
Sandra	Reading (varied subjects); Games, Film, Writing, Technology; Physical/Athletic (running, kickboxing)
Carrie	Writing (creative writing, non-fiction, poetry); Reading; Word Games/Puzzles
Jack	Music (singing, composing); Travel; Community Service/Volunteer work
Julia	Visual Arts (drawing and sketching); Sewing; Reading (varied subjects); Physical/Athletic (nature walks and hiking)
Adam	Music (composing rhymes, raps); Reading; Physical/Athletic (competitive surfing, swimming); Travel

Mia	Music (piano and the violin); Cooking; Gardening (all aspects including landscape architecture); Running (long distance, competitive)
Marie	Music; Reading; Cooking; Physical/Athletic (yoga, walking)

Most importantly, not only did all of these highly accomplished teachers engage in several diverse interests/avocations, but these teachers connected their personal creative endeavors to their teaching work. Evidence throughout the interviews reveals that the interests of excellent teachers outside of the classroom play directly into their creative teaching practices. This is the focus of the next section.

We Teach Who We Are. Avocation is a word that defines itself, as something *other than a vocation*, or activities that we do separate from work life, for the enjoyment or interest of them. Human interests in creative pursuits or extracurricular activities are nothing new or unusual, and in some sense is part of who we are and part of a balanced psychology (Miller, 1999).

All of the teachers involved in this study described having multiple avocations (as described in the above section) that constituted an important part of their lives outside of teaching, and more importantly, influenced their thinking within the profession and their teaching practice itself. One of the teachers, Sandra, reflected on the importance of meaningful or creative avocations in life, because in profession of teaching, “we teach who we are”. This was an emergent theme during the reading of the text data and process of coding, because many of the teachers comments seemed to echo this sentiment. As Sandra had stated it,

Outside pursuits always factor into your thinking about your classroom or your students - all the time...I think that *we teach who we are*, and I know that I teach who I am. So, if I am really into kickboxing, I see how facets of that experience connect to things that we're learning in class. If I am reading about Frank Lloyd Wright, which is what I'm doing right now, then I see how something about Frank Lloyd Wright applies to something that we're studying. I think that's true all of the time, that whatever it is that interests you...how that energy manifests itself in the fabric of the classroom.

As Sandra noted, an inclination toward creative or varied interests naturally reveals itself in the work of a teacher, and adds dynamism and variety to their teaching practice. This kind of idea was also expressed by Julia, a middle school science teacher who views teaching as a diverse and multi-disciplinary domain; one that allows creativity to come through from the personality into the classroom, or as she commented,

I have to be in a job where I can exercise some creativity. I knew when I got my degree in biology that I didn't want to be sitting under fluorescent lights, filling Petri dishes and analyzing them. To me that felt like drone work. It's important, and I'm glad people do it. But I have to have the ability to grab multiple colors and multiple palettes and multiple media and weave together what I see as a vital, vibrant day for my students, for myself.

Julia engages in a wide variety of interests and avocations herself, and considers these outlets to be integral in her approach to teaching,

I'm always quilting at home, and have always been interested in art – I enjoy drawing and things like that. That's another outlet that I bring to my classroom because I do a lot of posters, I do a lot of display cases. I'm always taking pictures of the students doing

their work and I have them displayed all the time. This way the kids can see themselves engage. I think that that is important for them to see themselves as scientists.

Carrie, a high school English teacher, is extremely creative in verbal genres, and engages in a great deal of creative writing and poetry in her spare time. She sees this creativity as part of who she is as an individual and a teacher, and her avocations play directly into her teaching practice, or in her own words,

What I think is a little different from other people, is my enjoyment in my spare time of reading, creative writing, and writing poetry. Robert Frost said that writing poetry - he called it a homesickness. It's like a homesickness and a lovesickness, when you get this lump in your throat. There is something that if you don't get it out of you and put it on a piece of paper, it's just going to eat you up. And that is how I feel and I feel that way about words, too. That's the way that I'm creative, and it comes out in my teaching...I've written lots of poetry for my students and am able to use that experience to teach poetry, which is very helpful, because then I can write the poem that I want to teach with, one that has within it what I need them to learn.

In this way, Carrie's experience of personal creativity in her avocation is highly valuable to her work as a teacher. It is less cross-curricular than some of the examples that other teachers noted in this study, but is deeply connected to the notion of creativity as a critical aspect of the lives and teaching practices of accomplished teachers. And again, the notion that "we teach who we are" helps to demonstrate how personal creativity and avocations are highly beneficial to the creative work of a teacher.

Marie also saw a connection between creative thinking in life and in teaching, she described several of her own creative interests such as music and cooking, and noted that they were an important part of a teaching too,

I think that's essential for all of our kids and for us as educators too, to be able to draw on and bring in an artistic side. The whole thing of art is it is such an integral part of all of our lives...it is art that motivates us. It's the visual and the music and dance. The different ways of expression that kids learn with, and then they make sense of their world through those. I think my whole approach to teaching is in an integrated way, so that even if I'm designing lesson or something for my students, I have all of my own inspirations going.

Jack, a third grade teacher, noted how so many of his outside interests have found a way into his teaching practice. He incorporates his love of travel by constantly seeking opportunities for field trips or day-trips that connect to learning opportunities from their classrooms; and his lifelong interest in community service activities is also brought out by seeking opportunities for his students to also give back by getting involved in their community (Pennies for Patients, Circle K, etc). His love of music is frequently expressed in teaching activities, where he has students come up with songs about subject matter, as he described the practice in his classroom,

My students were struggling with rounding to the nearest 10. They could practice rounding all day long, but they just weren't quite getting it. What I began to do was take commercial jingles and television songs, and rewrite them to teach concepts in my class. And I would take what my kids brought to me. Because I knew that every afternoon many of them were going home and they were sitting in front of the television. So I began to use that to my advantage. I had one child come in and say, "Can we use Subway, Eat Fresh?" I said, "Well, Tayshawn, go for it and do your best." He loved it.

Jack noted that using these personal, creative approaches in his teaching practice had helped all of his students to either meet or exceed state standards for the first time, in their math proficiency. In describing the impact of his own avocations and pursuits on teaching, he summarized it as such, “I guess it's hard to separate the life of a teacher into compartments. There's so much that goes on that finds its way into the classroom.”

Music and the Arts: Translating Avocations into Teaching Practice. It was notable to discover that the majority of the accomplished teachers, six of the eight interviewed in this study described having an interest in either musical or visual artistic avocations. While it is true that many people, generally speaking, have hobbies and that many of these may involve music or the arts, to find that the majority in such a small sample of people profess to have such inclinations is a considerable effect.

Under the HyperResearch[®] code or category of “Creative Avocations Influence Teaching” many of the teachers had comment about using some of their artistic or musical knowledge in teaching subject matter. Examining some of their statements on the topic helps us to understand whether these accomplished teachers are simply creative people overall (in teaching and in life), or whether they also find musical or artistic avocations to be a way of enhancing their creativity in teaching.

For most of these exceptional teachers having an interest or inclination toward music or art has become a teaching tool that has carried over from their lives into the classroom. For example, Adam (a middle school math teacher) has had enormous success in teaching math concepts using rap music. His success with this practice started in his own classroom, but has spread with the success of his nationally recognized “Rappin’ Mathematician” CD. Its actual inception however, began with his own personal interest in rap music,

I've always been a fan of rap music, and was always good at it. I listen to a song a few times and I sing it back, and I can think in rhythms fairly quickly, so I could make them up. I don't have any formal music background, so it's very important for me to make a distinction that I'm a teacher who raps, I'm not a rapper who teaches.

Adam described how he was a classic first year teacher having discipline problems, and struggling to engage his students' interest in math. He noticed however, that students could easily memorize the lyrics to a new rap song within a day of its release. Deciding to make the most of his own rap interest, he wrote a song called "The Itty Bitty Dot"...("just line up the dot and give it all you got") about adding and subtracting decimals. He found this to be one of the first instances in his teaching career of real student engagement with the mathematical content, as he stated,

I walked by the lunch tables on my way to the teacher's lounge for lunch. And all the kids were singing this song I'd done for the math lesson. One kid actually said, "Are you going to quit teaching now and be on MTV full-time?" For the first time, by the end of the week, they all understood how to add and subtract decimals, and their test scores were good. From there, when I taught a concept I would make up a little rap to reinforce it.

The notion of coming up with original rap songs about school subject matter might seem daunting to anyone unfamiliar with the rap genre. But as Adam states here the critical point is not really the rap itself, but the fact that he co-opted his personal creativity and turned it into a valuable teaching technique. He stressed the fact that the use of rap is incidental to the use of something fun and creative, saying,

Other teachers come up to me and say, “Wow! My students want to know why I don't rap like you.” And I tell them it's not about rapping it's just about connecting in their language, on a level that's both fun and focused on the academics.

While the use of rap music may be contemporary, the larger notion of connecting with students in a creative or artful way that is relevant to their own lives is really the key issue.

Jack (a third grade teacher) similarly noted that the arts were an important part of his life and his teaching, and that every teacher could find ways to draw their own creative passions into the classroom.

The arts are a part of my life. I sing, and since I was young music has always been an important part of my recreation... Working with new teachers is a way to really open up people's eyes to see that, ok, your particular talent may not be singing, but you can use these concepts of creative teaching. You can take whatever gifts or interests or expertise that you bring to the class, because each person has some unique or creative things about them that they can potentially bring. Your chance is to hone in on that creativity and see ways that you can make connections for your kids. I absolutely love that part of my work.

The notion that having an interest in music or the arts would bleed over into the classroom practices of a creative teacher was also described by Mia, a highly creative third grade teacher, who described it thusly,

Music is something I use; like having my students create a song about a topic we're learning or something like that. As a teacher, having a little bit of that background in an area like that helps bring that out in your students, too. The kids are so naturally musically inclined. They might not be able to memorize their multiplication table, but

they know the lyrics to any song on the radio. We need to embrace that and use that to really engage our students in learning.

Mia is an amateur musician herself, playing both the piano and the violin, and as in the cases of all of the teachers with an interest in the arts, it seems clear that these creative avocations work their way into a creative teaching practice. She described her musical approach to other subject matters, for example having her students come up with songs about a math topic,

When we were learning right, and obtuse and acute angles, my class and I came up with a song and a dance to Beyonce's "I'm a diva" but instead of "I'm a diva" we created a whole dance to "I'm an angle". Using all different learning styles, audio, auditory, visual, kinesthetic, tactile, the kids were creating a song of their own. That was kind of cool because at test time you see them at their desk, they are bopping out the song and singing it, so you know they remember it - they *own* it.

Such musical and artistic activities are prevalent in the personal avocations and in the classrooms of these award-winning teachers, and interestingly enough the creativity manifests not just in the teaching of traditionally "creative" subjects and topics, but it reveals itself across a wide range of different subjects. Both Adam and Mia's examples above illustrate the use of music to teach math.

Mark, a middle school science teacher, is also interested in the arts and music, as he plays both the guitar and piano,

Music's definitely been an important part of my life, creatively...art has also been important in my life and teaching (he started out as an art/graphic design major in college, and has artistic hobbies). I try and draw as much as I can, especially in the

classroom. If I'm whipping something up on the board during a lesson, I'll usually try and draw or sketch something to make it more interesting or more memorable.

Mark frequently carries these interests over into the classroom to teach science concepts in a more engaging way. This demonstrates again the manner in which creative interests and avocations meld into excellent teaching practice. It also reveals the trans-disciplinary nature of teaching, in the manner in which the arts are naturally blended into Mark's teaching practice. For example, he sometimes has his students create visual advertisements to describe a science idea, as he explains it,

Cell parts, the difference between plant and animal cells. That's one of the standards that we have to teach. So I have students create an advertisement, trying to sell cell parts that plant cells have, that animal cells don't have. Like chloroplasts, for photosynthesis.

Animals don't have them, but what if you could sell those to an animal cell? How would you try and convince an animal cell that it needs chloroplasts? Or a cell wall? Why would it be beneficial? So we take a look at actual advertising techniques and ads, and we critique them from a design perspective of: what does a good advertisement look like?

Mark talked about using his own artistic interests to teach science in a way that is more authentic and exciting for his students, but also crosses the curriculum to blend a variety of subjects such as biology, art and the psychology of design. In this way, he engages in an inherently cross-disciplinary method of teaching. This not only makes the science teaching and learning more effective, but also gives his students the benefit of learning multiple subjects in a very real and cohesive way. As he describes it,

The activity is pretty simple. There's a large graphic image and some text and design elements. In some ways, I feel like I'm sort of using up science time to teach design, but

on the other hand...it gets the idea across and it also kind of teaches them another discipline as well. It's integrating a lot, and it does use up time...but I think it teaches it in a more effective way. And we don't have an art program anymore. It got cut two years ago. I feel we've got to do that in our core classes or it doesn't happen.

Mark's description of teaching with the arts cuts to the core of how creative thinking across the disciplines can translate into a more cross-curricular and impactful learning experience for students. In his classroom this has demonstrated better science achievement scores for his students, but more importantly his students are excited about science – more motivated and curious about the discipline as they head to high school. He describes the impact that creative approaches to learning science have had in a measurable light,

One of the things that I feel really strongly about, is that our science scores have been steadily going up and up over the last several years, but what I'm more excited about is the fact that kids are actually coming out of our middle school excited about science, and enjoying it and wanting to learn more. We met with our high school teachers last spring and they said it's a huge difference, that eight or 10 years ago kids would come to the high school and walk into their science class and look at that science teacher and say, "I hate you. I hate science." But now they come in and not only do they have some skills and some knowledge to go with it, but they're excited about learning stuff because it's cool.

So what occurs as a common thread among many of these award-winning teachers is a tendency to use their everyday "little c" creativity, to influence how they manifest "Big C" creativity in the course of teaching activities (Gardner, 1992). In other words having creative

interests in activities that involve music or the arts, is something that naturally flows over into one's teaching practice.

It seems abundantly clear in the described experiences of these award-winning teachers, that interests and avocations do influence creative teaching practice, and one significant way this occurs is through involvement in some creative "artistic" pursuit (the arts or musical), which comes through in the course teaching activity. The manner in which these avocations manifest in the teaching of subject matter implies that creative teaching is frequently a very trans-disciplinary activity. Whether it is in the way that Mark uses art and design to teach science or Adam uses music to teach math, the blending of different disciplines into teaching and learning activities, for these particular teachers, is facilitated by their creative passions.

This is an important point because it goes to the fact of what they do that is not merely just "effective" teaching (since these teachers are clearly skilled teachers) but also "creative" teaching. In the previous discussion of the first research question, it was noted that several of the themes that arose in their classroom practices were also hallmarks of "effective" teaching, in the literature. This is true in several themes, such as cross-curricular teaching or real-world (authentic) learning, and it serves to complicate the question of "what is effective?" vs. "what is creative?" in teaching. Ultimately, it is a complex relationship with areas of crossover and overlap. But on the issue of creative avocations and their place in the fabric of the classroom, or music and the arts in the teaching of subject matter, we are in an area that is uniquely and definitively creative in teaching.

The concept of creativity in avocations or outside life vs. creativity in professional accomplishment is somewhat analogous to the "little c" (or "everyday" creativity) vs. "Big C" (or "sublime" creativity) paradigm discussed by such researchers as Gardner (1999) and

Csikszentmihalyi (1996). Gardner and Csikszentmihalyi, among other creativity researchers, assert that a focus on “Big C” or sublime creativity is most essential to really understanding the topic. However, the lived experiences of these exceptional teachers indicates that “little c”, or everyday creativity, expressed in avocations or interests like music and art has a profound impact on the way people attain their sublime teaching creativity. Moreover, this connects deeply to the Deweyan ideas of “Art as Experience”, which include an inextricable link between the classical aesthetic experience of art and everyday activities and experiences. In Dewey’s paradigm in order to understand true aesthetic or learning experiences, one must begin from the events and scenes of daily life. This makes aesthetic and learning experiences both relatable and powerful to the individual (Dewey, 1934). As Dewey frames it,

So extensive and subtly pervasive are the ideas that set art on upon a remote pedestal, that many a person would be repelled rather than pleased if told that he enjoyed his casual recreations, at least in part, because of their aesthetic quality. The arts which today have most vitality for the average person are the things he does not take to be arts; for instance, the movie, jazzed music, the comic strip...The task is to restore confidence between the refined and intensified forms of experience that are works of art and the everyday events, doings, and sufferings that are universally recognized to constitute experience. (Dewey, pp. 5, 1934)

From this perspective, we can begin to understand the prevalence of creative activities in the lives of exceptional teachers. Just as Dewey suggests, there is a continuity in creative experiences that extends into all areas of our lives. As Root-Bernstein (1996) discovered, this same idea applies to successful scientists. Across domains, anyone who does his or her work

with engagement and care, such as artists, scientists, engineers or mechanics, and so on, are all artistically inclined.

Athletics/Kinesthetic Pursuits: Mind/Body Connections. While I have noted the varied artistic, musical or other creative pursuits of these accomplished teachers, it is important to recognize that physical or athletic pursuits were also significant and influential avocations for many of these creative teachers; and this kind of activity this has its place in the framework of trans-disciplinary activity also. This fact is important because the trans-disciplinary skill of “embodied thinking” or kinesthetic thinking deals with the connection between creative/problem-solving thought processes and body movement or physical sensations.

The teachers comments on this topic were organized in HyperResearch[©] under the code of “Physical Activity”. Specifically six of the eight teachers talked about having physical/athletic hobbies. It is notable and interesting to see that physical activity is prevalent among these highly successful teachers. Moreover their comments on the subject regularly credit it with improving their teaching and thinking overall.

Mia discussed the impact of athletics and movement on her thought processes, and noted that this was a key way of formulating ideas for her,

Running truly spurs my thinking most of the time. It gets my thought processes going if I can move in some way. Exercise is the best little motivator for your brain to come up with great ideas. After you go out on a run you come up with a 1000 good ideas, or even during a shower after I keep a little jot pad nearby where I can jot things down.

Mia describes a notion of creativity springing from physical movement, which has also been asserted by Root-Bernstein (1999, 2003) who suggest that people from a variety of different disciplines find inspiration in the physical realm. The best musicians “feel” a piece of music,

just as painters and sculptures require tactile physical sensations in the execution of visual art. Interestingly enough muscular feeling, physical sensations and manipulations play an important role in scientific thinking as well. Scientists “play” laboratory experiments and develop a physical feel for experimental work. Higher order mathematics is often done not by “numbers and symbols, but by almost tactile feelings combined with reasoning” (Root-Bernstein, 1999).

Mia has found running to be useful as an avocation and a motivator for thinking skills, and reflected on this fact further to consider to consider how this mind-body connection works for her,

I think it is the therapeutic rhythm of it, and the getting away from it all, and the de-stressing yourself. But I think it’s also just the way that the brain works. I just finished John Medina's ‘Brain Rules’, which was a fascinating book. Looking at the brain research and how exercise can affect how the brain performs, there is definitely a connection.

Adam noted that he had been a competitive swimmer the age of five and continues to swim a lot. He’s also been a surfer his whole life and described the ways in which he’s developed a lot of “good ideas while sitting on my surfboard”.

Then surfing sometimes, when the waves are really good it can be so intense that you absolutely cannot think about anything... you have to just stay and focus. It’s a really good brain activity for me to not let ideas pop into my head, or else I'll lose focus and it's a wipe-out. While I'm actually in the physical act of surfing, I have to focus intently on just that, which I know is building a different part of my brain. Other times the waves are really small and I'm going out there to relax and have fun. I might chew over an idea in my head. Without getting too philosophical on you - it makes you realize how small you are when you're getting on that surfboard in the huge ocean. I'll always come in from that

refreshed and willing to try something another way or just drop something that's not working. Physical activity is a good outlet to think clearly and release stress.

This connection between kinesthetics and focused-thinking was one that was commented on quite a bit by all of the teachers with physical avocations. Adam discussed the way that swimming helps with this process for him,

When I'm swimming, although it seems like just sort of staring at this black line down on the bottom of the pool, once in a while I'll be swimming along and focused on this black line and an interesting idea will pop into my head. Or I'll get an idea as I'm diving and then I'll process it out while I'm swimming.

The notion that physical movement and bodily sensations have an innate relation to creative thought processes was also discussed by Sandra who felt, similarly to the other teachers, that athletic pursuits provided clarity of mind that helped improve her thinking in general, as she put it,

I always have some outside pursuits related to athletics since I was very young. I've kick-boxed for about three years really intensely, and I run quite a bit...I think it offers clarity. I guess I can only speak personally to that one, but I think it does offer clarity of mind. A lot of times, I use those athletic endeavors to give me that focus. To wipe everything clean, so I can concentrate on what's most important, which is whatever I need to focus on at that time, right? There's no doubt that sometimes I do my best thinking when I'm running. I think it's because there is a rhythm and there aren't other distractions.

Marie also connected to the notion that physical or kinesthetic pursuits were useful for improving her thought processes in the sense that, for her, yoga provides not just an avocation but a means of finding time for reflective thinking,

I'm fairly physical. I love to do yoga. Yoga is a really awesome thing because it helps me in the middle of a day that might feel very action-packed or even hectic, to be more introspective. To slow down my brain enough to really be a whole lot more reflective. I think that's one very cool thing that any of us get to do with our lives is get that kind of balance of the very high energy but also finding the time to slow down.

But as she further described it, physical movement or kinesthetics were useful not only for clarity of thought processes and reflection, but also for idea generation,

In fact, if I'm designing something that I need to get going, if I'm doing some writing or designing some lessons, it is absolutely movement that I need to do. In fact, I often don't sit or sit still when I'm working. I have to put myself into some type of physical motion in order for the ideas that I'm puzzling with to have a chance to settle down and make sense...Yoga class, for instance, is perfect for that. It's an organized way of allowing my mind to really focus in on just these particular body movements, which actually opens things up to some of the other big complex ideas. You can walk into a yoga class and just be downright out of sorts...then in the middle of yoga class be so completely involved in the movements that I actually feel I gain time and perspective by the time that I finish.

This notion of kinesthetic thinking or connection between mind and body movement is something that Marie has observed in her own physical avocations, as well as in those of people around her, as she puts it,

My husband is a scientist with the US Geological Survey. He's a marathon runner...has run 17 marathons and loves it. When he does a long run, there are times that he will come home...and will say, "Oh, guess what I figured out?" And I can say to him, "Which mile were you at when that idea came to your mind?"

The teachers in this study definitely connected with the notion that physical movement and mental activity have an important link, and this can be noted in their propensity for physical avocations, among their other interests.

Research Question 3 Analysis: Trans-disciplinary Thinking Skills

Q3) Are trans-disciplinary thinking skills used by accomplished, successful teachers?

- Question 3a: How do these accomplished teachers use trans-disciplinary thinking skills in their teaching practice and what are some classroom examples?
- Question 3b: Do these skills help them to be more effective, creative teachers? In what ways are these thinking skills important to teaching?

In this research question the findings of this study are that trans-disciplinary thinking skills are both important and highly valuable, in the experiences of these accomplished, creative teachers. Each of the six skills of observation, patterning, abstraction, embodied thinking, modeling and play, were each coded as a separate trans-disciplinary theme in HyperResearch[©]. Synthesizing was not specifically coded, because the meta-level and intangible nature of the skill made it difficult to ask clear or applicable interview questions on. It is however included and discussed in the analysis of the themes later on in this section. Each of the six skills that teachers were asked about, were organized by codes. Generally speaking, each skill tended to be used in a different but particular way, as revealed and interpreted in the nature of the teachers comments.

Observation was noted for developing an awareness of classroom dynamics, students, and learning progress. **Patterning** was discussed as valuable for understanding trends in classroom and school situations and events. **Abstraction** was considered important as a teaching approach to clarify and explain complex ideas in a clearer or simpler form. **Embodied thinking** was thought to be integral in making learning active and engaging. **Modeling** was noted as a useful

tool to make learning more real and tangible to students. *Play* was seen as crucial for making learning fun and developing a sense of curiosity about ideas and learning. *Synthesizing* involves the totality of who they are and how they use the previous skills. Essentially trans-disciplinary (or creative-cognitive skills) were highly valuable and relevant within these teachers' creative classroom practices, each in its own way.

Observation. As the first of the trans-disciplinary skills observation is the first step to understanding anything. Observing involves paying close attention to information gathered through the five senses, with intent focus and curiosity. *The teachers in this study generally saw observation as essential for developing an awareness of their students, their learning, and classroom activities overall.* All commented on the value of finely-tuned or well-honed observational skills. This was seen as necessary for running an effective classroom, and creating teaching and learning activities that are on-par with what their students need.

Julia discussed the importance of observational skills in multiple ways in teaching, and noted that it is an important skill not just for having a good overall sense of your classroom, but in identifying opportunities for “teachable moments”, as she stated,

One thing I would say is essential in teaching in general is always having your feelers out and understanding what's going on in all parts of the room with each student. It helps to be finely tuned into looking for not only, behaviors and misbehaviors, but also looking for those teachable moments, those times when you look out and see that the discussion is taking a turn; or hearing a question that was asked that you can turn into a teachable moment. Observing when there's an opening, observing when there's a chink in the armor of boredom, or the chink in the armor of a kid who pretends they aren't interested. You can find a hook that can get in there and pull them towards this science stuff a bit more.

In this way, observation may be a skill that helps take teaching to the next level, as highly skilled teachers like Julia are able to catch on to those moments that are opportunities to truly engage students. The ability to identify a “teachable moment”, or a moment when a unique and interesting situation is occurring that lends itself to discussion or a learning opportunity, makes observation a fundamental skill for successful teaching (Lozo, 2005). Julia noted that she felt that observational skills were an ability that she is highly focused on in general, and that this aids in her creativity, as she commented,

I'm very attuned to a lot of detail in the world around me...the nuances that maybe other people, their filter isn't as fine on some of these things. Being attuned to that kind of detail-oriented stuff helps my creativity because I'm always looking – I'm very focused on attention to detail.

As a nationally acclaimed and highly creative teacher, Adam also remarked on the fact that he felt that good observation is a skill he has a knack for, and that this has helped him deal with a variety of teaching situations. He commented on the importance of objectivity in observation, saying,

I think the key to observation is actually being able to separate yourself from the situation, and look down...as if you're hovering above it and seeing it clearly. That's one thing I either consciously or unconsciously, I think I have...something I'm good at is observing it *as is* and not as it relates to me. So you hear about some new student who transferred to this school who's got 50,000 problems. And I hear other people say, “Oh gosh. I don't even want to know about this guy. I'm sure he's going to end up in my class.” And I'll be thinking, “Oh, man. I've got to go meet this kid. I've got to go check this kid out.” I just enjoy that process of observation without taking it personally.

This ability to make careful and objective observations has thereby been a benefit to handling some of the stressful situations of teaching (e.g. troubled students), that might otherwise cause added anxiety. The objectivity of observation can thereby lead to a more accurate or constructive analysis of a situation. Sandra has found this to be the case. She has found observation to be so critical that she teaches it to her language arts students, as a pathway toward critical and creative thinking, as she noted,

I teach my students critical thinking skills for my language arts courses, and the first step is always observation. If we are not careful observers, we have no chance of doing any of the other work that we need to do, so observation is the first step...I set out to be a careful observer as a teacher. I have to know what each student needs and I have to be observant about them all. I mentioned early on in the interview about how, when I was in the psychology department for a while, that has had an impact on my teaching...Human observation and the attention to that, has been essential as a teacher.

In this statement, Sandra has not only highlighted the importance of observation as a first step toward creative thinking, she notes that it is important to her work as a teacher in being observant about her students and their needs.

Mia echoed this notion of observation as a critical pedagogical skill for gauging students. She noted how she needs to observe carefully to understand her own students, but also to identify ideas that might be useful to incorporate in her teaching practice.

I would use observation in teaching a lesson, and then going out and gauging the situation; making sure that if I'm conversing with one of my students, I'm hearing what she's saying and doing. I'm listening to what she's got on her paper. I'm kind of sensing if

she gets it. So I use observation all the time to monitor what's going on in the classroom, as well as to see what's going on in other classrooms that you can apply in my own.

Carrie further stressed the significance of observation in teaching as a skill that helps her gather information on the goings-on of her classroom. She noted that these observation skills have been honed through her work as a teacher, and extend into other areas of her life,

Well, I have been accused of not missing anything... Through trial and error I have been trained to really see all kinds of things in a classroom. I've got to notice body language and attitude right when they come in the door. If there is one coming in to class who has gotten upset during the day, or is upset about something at home, and I'm trying to get him to answer a question, there can be this huge outburst that is unrelated to me, that I didn't see coming. So I do probably have better observation skills than someone who works in a cubicle all day, at picking out different things with body language, reactions and communication styles... Teachers have to be keen observers on all of that.

Carrie's comments emphasize the value of attention to fine detail in observational skills. Highly skilled teachers must be able to notice a variety of things in their classrooms, right down to body language and subtleties of communication with students. She noted that not only is observation a critical pedagogical skill, it is one that can be learned and practiced. This falls very much in line with Root-Bernstein's (2003) framework of trans-disciplinary skills, and the fact that they can be learned, taught and developed in practice.

Jack highlighted the significance of observational skills not just for classroom management, but for managing student learning progress and developing a community of learners. Additionally, observation aids in being able to learn and develop as a teacher, he stated,

Observation is definitely important and essential, because that's how we learn, even as teachers. We make meaning from experiences we see and certainly I really advocate for opportunities for our beginning teachers to have observation...As a teacher, observing student growth over time is critical. We were talking before about establishing that community of learners – seeing and watching the interactions between the students is necessary for that. And a huge part of assessment is more than just the test at the end – but watching and observing that they can do or understand the concept.

Marie also talked about observational skills as a way of thinking that impacts her own learning and appreciation for knowledge. She noted that careful and curious observation about the world and subject matter is a desirable skill for teachers, because you want teachers to also be engaged learners. Prior research on creative, effective teaching has also found creative, effective teachers to be lifelong learners and curious individuals (Amabile, 1998). Marie commented,

Observation translates into so many other, bigger things to learn about or to want to learn about...Then as a teacher, being able to consider how that sense of observation translates to my students. I mean, that's the kind of thing that you also want teachers to be open to.

Mark's remarks on observation noted the importance of the skill in dealing with classroom dynamics and management issues, but like Marie, he also signaled the importance of observation for curious and capable learners, saying,

In terms of the basics of classroom management, you better be holding your ground otherwise you're going to get run over. Observation is certainly part of that, and clearly observation about the students themselves, and what works for them and what doesn't work. In the sciences, observation is a very key part of what I try and get my students to

focus on, instead of just blindly wandering around the world, they actually notice things.

It develops curiosity as well. So it's a skill that I certainly try and develop in kids.

Mark also broadened this discussion of observation out, to describe the fact that it is essential in teaching because it's a necessary thinking skill for self-awareness and creativity, as he noted,

I think in some ways it's sort of a survival skill. Evolutionarily, we have learned to observe the world around us and, in some ways, modern society has dulled that sense and in other ways it's heightened or maybe even over-stimulated that sense, depending on the context. More than survival, it ultimately becomes about the first step in terms of self expression. You've got to be aware to be self-aware, to be creative. You've got to be aware not only of the world around you, but also of yourself...and then to actually do something with that knowledge.

Patterning. As the second of the trans-disciplinary skills covered by this study, patterning works in two parts, including the act of recognizing patterns and forming them. Recognizing patterns involves identifying a repeating form or a plan in a seemingly arbitrary arrangement of things or processes, while forming is basically a creative act of innovation to come up with a new pattern/solution. *The teachers in this study recognized patterning as an essential teaching skill in being able to understand and assess classroom and school situations, and develop solutions as necessary.*

Adam definitely identified with the concept of patterns in teaching, though he has frequently thought about it as dealing with “systems” in his teaching career, as he described it, You could say “patterns”, but I would say systems. I love creating systems...I also enjoy really looking at system that's not working and saying, “OK, where is it breaking down?”

And so you'll often hear me saying things in class like, "Hey, come on, we all know the system." So, I'm always looking for sort of a better system in how I run my classroom or in how I teach a certain mathematical procedure. I guess that *would* be about patterns...looking for different trends or different things that happen. If a student's not doing something, if a student's off task I'll say, "Hey, come on, that's not the system that we've all decided works best for us." I enjoy creating useful systems.

In this way, Adam's notion of systems corresponds to the element of patterning in that he looks for trends and commonalities in teaching situations, and then problem solves by establishing useful patterns for his students.

Carrie noted that as an effective teacher, she needs to be able to see patterns at multiple levels of teaching, in dealing with individual students and parents, patterns in the school day, or even patterns in the school or community, as she commented,

In the classroom, as far as patterns I can see patterns in student behavior, patterns in work that they turn in...Or as far as the school day, there are patterns you'll notice. There's definitely a difference after lunch than there is before...when they come back, they're going to act a certain way. Then there are patterns between different schools where I've taught in different types of communities. I see behavior patterns that look different from another school, and how those kids act when they get, let's say, angry. The story I usually tell is; the angry kids in the inner-city schools are quite verbal about being angry...But the kids in the school I'm in now, which is very rural, the kids can tend to be just as mad, but they just shut down, because they live out in the country and they are used to more distance and space. I think that seeing patterns in kids is useful to the work of a teacher, because when behavior or work is out of the pattern, then that's key to us to

know that something is going on... That gives us the opportunity to go and follow up and check on those things. And help us to be more in-tune as a teacher.

This ability to identify patterns in the world around her is useful in understanding teaching situations and settings, and then coming up with valid solutions.

Mark commented on the necessity of dealing with patterns in identifying trends in all kinds of teaching situations, from behavior to student performance. This act of pattern recognition is again useful to him in solving problems or creating new and better patterns, as he noted,

The way that I can think of how patterning comes into play is, as a teacher in general, definitely seeing patterns in students themselves, and noticing patterns or trends in either behavior or performance can be used to diagnose a range of problems or difficulties. I think especially when things get pretty bad or hit the fan and you're having a parent conference, the ability to recognize a certain pattern or how things have been trending behaviorally or performance-wise can definitely be valuable.

Mia remarked on the importance of patterns in dealing with subject matter, in that as a teacher she needs to be able to emphasize the patterns in learning a topic or idea to her students, she noted,

I think patterning is an important skill both personally and professionally. You have to have an understanding of patterns to teach students to have that same understanding, like when you're looking at numbers on a chart in math. Or looking at patterns within multiples, or looking at patterns that you might find in different literature pieces.

Jack also focused on the need for patterns in understanding his students and their learning needs. He noted some questions that he asks himself in examining his students' work for

patterns, and commented that looking for patterns in teaching is a learned and practiced skill, as he stated,

We need to look for patterns when we analyze our students' work – we're looking for patterns in their learning and in our instruction. What's the lesson as you analyze the data? What areas were most challenging for your students? Understanding how to analyze your own teaching or classroom information is a skill that comes with time and practice. I remember my first year of teaching...you didn't understand how to take a lot of the information and apply it to what was going on in your class. I think if we can teach our beginning teachers how to analyze and look for trends and patterns...it's going to make them better prepared to help their kids.

Julia also emphasized the fact that understanding patterns was a skill that she had become increasingly fluent in as she developed as a teacher. Patterning, for her, is a skill that she has fine-tuned with teaching experience. Like Jack, she identifies patterns via a series of questions she asks herself. Interestingly enough, it has helped to understand how to pattern and structure her teaching activities and the subject matter itself, as she commented,

As you become more expert in the age level at which you're teaching, you see patterns. When I approach a new topic, I immediately start to chunk it out into what would I see as a flow from the viewpoint of an 11 and 12 year old mind. What is it that they know and what's the foundation? What can I find out what they know about it? Where do I go from there? What are the sizable chunks? What's the angle of the attack? What's the way to make it relevant to their lives? That is a pattern of teaching, and in the structure of the day...I find I have to have a pattern to help accommodate attention spans. There is a saying that mind cannot absorb what the seat cannot endure. That's especially true for 11

year olds who are wired to move, so I segment my teaching...A lot of it involves giving them some opportunities for movement.

Marie sees patterns as being a vital part of subject matter, and she attempts to cultivate and foster the skill of patterning in her students, as she noted,

The whole idea of pattern is all making sense of not only what it is they are doing and seeing...but also then what they will then be able to predict beyond there. Let's use that sky watch example...The reason I did that day after day after day, I was hoping that the students would see that kind of predictability of what was going on with the natural world. I wanted them to see the patterns, to see the seasonal changes, and to be able to experience that in such a way that by doing it day-by-day, that they would discover that pattern of how things change on their own too.

Sandra highly identified with the concept of patterns, and similar to her focus on observation in critical thinking, she includes the skill of identifying patterns into her teaching of language arts. She considers patterning to be a critical part of a creative thinking paradigm as she stated,

I pretty overtly ask my students to look for patterns. What critical thinking is, marginally it's the acquisition of patterns. So, there's this incredible relationship between critical thinking and how it sparks creative thinking. ...One doesn't exist without the other. It's pretty impossible to be creative if you haven't also been critical. It's pretty difficult to look at patterns effectively if you're not willing to make mistakes or see things out of order in order to put them in order. There is just this incredible relationship between the two functions.

Her comments on patterning signal the importance of patterning for critical thinkers and creative people alike, she has woven this skill not only into her teaching practice, but directly into her subject matter.

Abstracting (abstract thinking & analogy). Abstracting is the third of the trans-disciplinary skills discussed with the highly accomplished teachers in this study. Abstracting involves capturing the essential nature of a thing or idea. This is often done by concentrating on one or just a few features of an object, idea, or process, in order to boil it down to basics and grasp its essence; the use of analogy may be used in abstracting as well, which involves drawing a comparison or a practical similarity between the basic elements of seemingly disparate things. *The teachers in this study found abstracting to be an extremely useful cognitive skill in their teaching, in that it helps them to clarify and explain complex ideas and topics to their students.*

Adam noted the importance of using abstraction in his teaching, in that he at times needs to simplify a topic in such a way that it is still accurate and complete, yet makes sense to students.

I would say I use abstraction when I'm teaching a concept...I try to get rid of anything that's not useful...anything that's going to distract. For example the other day we were talking about how to change a decimal into a fraction. So, there are all these different steps you can take and different ways you can do it. But I had to stop and think about how I wanted to explain it in a way that really boiled it down to just three fundamental steps that students can remember to do. For that, I would abstract the bigger idea of decimals and fractions - getting rid of anything that could distract.

Similarly, Julia remarked that she found abstracting to be a crucial thinking skill for creating lessons that are both clear and meaningful to students. To do this, she considers what are the essentials that she needs them to comprehend and hold on to, stating,

When I'm structuring a lesson I ask, what are the bare bones that I want these kids to walk away with? What's the essential kernel of truth that's going to best serve them when they leave here? Distilling a topic is very important to me to just cut away some of the big confusing terminology...I think germination is important for them to know, but I'm going to talk about it as sprouting. I might frame it as - a seed itself is like a baby, and it's got its lunch and the mother plant wrapped it up and sent it off...It's going to travel out into the world. It's going to travel through the air, or on the water, or on somebody's fur. So they can see that as a picture in their head...Those kinds of abstractions, they help you file away the rust and get down to the gold...With 11 year olds, it's not primary grade, but they still have a primary heart in a lot of ways. And everybody loves to hear a story. So in this way, abstracting not only makes the concept clear and sensible to students but it is something that has relatable meaning and that they will respond to and remember.

Carrie also noted that as a teacher she must use abstraction in structuring her lessons, so that complex topics are first given in small but illustrative pieces. In teaching the elements of writing, she starts her students off with the simplest means of understanding them in short stories, before working up to how they occur in novels,

I start off the year teaching students all the elements of a short story so that they're ready to understand the elements of a novel. We look at, in very small pieces, the things that they are going to see in a bigger way which will be harder to pinpoint as quickly, like plot. In a novel characters are going to be so much more developed than they are in a

short story. Setting - in a short story it may be one place, in a novel it's going to change and will be different places. Theme - there can be several themes in a novel whereas a short story is probably going to focus on just one thing.

Mia also uses this concept of simplified but representative concepts in teaching big or complex ideas to her students, as she noted,

The thing that comes to mind when I think about abstraction is teaching something very broad, such as reading; then about having to focus it down to the simple aspects or parts of it in order to teach your students about the whole idea of reading. Instead of just teaching reading, you're teaching inferring or you're teaching main idea or skimming and scanning. You're having to teaching a simple part of it in order to be the whole.

Thereby, moving between the simple and complex forms of an idea is akin to going from the concrete to the abstract in teaching a lesson. Marie noted that she would often help students to connect to complicated or abstract ideas with the use of simple objects or stories. She described this aspect of abstraction in one of her teaching techniques,

When you can use an object that goes with a story to help make that abstract leap to a much more complex concept, well, I'm absolutely fascinated by that technique. I had done some teacher education work in South Africa, and I learned a lot while I was there. I wanted to help my own students to understand about what had happened in Cape Town during the time of apartheid. This all tied in with a much bigger concept. The thing that I brought in to show them to kind of drive home this idea was a piece of sea glass. The very smooth kind of glass you can pick up on a sea shore that has been tumbled around in the sand all that time. That simple piece of sea glass was what I used in order to tell the children the story about this neighborhood in Cape Town called District Nine and how

this neighborhood got displaced because of what occurred there. How one day the bulldozers came in and literally bulldozed these informal houses right into the ocean. That piece of sea glass, it became an abstract representation of what happened to that neighborhood of people. One little tiny object but then it made the leap to this very large concept of the historical perspective of what was going on in South Africa at that time...The object tells the story. Really effective teachers will use simple objects or stories in order to drive home different kinds of concepts, to get the curiosity going.

This use of abstraction was a frequent teaching technique for Marie, and she described how she was able to tackle complex concepts with her elementary students, by using abstraction to clarify and explain things to them. She described another such example,

Something typical that I'll use, is a ball of string. I will want my students, or even when I'm working with teachers I'll do the same thing...I want people to think about how ideas and information connects. So, immediately after a lesson I'll pull out that ball of string and I'll start it off by saying, "Well, let's just remember what it is we just learned. Let's see, we just learned a lesson about the wetlands. One of the things we learned is that wetlands help to filter water and my example of that is etc, etc...Who else has an idea that they want to say?" And somebody will say, "Well I know there are migrations going on with the Canadian geese." The string will go to that child and somebody else will say, "Oh what you said there reminds me of this." The string will go then on...then what you see is this circle of people, this web of string that goes every which way, and ideas are connected. The web of knowledge goes and there's this web of information. Even though it's an actual piece of string, it is an abstract way of showing this.

Jack also described how abstraction was helpful to him in explaining ideas in a way that people could more easily relate to and understand them. He noted how he often does this through the use of analogical thinking, stating,

The use of analogies, metaphors, really allows people to quickly identify with a concept, or more quickly identify with what you're trying to convey. Analogies and metaphors are even similar to storytelling, and it helps with making connections to relatable knowledge and experiences. I think that really helps make meaning for people.

Sandra furthered this notion of abstraction in order to move from the intangible to the tangible, as she stated that this helped her to get her students thinking in complex ways, “Without a doubt, I use abstraction to make something concrete. And then once we have it in the concrete, my goal is to help students to construct their own knowledge back into the abstract.”

Sandra commented that the use of analogy was also integral to her being able to do this kind of abstraction in teaching, and she described how she had been inspired by this technique by witnessing it in an excellent teacher she'd had. Not only does she use analogy herself in communicating with her students, but she encourages her students to use analogical thinking, remarking,

I use lots of analogy. I once had this brilliant teacher, and she always talked in analogies. I was so moved by the power of my own learning through her use of analogy that I have become very confident in using analogy. I think in analogy often, and I bring it into the classroom a lot. I ask students to create their own analogy because it does boil down the distractions. In fact, I use that term with my kids all the time. We're going to boil this down, and sometimes we do exercises that are constructed very deliberately for that boiled down process... I may start with having students do writing that has some

constraints with it, and then we start to boil down the most important words so we eliminate the distractions, and then start to look at how if we start to pare some of these words that we boiled down together, can we start to create metaphors? Create analogies? Mark also underscored how critical abstract thinking is in the realm of teaching and learning. Abstraction for him is again about distilling and explaining information in useful ways. He noted that this is how he is naturally inclined to think about teaching, because this is how he learns himself, stating,

My general approach to teaching, or in fact in general approach to knowledge in general, is fairly abstract. I've never been good with remembering small details, in fact. I might notice them...I might analyze them until they're gone. So for me, the ability to abstract specific instances or specific individual facts into something bigger, into concepts, into big ideas, is a huge part of how I learn, and I think most people should learn.

Mark stressed the importance of abstraction in teaching and learning, because this helps clarify and explain the biggest and most important parts of an idea or subject matter. In essence this involves recalling concepts as opposed to facts. And like many of the other teachers in this study, Mark found the use of analogy to be crucial to his paradigm of teaching, he noted,

Facts are fleeting. Facts are oftentimes fairly unimportant when taken on their own. But I guess I sort of have this analogy. When I was younger, I used to be called Analogy Man, and I think it that's how I see the world. I love analogies, and I use analogies all the time when I'm teaching or I'm speaking or when I'm thinking, a lot of times. I've had this analogy in my head the last few days. It's of a tree, and the individual leaves are just facts. And they may come and go with the seasons, or with your state of mind or what you can remember. But those facts, actually, are what provide the energy to build the

branches and the more permanent parts of the tree. Those more permanent parts of the tree are the big ideas, the concepts, how it all fits together into a big picture.

In Mark's teaching practice, as with all of the teachers in this study, abstract thinking is critical for clarifying and explaining the important aspects of an idea, and he noted the importance here for creativity,

It also, I think, makes life much more interesting. That oftentimes the basis of most art is abstraction, of deciding which details are important, or which details we're going to focus on. I guess that's really art, abstracting ideas, in a sense.

Embodied Thinking (thinking with the body & empathy). The fourth trans-disciplinary skill of embodied thinking involves two skills, which feed into each other - kinesthetic thinking and empathizing. Kinesthetic thinking is thinking with the body, or the sensations of physical movement, balance, tensions, etc. Another aspect of embodied thinking is empathizing, and this requires imagining oneself in someone else's position, walking in their shoes, feeling what they might feel. These elements both make up the concept of embodied teaching. *The teachers in this study found this skill to be highly beneficial for helping to make learning active and engaging for students.* They noted a variety of lessons and ways in which they value embodied thinking.

Mark commented on the importance of physical movement in his classroom, and described the way that he ties it directly in with science ideas that his 7th graders are learning about. It may involve getting up and acting out the role of a molecule, or perhaps tracing out the arc of the sun in the sky through the season, but embodied thinking helps his students use their bodies for active learning, as he stated it,

I get kids up and moving and acting things out. Oftentimes they're playing out the role of molecules or something like that. When we're learning about the seasons and what causes the seasons - the path of the sun through the sky - we get up and actually trace the path of the sun through the sky with our arms. In the wintertime, it just comes up in the southeast. It'll be up south and down in the southwest, and it just does a quick arc. We trace that arc out, then we might make it into a little dance move, like "Oh, yeah! It's wintertime!" Then in the summer it's a much higher arc and starts way up in the northeast...So we trace that out in the sky too. Whenever possible I'll go through a lot of different exercises where they're actually using their bodies to understand a science idea.

Mark also incorporates the embodied thinking aspect of empathy, by having his students feel what it feels like to be another object or organism in order to understand its role in science better. He also encourages an active, hands-on approach to his students' learning, so that they can get a real physical sense of what things "feel" like, which gets them engaged in scientific processes or ideas, with as he denoted,

I do things like, encouraging students to try and interact not only by taking on the persona of an object or an organism, but also then in more traditional lab settings to actually get their hands right in there. What does that substance feel like? If we're doing erosion and deposition, get in there and work with the sand and create some stuff. What does that feel like? I want them to be engaged and using their physical senses as much as possible.

Jack also emphasizes a kinesthetic approach to the teaching of subject matter, and he reiterated the trans-disciplinary notion of empathy as described by Root-Bernstein (2003) of "some things that we know in our body". This has helped him find ways to teach concepts to his elementary students in active and moving ways, as he stated,

Definitely there are some things that we just know in our body, we know it. Incorporating physical movement was a major teaching goal for me. For a math example, moving on the number line - physically having the kids move up the line. When we were doing the order of the planets from the sun, I would have the kids get up and form a human solar system. It was important to me to find ways to use the body to help teach concepts - that movement is so important.

Jack has taken this concept of motion and the connection between the mind and the body to heart. He described how it has become an important part of his overall teaching philosophy, As far as movement or the body in learning settings – there are some statistics out there, that just by standing up we learn 10 percent better. Memory is retrieved better when something is learned through movement. If you're using that whole concept of body memory, the statistics are very high in terms of recall in the work that you're doing. But I always have said that movement has to be with intention, so again, there is that whole sense of a learning purpose behind it.

Not only has Jack adopted this concept of kinesthetic learning into his own teaching, but in his professional development courses and his work with new teachers, he stresses the need for this kind of activity, commenting,

That kinesthetic connection in teaching and learning is something we actively have to cultivate in new teachers, the ability to find those creative connections. Sometimes we have to spell that out, and really encourage that tendency so that they are constantly looking for ways to do it. Actually that is one of the professional development workshops that I've presented to teachers...their assignment is to create a lesson like this that they can take back to their classrooms. What's been so great is to see a high school teacher do

this, because some folks tend to think, “Oh, elementary school, yes, of course you sing songs...” But after that workshop, I’ve had high school teachers email me later saying, “Oh, this has made a huge difference!” That’s exciting for me - the light bulb moment in new and veteran teachers. When we can cultivate those connections it makes a difference.

Mia noted the importance of embodied thinking in that it plays directly into a student population that is inclined toward movement, as she stated,

The student population is so kinesthetic. I think that embodied thinking...or kinesthetic thinking, comes into play a lot. Whether we’re acting out concepts with our body, like different punctuation marks or making our bodies into multiplication signs. A lot of times, kinesthetic thinking seems to really help cement things into long-term memory.

In his teaching of mathematical concepts to middle school students, Adam has found different ways to integrate movement into his lessons. He described how he has his students learn about the number line by doing dance moves geared to help them understand the concept in a physical sense, as he stated,

As far as movement, there’s the number line dance that we do. The negative to the left. To remind the students that when you move to the left of the line, you’re going to the negative. And now make a plus sign with both your hands in front of your chest. And then put your right hand off to the right. That’s plus positive to the right. “Negative to the left, positive to the right, it’s the number line dance, I could dance all night.”...Actually, these students taking a test, they’re now doing the hand signals to figure out where they’re going.

In addition to integrating physical movements directly into the teaching of ideas, Adam sees value in giving his students a chance to move, to re-energize and wake up their thinking, as he remarked,

Sometimes I'll notice that the kids are starting to get a little tired or they're starting to look kind of lethargic, and we'll get up and do some quick yoga poses or we'll all just do some arm circles or jump up and down just to get the body moving.

Or to keep their attention with some movement, Adam has found some other ways to help his students become engaged and focused, using some simple kinesthetic techniques,

One of the things I do to get the class on task or anything is we do the two claps, two snaps, two stomps. So we literally go, "On three, one, two, three," and then they clap twice, snap twice, stomp twice and then sometimes we'll do harder claps. Or if a visitor comes in the room we do the two claps, two snaps, two stomps and then we all say, "Welcome." So it's just a way to keep their bodies moving and attention focused. And these kids are twelve, thirteen years old. They need to move...I try to get them moving around without running around because then it just becomes too hectic.

Like Adam, Julia also uses some kinesthetic techniques designed to get her students moving and engaged in the classroom. She sees this as a chance to get their attention and wake them up a bit, as she stated,

Some of the things that I do in my classroom...the kinds of things where they're actually moving - sit up straight; breathe in some deep air because it's going to help your brain, and...we're going to feel better and more awake; those kinds of things, where we're shaking out the cobwebs and waking up. It's important, giving them a chance to have

some physical movement that's not at all in the lock step, "we're in school, you better behave yourself" sort of stuff.

And like the other teachers in this study, Julia also incorporates embodied thinking methods into her teaching of subject matter, in order to make the learning more active and engaging. She asserted that science in her classroom is an active process, and that she wants her students to "see themselves as scientists". Along these lines, she tries to keep them active and engaged in the process of "doing science", via the use of physical activity, as she stated,

In my class, doing science involves movement, if you're going to talk about momentum and things like that, we're going to get a bunch of balls, we're going to go into the gym, and we're going to take data on bouncing balls. Instead of watching a movie about momentum we're going to actually do it ourselves. I think when they are doing it more of their neurons are engaged as opposed to when they're seeing it or hearing about it.

It is interesting to note that there are some subject matter differences to the way that these teachers perceive and employ embodied thinking. While Carrie viewed it just as importantly as the other teachers, as a language arts teacher, she honed in closely on the facet of empathy within embodied thinking, stating,

You know, I can read a book and feel like I know the people in it when I'm done, and I miss them. [laughs] Because they are gone. I just embrace as a reader and a writer too. In order to write, especially the fictional stuff that I've shared with my classes, I can't just write about me and my life. I have to understand other people's lives. Empathy, that's what I use. I put it in the fiction, a short story, or a little novel...for my kids. I really think the best teachers are the ones who can put themselves in the place of someone else.

This notion of empathy is important not only in her teaching of language arts as a subject matter, but she described how it has also been useful to her in dealing with parents and students, commenting,

When my parents of kids come in, usually there's a problem, either with grades or behavior. I try to actually - I visualize them at home at night, tucking their child into bed. And that child laying there, getting ready to sleep, because it puts me in the place of that parent. I see that child not just as my student, but as somebody's child. These kids that we teach are someone's dream come true. That's a big responsibility to teach someone's dream. You have to treat them like you want your own children treated by someone else. That has probably been the biggest part of what's impacted me as a teacher.

As a middle and high school language arts teacher, Carrie's notion of embodied thinking placed the emphasis on empathy. Interestingly enough, the only other English teacher in the study, Sandra, also immediately highlighted the concept of empathy in her teaching of subject matter when we discussed embodied thinking. The empathy facet of embodied thinking is likely very connected to disciplines involving reading, writing, and language arts, because of their emphasis on characters and their situations or behaviors. Sandra uses this sense of empathy to her engage her students more deeply in a piece of writing and its ideas, stating,

One thing that will draw a student into a piece of literature is the character. A lot of times it is that they see themselves in the character, or they get frustrated by the character, they don't understand the character. So I use a reader's reaction to character as a way to get them to start to work with ideas that are also present in the text. When we think of it that way, in order to understand a character we do have to empathize with the character. And I think that empathy is very akin to...holding two conflicting ideas at the same time in

your mind without judgment. When students empathize with characters, it opens them up to the possibility of working with ideas.

Modeling. Modeling is the fifth trans-disciplinary skill investigated in this study of accomplished teachings, and creating a representation of an idea or thing in real or theoretical terms in order to study its nature, composition or purpose. This can include sketches, drawing, diagrams or physical representations of any kind that create a tangible or representational understanding of a concept or object. *The teachers in this study discussed modeling as a useful teaching/creative skill for helping to make learning or ideas look or feel more real to students.*

As one might imagine, the sciences present opportunities to use the skill of modeling in teaching. Mark commented on its importance in his science classroom, and discussed the following example, in which modeling and abstracting are used to give students a real and relatable grasp on the structure of cells, he noted,

We do quite a bit with sketches, diagrams, drawings, that sort of thing; and with models, often, instead of having them build a physical model of say, a cell, I'll have them make it in terms of an analogy. For instance, the cell is like a school. The principal is like the nucleus, the office is like the nucleus, the computer system is like the DNA and so on. And then they'll actually make a poster or diagram of the school as analogous to a cell.

Mark further stated that one reason modeling was so important in his classroom was that it helped to teach science concepts that are otherwise somewhat un-relatable to students because of size and scale. In this way, modeling is a way to make learning large-scale concepts appear more real to students. He gave the following example of modeling objects in space,

One of the other ways I definitely use modeling is...in ideas that are difficult to comprehend because of their scale. I think especially about modeling of the solar system.

It's remarkable how much of nothing is out there in space. So we actually try to make a scale model of the solar system. I have an exercise ball that we use as the sun and have them do some math to calculate how big the planets will be based on this. So we look at the data from the planets and the students have to calculate how big they'll be. They sketch out or draw or come up with a small model...and show us where they think all of these planets would be. We go out in the courtyard, I put the sun in the middle, and they lay down their planets where they're supposed to go. We tease the folks who are stretching it way out to be 100-feet long and say "give me a break". But we do the math, and we see that only the first couple of planets would fit in the courtyard, and that Pluto would be on the other side of town, on the cliffs above town and it would be smaller than a pebble. Getting ideas like that across with modeling is absolutely invaluable.

So modeling allows highly skilled teachers like Mark to explain difficult concepts in more tactile or real ways. His creativity in coming up with unique means to model ideas has helped him to relate large-scale ideas to his students. He described another example of how this occurs in his classroom,

Or with concepts of time, for instance. I'll use a roll of toilet paper to model geologic time where each square on the toilet paper represents 10 million years - all the major events in evolutionary history, or the earth's history. I have them estimate where they're going to go on this roll of toilet paper that we stretch across the gym. We put them evenly along there. But then we do the math to see where did the first mammals come onto the scene, and we find it was only a few sheets of toilet paper ago. All of human history is only the thickness of a piece of toilet paper. Then students have this image in their mind for the

rest of the year as we talk about rates of erosion or how mountains develop... So

modeling can be really effective for teachers, especially to get across ideas like that.

As a science teacher, Julia also related the concept of modeling to give kids a real or hands-on sense of an idea. Like Mark, she uses her creativity and resourcefulness to come up with modeling ideas for her classroom that were simple, accessible and affordable. She described how, with a few simple food items, she could create a basic little cell model for her students,

One example that I love to use... We study cells, and we make cell-like models. I'll have baggies that have Jell-O in them that I make the night before, and I'll pick up a big marshmallow. I'll say 'What could this be?' The nucleus. I'll drop that into the bag, and then I'll say, 'What does the nucleus do?' We talk about it being the control center, and I'll have all of these different types of candies that I drop in as different cell parts: "What could these be? They're long and they're extended; they're kind of like assembly lines." "The endoplasmic reticulum", the kids will say it as I put these long licorice strings inside.

Mia also talked about how she finds ways to do simple yet effective modeling with her students, in ways that creatively demonstrate an idea in real terms, as she offered the following example,

I'm thinking about when we're studying polyhedrons, making them with toothpicks and gumdrops... we're making little models to give a demonstration of how they work or look. And we do stuff like that all the time. Again, the students are creating something, they're using their hands, they're talking about it, and they have that accountable talk. They're using all different modes of thinking within modeling.

In the teaching of mathematics Adam also uses modeling, and again, this is done to give a more real or thorough-going sense of an idea to his students. He noted that models are naturally prevalent in mathematics, and he finds them useful in his teaching of the subject matter, stating,

When we're solving an equation, we draw a scale underneath the equation with the middle of the scale below it, directly underneath the equal sign. So that way it helps them realize it's something that they need to keep balanced. Also, the number line dance can be a model... But then we also talk about real life representations of number lines like thermometers and profit and loss and debt and things like that. Or when we're calculating perimeter and area, I actually have them build models. We have a math project where the students build, design their own dream house where they have to calculate square footage and things like that. So they actually make a model. Models happen all over mathematics.

In the teaching of language arts, Carrie talked about how she used modeling to create a graphic organizer to help relate concepts in the domain of writing to her students,

When we do writing, I draw a house. The house has a roof, and then the body of the house is divided into three parts. The kids write the thesis or opening sentence of their paper in the roof and then three details, three reasons, three whatever that they are going to write about in each of the columns. And then the little details that go under them.

That's kind of a graphic organizer. And graphic organizers could be considered models in language arts, and we use those a lot just to help kids organize their thoughts.

Sandra reflected on the fact that modeling is valuable for moving between the abstract and the concrete. In trying to take something conceptual and relate it in a concrete way, she is trying to make something more “real” to students. This notion of modeling as a creative skill that makes learning more real or tactile was summarized by Sandra, as she noted,

Modeling for me, it's really closely aligned to that desire to move between the concrete and the abstract. So sometime my models are physical, they're drawings, they're sketches, they're trying to take an idea and make it concrete for someone else to understand... What I find is that this applies into so many different areas. Whether it's the classroom, whether it's a novel I'm reading, whether it's a piece of writing that I'm working on... any kind of endeavor. I see those models in lots of different disciplines.

Play. Play is the sixth trans-disciplinary skill studied among highly skilled teachers in this research. Playing is something that we do just “for the fun of it”, and it involves the opportunity to play or toy around with ideas or objects. Simply put, play is using knowledge, body, mind and abilities for the pure enjoyment of using them. And when people play with things or concepts or processes, they may open doors to new ways of thinking or learn in organic and vibrant ways. *The teachers in this study spoke to the value of play in helping to make learning fun for students.*

Mia noted the importance of play for developing a fun and creative approach to learning in students. She framed this in the perspective of the current educational climate of high-stakes testing, and noted that “play” helped give kids a needed mental break, stating,

With this pendulum swing towards standardized assessment, we focus so much on curriculum, and I think our students need a chance to also have that time to give their brains a break and play...that can lead to a lot of interesting thinking... That is creativity, when you're experimenting, trying new things and discovering what you come up with.

Her notion of play is quite trans-disciplinary in that it involves unstructured play that ultimately leads to creative output. Adam also views play as a necessary part of a teaching and learning paradigm, noting that it not only makes learning fun, but also teaching, as he said,

Play is...I think it's actually crucial and it's necessary. The truth is as teachers we often have to deliver the exact same kinds of lessons. So some days when I have all my classes doing the exact same thing, I deliver the same lesson five times. Sometimes I just have to let things get weird or let things get fun. I do different characters to talk about how math relates to different subjects. One special character is “the Math Comedian”, and he tells jokes. The truth is some of the jokes only have a little to do with math. But I call it the Math Comedian so that it can be part of class, and they love it.

Adam further described how sometimes taking a playful approach to teaching made the lesson more enjoyable, again not only for students but in his role as a teacher, as he put it,

Once, we had to grade 100 multiplication facts. There were 10 rows of 10. By the third row I thought I was going to go crazy. So I just started doing every row in a different voice. So, I'd do row three and I would pretend I was a guy from Australia, and row four I'd pretend I was Barack Obama and...by row five, I'd pretend I was Arnold Schwarzenegger. And then, of course I drew myself into a corner because after that I couldn't ever read answers again without the kids wanting different characters. But it was just a way to...have some fun and to let the kids have fun with the subject matter.

Sometimes it's subtle and sometimes it's not so subtle. But I think it's just necessary.

Jack also spoke to the value of play in making learning fun for his students. He described how play in learning had made a tremendous difference in his students' enjoyment of school and learning overall, as he remarked,

I see huge value in play. I think it is one of the most essential pieces of learning. And I have to say that again, that making those learning experiences fun is essential. When we are learning we are playing around with ideas, but we are purposeful in that play. I was

just looking at one of the pieces one of my students wrote, saying my favorite thing about third grade is making up songs for learning. “I had so much fun, my teacher makes learning fun.” And my students met their learning goals that way. To me, that speaks volumes to me about the value of play - that you can learn new and exciting things and have a great time. I can read countless examples from students that say “I was having so much fun that I didn't even realize we were learning.” If you can take the mundane out of things and really explore through play...it is going to make a huge difference.

This notion of deep intellectual engagement with ideas through the process of play is akin to Mishra et al.'s (2011) notion of “deep play”. Julia remarked on the fact that play is an essential part of childhood, and that young people naturally seek out play. Incorporating this into teaching makes the connection to learning both fun and organic.

Kids, they are at that stage - we all were at that stage once...where they want to get up and move, so I try to make sure they get time for that, and again play is different for all kids. I have a couple of students who love to draw and sketch, and if they get a hot minute, that's their idea of play. Kids who are readers, they want to have more of their solitude. That to them is just enjoyable, to just sit and soak their brain in a book...I think play in that regard, is just working in a little time, if possible, where the kids can just play and let the mind relax.

Julia's recognition of play as a natural stage of childhood creativity is similar to Vygotsky's (1978) notion of imaginative play as a developmental phase of childhood, which sets the stage for the development of creativity in an individual. She describes how she upholds this playful sensibility in the atmosphere of the classroom, stating

I have an area in my classroom the “experience station” where there are “natural world” artifacts. If I've been to the seaside, I bring back crab shells, bring back sea urchins. We have tree limbs that have lichen and different kinds of fungus growing on them. I have little science games...and things that they can explore. It's an exploration area. For some kids, it's a great place for them to let off a little steam and stay connected by moving their hands around in a positive way, and it's like “wow, look at this; look at that, look how it feels”, that kind of stuff. They have a lot of fun doing that, absolutely.

Marie noted that the freedom associated with having time to play with ideas or objects in a learning setting is integral to generating true creativity and curiosity in learning. She commented on the necessity of working in time for play in learning scenarios and in lesson planning, stating,

I find that a fascinating thing to do with children when I am teaching is to just allow them time to explore and play with ideas...Do allow for exploration and some uninterrupted, unstructured, “let us just kind of hang out with this stuff” time; kids will say “look we can do this, or how many different colors, or how many different patterns can we figure out, and what if we did this or that.” Play is an interesting way to help kids learn, because then the creative spark about understanding something in a much bigger way comes across.

Mark reflected on the fact that he finds play to be one of the essential components of childhood, and of learning and thinking in was that are fun and creative. He lamented the fact that the structure of modern schools tends to separate play from learning, and sees it as partly his responsibility to share that sense of playful learning with his students, as he remarked,

This is an area I feel pretty passionately about, the loss of play from many kids' lives. As a teacher, I feel like it is partly my responsibility to allow kids to play and to encourage

not just kids to play, but also my colleagues to play. I guess that kind of goes along with risk-taking to some extent, that it's ok to just try stuff for the sake of trying stuff and to do things just because they're enjoyable. Oftentimes it leads to a state of mind where creativity can happen more readily, and also it is kind of a breeding ground for ideas. And fun. I feel like education, unfortunately throughout the years, hasn't been all that fun. Kids get all excited about going to kindergarten and they're just stoked to get there...by the time they get to me in seventh grade, the kids are generally disillusioned with education and it's just not fun anymore. I think it should be. I think it has to be. Because we're all kids. The whole idea of using kindergarten...to bait kids in and then slam the door behind, and stick it to them for 12 more years, I think is morally reprehensible.

While Mark highlights the notion of play in stimulating creativity and in making learning fun for students, he stressed that play in the classroom does require some constraints or structure. But within this structure there is freedom to try out new things and ideas, and learn in ways that are fun and creative. He described how he sets up the conditions for play in his classroom, in ways that uphold its dynamic nature and set the stage for creativity, as he stated,

You can't just say, "OK, we're going to play all day." You give them somewhat structured conditions to play under. For instance, we're studying electricity. I'm not just going to let them start shoving stuff into wall sockets. I give them basic stuff to play with as an introductory activity. Here's a bunch of wires and batteries and bulbs and miscellaneous stuff. See if you can get a light bulb to light up. See if you can get it to get brighter...Play around with this stuff and see what you can do...Or when we're studying erosion, I bring in these big sleds full of sand water, and we're making streams and

gullies and all that good stuff. I encourage kids to play around and try and create different things and see what happens when you just, play.

Synthesizing. It must be noted that synthesizing was not specifically investigated among these interviewees, because it is a very meta-level tendency. It involves putting together the previous skills or subject matter into a fluid synthesis of knowledge and creative ideas. There was no specific question about synthesis in the interview guide that could have equated to the kinds of questions asked of the teachers about how they used observation, or modeling for example. However this is not to say by any means that synthesis, as a cognitive skill, does not exist in their lives or teaching practices. Rather synthesis is the totality of what these teachers do, and who they are in the broadest senses of the word.

In reading their comments, classroom ideas and philosophies of creativity, it is hopefully apparent to the reader that creative thinking spans disciplines, life activities and teaching practices for these accomplished teachers. They commented on the importance of creativity in their broad range of avocations and in their outside lives; noting the way that creative sensibilities impact their athletic pursuits, interests in the arts and music, hobbies such as travel or cooking, and generally all of the extracurricular pursuits of life. They noted examples that show how connected they are to the world at large, from a standpoint of social responsibility awareness of the wider world. This real-world knowledge is deeply instantiated in their teaching practices. They are highly connected and dedicated to their students, in understanding their emotional, psychological and learning-oriented needs. Finally, there is a clear commitment to their teaching practices, shown in an emphasis on developing excitement for specific subject matter in students, as well as an overall passion for learning.

Root Bernstein (1999) notes that, “Contrary to popular myth, we are all whole-brain thinkers... We sense and make sense of the world in multiple, concurrent, and intersensory or ‘cross-modal’ ways... This is synthetic knowing.” (p. 306)

What was interesting in the comments and themes of these interviews was just how connected or “cross-modal” these teachers are, in all senses of the word. They are connected to their kids, to what they are teaching, to the wider world, and to their own selves and their artistic pursuits. This kind of “synesthetic knowing” allows them to cross-pollinate ideas from different domains and areas of life, and combines into a richly creative teaching practice. Root-Bernstein (1999) again encapsulates the significance of synthesis stating,

What applies to art and medicine applies to all people working in every area, argued biologist, philosopher, artist, and art historian C.H. Waddington... he wrote, “The acute problems of the world can be solved only by whole men and women, not by people who refuse to be, publicly, anything more than a technologist, or a pure scientist, or an artist. In the world of today, you have got to be everything or you are going to be nothing... With so many eminent people in different disciplines proclaiming the same need, it is incumbent that we listen.” (p. 315)

This kind of synthesis of knowledge, skills, interests and creativity goes a way in explaining why these accomplished teachers are highly successful and creative in the classroom, and how this kind of knowledge is necessary to the practice of teaching and the demands of education.

Summary. In terms of how they defined creativity, these successful teachers did use some universal definitions of what creativity is, such as novelty and effectiveness/value. However, they additionally defined it in context-driven and teacher-specific ways. It would seem

that creativity has some generalized elements, which are applied and evaluated according to context. This maps quite closely onto Mishra and Koehler's (2008) rendering of creativity, in that it is Novel, Effective, and, Whole (NEW). The "wholeness" here relates to the contextual and teaching-focused elements of creativity in their definitions. These teachers cultivated a "creative mindset" as a kind of open-mindedness of thinking, where creativity means being constantly aware of and looking for different inspirations and problem solutions in the world around them. In giving examples from their teaching practice, there were central themes that their creative teaching approaches clustered around. These included *real-world teaching and learning, cross-curricular connections, and taking intellectual risks*. In summary, creative teachers integrate realistic learning examples, scenarios or lessons in their teaching; they connect different subject matters or across curriculum; and they are willing to try new things or to take intellectual risks in their classrooms.

All of the eight National Teacher of the Year award-winning teachers noted that they engaged in a variety of creative pursuits and avocations outside of their work as a classroom teacher. Most notably they all described ways in which their avocational practices deeply influenced their creativity, teaching practices and thought processes. The most popular types of hobbies or creative interests were generally categorized as relating to musical/artistic avocations, or to physical/athletic pursuits. The teachers with interests in music or art described ways that this incited their classroom creativity overall, and specifically helped them to bring musical or artistic habits and knowledge from their personal life into their teaching of different subject matter lessons. Such findings are remarkably similar to what Root-Bernstein (2003) discovered about the link between professional creativity and accomplishment and personal life creativity and avocations. Teachers who described having kinesthetic or athletic hobbies frequently noted

that these physical avocations had an impact on their creative thinking also. They noted cognitive benefits such as problem solving, focus, and clarity of mind, that stimulated creative thought processes, arising from engagement in physical activity.

Finally, a major finding of this study is that trans-disciplinary skills are valuable and frequently used by successful and accomplished teachers. Every teacher in the study provided examples and discussion of how trans-disciplinary skills were each used in their teaching practice. In general, how they used each of these skills tended to revolve around a particular theme of teaching and learning. *Observation* improves awareness of classroom dynamics, students, and learning progress. *Patterning* helps teachers understand trends in classroom and school situations and events. *Abstraction* helps to clarify and explain complex ideas in a clearer and more relatable form. *Embodied thinking* makes learning active and engaging. *Modeling* is a useful tool to make learning more realistic and tangible to students. *Play* makes learning fun and develops a sense of curiosity about ideas. *Synthesizing* is a function of who these teachers are, and how they are connected to creative thinking in multiple facets of their lives. The trans-disciplinary (or creative-cognitive skills) discussed with these accomplished teachers were seen as being highly relevant within creative teaching practices, each in its own way.

CHAPTER 5

Discussion

“Leaders are 'canny outlaws' system benders, creative and responsible rule benders. They have to succeed...because the deck is stacked against creative, imaginative, and entrepreneurial teachers.”

- Thomas Sergiovanni

In recent years, creative thinking skills have become a psychological trait of increasing interest and value (Sternberg & Lubart, 1999; Lewis, 2008). Florida (2002), notes that modern employers and workplaces seek and encourage creativity more strongly than ever. Mishra, Koehler, and Henriksen (2011) advocate the importance of creative thinking skills in 21st century education and as a means toward transformational learning and teaching. Despite all of this, as well as an apparent conviction in the field of education that creativity must be nurtured in the classroom, creative thinking in teaching is still little understood (Williams, 2002). Almost conversely, a strong push towards a highly standardized and rigid high-stakes testing environment has become prevalent in American education in recent years. Such standardization and “teaching to the test” approaches are not necessarily congruent with constructive, creative teaching approaches or with authentic and meaningful learning experiences (Guthrie 2002; Mock et al 2006).

I sought to investigate creative interests and avocations among highly accomplished teachers, as well as to examine creativity and trans-disciplinary thinking skills in their teaching practices. Within the framework of trans-disciplinary thinking, specific trans-disciplinary thinking skills were emphasized and studied among these participants. The participants were teachers who have won, or have been finalists for, the “National Teacher of the Year” award.

Eight accomplished, successful teachers were interviewed in-depth with regard to their creative thinking tendencies, creative interests and avocations, and creativity in their teaching practices. Long interviews, generally lasting anywhere from 90 minutes to just over two hours were conducted with each of the participants. With their informed consent of participants, interviews were audio recorded and transcribed. I analyzed the verbatim transcripts using qualitative coding procedures, via three iterations of coding, which narrowed and organized several themes and strands of ideas of relevance to this study (Anfara et al, 2002). These themes were analyzed in the preceding chapter, and will be discussed along with recommendations as follows.

Interview data revealed ways in which the avocations and creative interests of successful teachers inform their teaching and thinking. It also highlighted the importance of creativity and trans-disciplinary thinking skills among accomplished teachers, and how this translates into successful, creative teaching practice.

Discussion of Findings

As a psychological construct, the variable and complex nature of creativity makes it what Spiro, Feltovich, Jacobson, & Coulson (1995) define as an "*ill-structured* domain". The fact that creativity is somewhat abstract in nature makes it vulnerable to being marginalized at the policy level in education, particularly in a climate of standardized, high-stakes testing and teaching. Yet the necessity of creative thought processes for success in our increasingly complex world is not lost on many in the field, and there is a great need to understand how creative thinking impacts effective and successful teaching. Society is progressively becoming more competitive and interdependent, with diverse knowledge bases and multifaceted problems that demand creative thinkers and solutions. An ever-increasing interest in creativity in the field of education, coupled

with the knowledge gap on this topic, means that it is critical to consider and understand examples of how creativity plays out in successful teaching paradigms.

Based on prior creativity research (Root-Bernstein, 1996; 1999; 2003) the research questions for this study involve an examination of several different strands of creativity among proven, successful teachers: (1) the importance and meaning of creativity in general within a successful and effective teaching practice; (2) how the creative interests and avocations of accomplished teachers positively influence their overall creativity and teaching; (3) how trans-disciplinary thinking skills inform an effective, creative teaching practice.

Defining Creativity & What It Means. Central to the research questions of the study is the notion of what creativity means to accomplished, successful teachers, how they define it and how it occurs in their classroom practice. The teachers in this study incorporated some universal definitions of what creativity is. Additionally though, they also defined it in context-driven ways specific to teachers and classrooms. The contextual nature of their definitions is similar to Mishra & Koehler's (2008) concept of creativity as NEW (novel, effective and "whole") which denotes "wholeness" as aesthetic sensibility which is deeply bound to context. The findings of this study showed that these successful teachers defined creativity both broadly and contextually. In terms of how creativity plays out in their classrooms, the teachers tended to discuss creative teaching examples that clustered around several themes: 1) Real-world or "authentic" learning; 2) Cross-curricular connections; 3) Taking intellectual/educational risks.

All of the teachers defined the standard elements of creative work as being novel and effective. Elements of novelty or originality (i.e. creative things are new or different in some way), as well as value or effectiveness (i.e. creative things "work well") are generally part of a collective understanding of what it means to be creative (Amabile, 1988, 1996; Oldham &

Cummings, 1996; Fox, J., & Fox, R., 2000; Cropley, 2001; Zhou & George, 2001). After this, definitions of creativity become more complex and nuanced. In asking eight different creative or successful people to discuss the meaning of creativity, there were eight subtly different interpretations of the concept.

Despite this, there were some common ways in which these creative teachers viewed the construct. For instance, several of the teachers stressed the importance of creative teaching from the student's perspective. Novelty and originality were instantiated in statements like, "if it's something that the students have never seen before or if it's something they latch onto or really like", or something might be defined as new if it involves tweaking an idea that exists, such as a curriculum standard or textbook information. Value or effectiveness were also contextually defined as practices that are not only effective in communicating or teaching an idea, but that are relevant to students lives, or fun and exciting from a student's viewpoint. In short, they embraced a student-centered perspective on their teaching creativity.

Also inherent in these teachers' definitions is the fact that creativity is a manner of thinking that is available to everyone, not just people typically termed to be "artistic" or "creative". Essentially, these teachers maintained the attitude that people are not necessarily creative or uncreative, but that it is something that can be learned and developed through knowledge and opportunities to practice unique and different problem solutions.

Finally, one of the most pervasive and prevalent notions that the teachers had about creativity is that it is an "ongoing mindset". Creativity is not something that can be put into a box or pulled out only in specific moments when creative thinking is needed. Rather it is a constant mindset based on openness to new ideas and willingness to try new things, which is actively cultivated by successful and accomplished teachers - both when they are teaching and when they

are not. Several of these teachers noted that they are always ready to make mental connections to teaching activities, even when they are engaged in doing something completely different. This skill for transferring ideas between disparate activities is akin to trans-disciplinary thinking, in drawing on ideas from another separate topic to apply it to teaching. Lastly, a common part of this mindset is a willingness to put themselves in their students' positions when considering lesson plans and think about what would be "cool" and motivating from their perspective. This openness even extended to a willingness to ask their students for input about the kinds of activities or approaches that might be fun or engaging.

With regard to the issue of how creativity actually plays out in the classroom practices of exceptional teachers, there were several key themes that recurred as they provided examples and discussed elements of their creative approaches to teaching. These included *real-world teaching and learning*, *cross-curricular connections*, and *taking intellectual risks*.

Throughout the examples of creative lessons that each teacher gave, one of the frequently threads was a tendency to create lessons with a focus on real-world learning. Although this was instantiated in many different ways and with different subject matters, all of the teachers tried to root their lessons in a real-world, or "authentic" basis or framework, whenever possible. They generally that such realistic teaching examples made their subject matter more relevant, relatable, interesting, and ultimately more meaningful for their students. This type of real-life teaching mainly requires that teachers seek connections between the ideas that they are teaching to their students, and activities or links with real world applications.

Another finding of this study was the tendency for this group of teachers to teach creatively through cross-curricular connections. They all provided examples of teaching subject matter via the medium of the arts or music, which is certainly cross-curricular in that the arts are

blended with school subjects. But they also used a variety of cross-curricular connections for teaching subject matter. Whether it's the teaching of science through a design lens or with a social-justice dynamic, or teaching mathematics using advertising activities, or the teaching of language arts via an idea from music theory, it seems clear that successful teachers are able to maximize and enhance their students learning through cross-curricular styles of teaching and lesson planning.

Finally, a key finding from the creativity paradigms of successful teachers is a willingness to take risks. This is not meant in the sense of careless or "risky" teaching, but rather in a willingness to think outside of the box and to take intellectual or teaching risks by trying out new ideas and approaches to lessons and classroom practices. In describing how they devised creative and effective lessons most of the teachers noted that one of the key ingredients in a creative teaching practice is a willingness to take risks by trying out new, different and unknown approaches and ideas. They frequently noted that this was one of the best ways to figure out what kinds of ideas and lessons worked well in their teaching practice. Several of the teachers stressed that in order to be creative, it is essential to take risks, because we only discover interesting and innovative approaches when we feel free to try new things out. They noted that it was also beneficial for their students to see this kind of creative openness practiced by teachers, as it helped to encourage and instill such creative behaviors in students as well.

Avocations and Creative Interests. The eight accomplished teachers in this study all demonstrated several instances of what Csikszentmihalyi (1996) and Gardner (1999) consider to be "little c" or everyday creativity, expressed in a variety of avocations and personal creative hobbies and interests, which they weave into their teaching practices. One of the major findings of this study is that people who are accomplished and recognized as successful classroom

teachers are also highly creative individuals in a personal sense. All of them not only noted a variety of avocations and pursuits in different creative, kinesthetic and subject matter realms, but moreover they observed the vital importance that these activities had in impacting their creativity overall and as a teacher.

Every accomplished teacher noted a combination of multiple avocations and interests. Six out of the eight teachers regularly engaged in musical or artistic pursuits and avocations. Six of the eight also pursued physical or kinesthetic hobbies ranging from running or swimming to rock climbing or yoga. Additional activities that were remarked on included miscellaneous subject matter interests, cooking, travel and so on. They each gave credit to their outside hobbies and interests as being quite impactful toward their successful work as a teacher. The impact of these creative pursuits and avocations revolved around several themes such as: (1) teachers tend to “teach who they are” and this helps accomplished teachers bring their interests outside of the classroom into their teaching work, (2) musical or artistic interests tend to work their way into classroom practices and the teaching of different subject matters, and (3) kinesthetic activities are a valuable way of both clearing and focusing the mind and stimulating new creative thought processes.

These teachers frequently noted that outside pursuits always factor into their thinking about their classrooms, because teachers tend to “teach who they are”. Creative passions in their personal lives naturally become connected to ideas or subjects that they are teaching in the classroom. They begin to see connections between their interests in anything from rap music to cooking or travel, to school subject matters like math or language arts, and thereby find interesting ways to teach and develop creative lessons. In short, having avocations and creative interests spawns more creativity within a professional context.

Another finding was that the impact of music or artistic hobbies on creative teaching was quite important. Within this small but unique sample, having six of the eight people describe such similar interests was noteworthy. Moreover all of the teachers with artistic or musical interests described having teaching practices in which they used these creative skills in the teaching of subject matter. They might have their students write songs to teach and learn a subject matter concept, or incorporate visual or graphic design into teaching science concepts or talking with students about the visual or aesthetic beauty in the natural world.

The notion of using music in teaching activities might seem daunting to anyone unfamiliar with the discipline, and the same is true of art. But it is important to stress here that the critical point is not really the medium itself, but the fact that these successful teachers found ways to co-opt their personal interests and creativity, and use them in valuable teaching techniques. Dewey (1916, 1934) viewed truly educative experiences as being both aesthetic and meaningful. In this way, teachers that draw upon things that they find aesthetically pleasing, and can use this in their lessons to craft educative experiences for their students.

Finally, the findings of this study showed that mind/body connections, in terms of physical or kinesthetic pursuits, were very significant to these teachers. Again six of the eight teachers noted physical or athletic interests that were frequently part of their everyday life, such as running, kickboxing, yoga, etc. The teachers in this study observed the connection between creative problem-solving thought processes and body movement or physical sensations. This is deeply connected to the trans-disciplinary skill of “embodied thinking” or quite literally, thinking with the body. Physical activities appear to be useful to these teachers in stimulating their thinking and creativity overall. Many of the teachers also managed to work kinesthetic activity directly into subject matter lessons, recognizing the connection between movement and thought

processes. Therefore, as with music and art, personal avocations become interwoven with the teaching practices of successful teachers.

Within an educational and teaching context, all of these findings lend further support to the work of Root-Bernstein (1996; 1999; 2003), who asserted that those who are successful and creative within a professional discipline tend to have creative interests and avocations that enhance their thinking overall. Root-Bernstein's (1996) findings showed that highly innovative and accomplished scientists frequently draw inspiration from avocational work, which contributes to professional creativity. Based on evidence from my interviews with these eight highly accomplished teachers, there is also credence to this in the field of education and teaching.

It has been previously suggested by some researchers that studies of "Big C" creativity are more useful for informing our understanding of creativity overall and that this is not necessarily true of studies of "little c" creativity (Csikszentmihalyi, 1996; Gardner, 1999). However, this study reveals that there is much significance in the works of everyday or "little c" creativity, and it seems that this can impact "Big C" or sublime creativity. Incorporating avocational activities that stimulate creative processes and thinking in everyday life is a key factor in inspiring bigger forms of professional creativity and success.

There is also research to indicate that when people do things outside of their standard routine, the left side of the brain (which rules logical, analytical thinking) yields to the right brain hemisphere, the domain of creativity (Miller, 1999). This may help to sharpen divergent thinking, and promote a creative flow of thinking or problem solving (Csikszentmihalyi, 1996). Essentially, the left brain works in the background, while the right brain actively engages the task or ideas at hand. So analysis and creativity come together to find solutions to problems that

might have initially felt unsolvable. In this way, interesting things can happen, and new ideas emerge, which is the starting point and often the catalyst for creative thinking.

Trans-Disciplinary Skills in Teaching Practices. Trans-disciplinary thinking skills, or creative-cognitive skills that cut across a variety of disciplines, have been studied and considered among respected scientists and among creative minds in different domains (Root-Bernstein, 1996; 1999; 2003). The notion of trans-disciplinary thinking was a key emphasis in this study, in determining if and how accomplished teachers use trans-disciplinary cognitive skills such as: (1) observation; (2) patterning; (3) abstracting; (4) embodied thinking; (5) modeling; (6) play; (7) synthesis

These trans-disciplinary thinking skills – adapted and condensed from Root-Bernstein (1999) by Mishra, et al. (2011) – have been suggested as key thinking skills for successful, creative people across a variety of domains in the arts and sciences. Since trans-disciplinary thinking skills have not yet been studied among successful teachers, this study was an opportunity to initially understand and describe whether and how they are useful in teaching. The findings of this study are that, in the experiences of these accomplished teachers, each of the trans-disciplinary thinking skills are important in different ways.

All of the teachers in this study described the importance of **Observation**, or careful attention to and noticing of fine details, for developing an awareness of classroom dynamics, students, and learning progress. Observation was a skill that the teachers in this study immediately identified with as an essential component of running an effective classroom, and developing teaching and learning activities that are on-par with what their students need. They talked about it as both classroom management (e.g. “always having your feelers out and understanding what's going on in all parts of the room”) and teaching/learning theory (e.g.

“always looking for those teachable moments”; or “observing when there's an opening, observing when there's a chink in the armor of engagement or boredom”). Overall, observation was considered to be an incredibly vital teaching skill on many levels – from classroom management, to awareness of student learning, needs and progress, to creativity in developing activities.

Patterning, which involves both recognizing and creating patterns, was also discussed by all of the teachers in this study as essential for understanding trends or occurrences in classroom and school situations. This might involve understanding at the level of their individual students, or their class or school as a whole. Teachers noted that they needed to be able to see pedagogical patterns, such as patterns in student behavior, patterns in work that they turn in, or in their learning progress. Or they observed patterns in the school day, or patterns in different types of rural or urban communities or school settings that relate to teaching context. The teachers in this study not only observed patterns in students and classroom over time, but also acted on them constructively. Once teachers can identify a pattern and assess what's occurring with students and class behavior and learning, they can create accurate and useful solutions or change the patterns if necessary.

The skill of **Abstraction**, which is a combination of abstract thinking (simplifying an idea in an accurate and representative way) and analogy (drawing comparisons between different things to explain the fundamentals of them), was considered quite useful for the teachers in this study. Overall, teachers noted that abstraction was helpful as a way to clarify and explain complex ideas in a clearer or simpler form. They all noted the importance of being able to distill a topic by identifying the essentials. How each of the teachers used abstraction varied a bit based on subject matter, but it generally was used to teach big ideas in manageable ways. It might

involve looking at, in very small pieces, the things that will ultimately be seeing in more complex or whole form. It might involve teaching a complicated concept through a small story or a single object. Or in many cases, the teachers in the study remarked on the usefulness of analogy, drawing comparisons between a new topic and something that students already understood and related to. In this information age where students are bombarded with data, and where teachers are responsible for increasing amounts of curriculum, abstraction is a highly useful skill for identifying the most important nuggets of information and the most relatable, manageable ways of teaching it.

Embodied thinking, or quite simply “thinking with the body” includes physical movement connected to thinking, and/or empathy. For the accomplished teachers in this study, this was a key ingredient in making learning active and engaging. Teachers frequently noted that at one level movement and physical activity helped to clear the mind and “shake off the cobwebs”, and at another level physical movement with the body could be used to help students better understand ideas in fun and engaging ways. Embodied thinking might be as simple as having students stand up and do a few yoga poses to clear their heads. But more often, physical movements were part of the lesson. For example, some teachers would have their students form a human solar system in order to see the order of the planets, or create a dance to help understand negative/positive numbers in math. Empathy also played a part in this, as teachers noted the importance of helping their students to be able to relate to or feel what someone or something else would (e.g. having students act out the roles of molecules or organisms in a science lesson). The options for using embodied thinking were many and varied, the key characteristic was that physical movement helped them to engage their students’ minds in ideas.

The trans-disciplinary skill of *Modeling*, or creating physical representations of ideas and concepts, was frequently used by the teachers in this study in order to make learning more real and tangible to students. Many of them noted ways in which they used sketches, diagrams, drawings, or representations of ideas and topics, to help make things that are large or abstract seem more real and comprehensible to students. Making models of the solar system, or of evolutionary timelines, helped teacher explain vast scales to students in ways that they could grasp them. Even elementary teachers might use candy and toothpicks to have students build little 3-d geometric figures in a way that better showed what a polyhedron looks like. The types of models described by teachers in this study were not expensive or fancy, but made use of resources at hand to represent and explain an idea. The findings of this study showed that successful teachers found creative ways to use modeling, because it makes ideas and subjects more “real”, tactile or relatable to their students.

The trans-disciplinary skill of *Play*, or playing/toying around with ideas, objects or concepts in a relaxed manner, was commented on by all of the accomplished teachers in this study, as being integral to how they make learning fun. Across ideas, disciplines and age groups, the teachers found different ways to let their students play around with ideas or learning artifacts. They saw play as necessary to developing an appreciation for ideas and curiosity in their students. Several noted that the tight schedules and results-oriented learning structures of American education today make it difficult to work in time for play. In any subject matter, the teachers in this study felt that carving out time for fun or to allow their students to explore and play with ideas was a necessary, if not always easy, part of their teaching practice.

Finally, while *Synthesis* was not, as noted, specifically discussed with teachers during their interviews, it is still a highly present skills in their lives. Their comments, classroom ideas

and philosophies of creativity reveal that creative thinking spans disciplines, life activities and teaching practices for these accomplished teachers. Creative sensibilities impact their artistic and kinesthetic avocations, hobbies such as travel and cooking, and generally all of the extracurricular pursuits of life. The teachers in this study are highly connected on all levels; connected to their kids, to teaching and subject matter, to the outside world, and to their own selves and interests. This kind of “synthetic knowing” allows them to transfer ideas from different domains and areas of life, and combines into powerful creative teaching

Conclusions

Based on the findings of this study, the following conclusions can be drawn. In the order of the research questions, the first major finding of this study revealed that creative teachers noted basic elements of novelty and effectiveness in their creativity definitions; but they additionally defined in very contextual and teacher-specific, or “whole” ways (Mishra and Koehler, 2008). Creativity has some generalizable elements, but these are instantiated and evaluated according to context. In terms of how this creativity plays out in their teaching practice, there were key themes including *real-world teaching and learning, cross-curricular connections, and taking intellectual risks*.

The second major finding of the study is that accomplished teachers engage in a variety of avocations and creative pursuits in their outside lives which creatively impacts their teaching practices. People with interests in music and the arts noted various ways that they incorporate this into a creative teaching practice, and teachers with kinesthetic avocations likewise used movement and physical aspects of learning in their teaching practices. Teachers frequently noted that “we teach who we are,” and it seems that those who engage creatively outside of teaching are able to usefully draw on this in their teaching.

Finally, the third major finding of this study is that trans-disciplinary skills are highly valuable and utilized by successful and accomplished teachers. All of the teachers in the study provided examples and discussion of how the noted trans-disciplinary skills were each used in their teaching practice. In general, their use of these skills tended to cluster around particular themes for each skill as previously described..

Implications for Policy and Practice

This study raises several issues about creativity in teaching and learning, which have implications for educational policy in K-12 teaching, as well as teacher education in higher education. The results of this study revealed some interesting and important themes of creativity in successful teaching, but also revealed some of the difficulties of using creativity given the current context for many teachers. The following addresses this notion of “creativity in context”, then suggests how educational policy and teacher education might consider infusing creativity into policy or curriculum.

Creativity in Context. Creativity is, by its very nature, multifaceted and complex. Any creative thought or action arises out of a web of influences and existing ideas, and is highly tied to the context that it develops in. Because creativity is such a complex topic, and teaching such an ill-structured domain, it is clear that context will play an important role in any teacher’s ability to exercise their creativity in teaching practices. Along these lines it must be noted that most teachers today struggle to balance the demands of current high stakes testing/accountability, with the ability to act flexibly, independently and creatively in their classrooms. Despite being some of the most recognized and lauded teachers in the country, it was interesting to note that many in this study faced this same challenge as well.

In discussing what she considered the biggest challenges of the current state of U.S. education Julia, a middle school science teacher, noted the feeling of discouragement brought on by the climate of rigor and accountability/testing. As she noted,

I would say discouragement, particularly in this time and era that I'm teaching in, where teachers are the scapegoat and whipping boy for everybody across the country. (Referring to the movie "Waiting for Superman")... Whenever they're looking at Finland. "Oh. The great Finland. Yay. Finland. They have great teachers." They also have a monoculture of people. They respect the profession. They also actively seek and recruit top college students and it's a position of honor to be a teacher. Here... there is this whole idea that we're overpaid and underworked.... We all wear so many hats because there's fewer of our staff to meet the needs. It's lot of different roles and that can be very energizing, but it can be very grueling.

Overall, Julia remains positive and highly motivated by her work as a teacher, commenting that she feels that the challenges of education are some of the most important ones that society must face, noting, "I've tried to be a leader in meeting those challenges." But it must also be acknowledged that while she consistently practices engaging teaching, bringing art and creativity into her science classroom, the challenges of doing so today are not small. Her resourcefulness in finding grant funding for classroom resources, trips, etc, has helped her to maintain her creative energy in teaching. But it is clear that this is at times an uphill battle. The concern then may be that the direction of the U.S. educational system is not always geared toward creative teachers.

Adam, a middle school math teacher had noted during our discussion of cross-disciplinary teaching, that he felt it was very important to help students make connections

between different subject matters. Yet he also reflected on the fact that this was not something that national standards/curriculum was always amenable to, stating,

I actually think that's one of the weaknesses of American education, is our inability to make connections across subject matters. We've moved so far away from projects to covering the standards as quickly as possible that we've lost a lot of those connections. I'd like to see American education move towards more of a truly inter-disciplinary curriculum.

Adam furthermore commented on the challenges of more and more curriculum, but with less time to adequately cover and explore ideas, noting that this seems to be a problematic direction for U.S. education, stating

I think that it feels like I'm more overwhelmed now. I'm more an experienced teacher even when I was at the beginning of my teaching here. But...I feel like the pressure is building. It just seems to me that my classes have gotten bigger over the past five years and the pressure to cover a lot more material has gotten greater...I'm trying to do it in less and less time now. So, there's this pressure to keep up which I find very disheartening.

Adam, like others in this study, maintains his commitment to creative teaching, utilizing the creative, fun and real-life teaching practices that have made him so successful as a teacher. Yet the current state of our educational policy makes this increasingly difficult.

Mark (a middle school science teacher), also felt very strongly about creativity being an integral part of any successful teaching practice. He noted that the ability to try new and creative ideas in the classroom is a critical component of successful teaching, and yet many teachers unfortunately don't feel that they are free to do this, as he stated,

Being willing or able to try new things or risk doing something different in the classroom is important. That's something that I think a lot of teachers, they don't have an environment, a school environment or climate that's conducive to risk-taking, for whatever reason. It could be just that they don't think of themselves as a creative individual. But I think oftentimes it's sort of that fear of “well, there's so much pressure right now to keep achievement high”.

At the same time though, context does not always have to play a negative role. While at the national level, education policy can be quite restrictive to innovation and creativeness in teaching, a supportive administrator at the local level can make all the difference. Mark commented that he felt fortunate to have a school setting that was conducive to taking some teaching risks and trying new approaches. The end result of this key of teaching practice is ultimately highly positive and has been beneficial for his students:

I know I've been very fortunate that my administration has been very supportive and very hands off...and my principal over the years has been very supportive in the fact that he's OK with me trying new things, and ultimately it leads to good results on those sorts of objective measures of achievement. He also sees the fire in the students' eyes, the passion for learning, and the excitement about science. When administration sees that, wow, it's not just our achievement scores that are going up, but it's also a lot of other things that we are not necessarily measuring.

Overall, the teachers in this study manage to uphold their creative energies and succeed with extraordinary success at great lengths in the classroom. Yet they still, in this group of the most accomplished award-winning teachers in the country, struggle to work through or around certain aspects of the U.S. educational system. This underscores some pitfalls of our current

policy, which could be addressed through an infusion of creativity or trans-disciplinary thinking into the curriculum.

Educational Policy. For the past decade, educational policy in the United States has seen a definitive focus on standardization and accountability, as quantifiably measured through basic standardized tests. As the pendulum of educational policy has swung in this direction, it has also forced teaching into a more standardized or rigid position, with approaches sometimes referred to as “teaching to the test”, “drill and kill”, or “no child left untested”. While there has been a certain acknowledgement of the problems associated with this kind of policy, there are continued calls for accountability in the educational air. If the federal government is seen as the investor in education, then they are certainly the investor looking for measurable results.

The problems with some of the standardized teaching approaches and rigorously paced content that have arisen out of such educational policy is that they often have the adverse effect of killing curiosity, creativity and enjoyment in learning; in short, all of the things that stimulate a desire to learn in school and throughout life (Robinson, 2003; Jones et al, 2003). Additionally, these approaches have been found to suppress teacher creativity, and detract from opportunities to explore subject matter and develop critical thinking skills in students (Mock, Moorman and Lewis, 2006). Broadfoot (1996) found that modeling creativity is an important part of the art of teaching. When teachers are deprived of the opportunity to foster creativity in their classrooms, students cannot begin to develop a mastery of critical or creative thinking abilities (Giroux and Schmidt, 2004).

This lack of creativity in the current educational climate is problematic, because at a global level, creative thinkers are needed and valued to solve problems and develop solutions in modern society. In business and technology, companies like Apple or Microsoft seek to hire

innovative people. In mathematics or the sciences, creativity is strongly correlated to professional accomplishment (Root-Bernstein, 1996). In subject matters from writing, to design, or to the more traditional arts or music, creativity has always been and will continue to be a driving force in producing new and important work. So across disciplines, we see creative thinking as important, yet the current American model of education frequently devalues it within policy.

That is not to say that there is no place for seeking to meet or exceed standards, or for having measures of accountability, but rather that the current high-stakes testing model or “teacher-proof” curriculums have impeded teachers from applying creative teaching methods and from fostering creativity in their students.

The eight award-winning teachers in this study all have been singled out at the national level for teaching accomplishments that helped their students to achieve significant and measurable results. However, they frequently managed to do this against the odds, or *despite* educational policy, rather than being supported by it. All of the teachers in this study taught subject matters such as math, science, language arts, or elementary classes (i.e. no explicitly creative subject matter teachers, such as art or music teachers). Yet they all incorporated creative teaching techniques into their practices. Many of them mentioned “sneaking” creativity or the arts into their curriculum, or struggling to find time to do cross-curricular activities, or allow their students time for “creative play” in the classroom.

One of the themes of this study was the willingness to take creative or intellectual risks in successful teaching practice. Yet the “factory model” approach of high stakes testing can impede this enthusiasm for trying new things in the classroom. As one of the teachers, Mark, summarized this problem:

I think that there's a lot of fear. And when teachers are teaching in fear, they take few risks. And ultimately I think that's going to sink our educational system, this sort of fear-based climate that everything's all about achievement, achievement, achievement.

It should be noted that Mark's students have increasingly met and exceeded their standards (even in a low-income and struggling rural district), due to his willingness to focus on creative and varied approaches to teaching. Educational policy approaches geared at reducing this climate of fear, easing the reins on high-stakes testing and nurturing creativity within national standards and curriculum, could promote the notion of successful risk taking.

In trying to facilitate the teaching practices of new teachers and veteran teachers alike, our educational policy might be well served to consider the classroom efforts and impressive teaching records of skilled creative teachers, such as the participants of this study. Involving such noted, accomplished, and creative teachers in policy making and curriculum creation would be an excellent first step to opening the doors to creativity in education.

The kinds of creative and successful lessons that these highly recognized teachers mentioned, frequently used artistic, design-based, or musical approaches to teaching school subject matter; and they also implemented a variety of cross-curricular learning approaches in their classrooms. Using these artistic and cross-curricular approaches when writing national curriculum, as opposed to test-driven or drill-oriented approaches, would be another way to instantiate some of their successful approaches to teaching creatively. Many of them also cited doing lessons with a focus on real-world learning, or classroom activities with some focus or lens on subject matter in the real world. Such "authentic" learning has long been touted in educational research as important for meaningful and motivating learning; and the findings of this study show that attempting to tie school curriculum to the real world (as opposed to traditional or cut-

and-dry textbook learning) may be an interesting approach to creative teaching and learning. Additionally, the trans-disciplinary skills emphasized in this study were found to be valuable in the practices of successful, creative teachers. Therefore, policy makers might consider enfoldng them into curriculum and subject matter, much in the way that the teachers in the study innately do in their classrooms.

As a potential resource for policy leaders, the Partnership for 21st Century Skills is an organization aimed at infusing creative thinking and problem solving skills, among others, into education for the 21st century. Their framework for teaching and learning includes innovation skills as a key component, as stated on their website:

Learning and innovation skills are increasingly being recognized as the skills that separate students who are prepared for increasingly complex work and life environments in the 21st century, and those who are not. A focus on creativity, critical thinking, communication and collaboration is essential to prepare students for the future.

(Partnership for 21st century learning, 2004, paragraph 1)

Higher Education. Teacher education programs in higher education are intended to provide teachers with the knowledge and skills needed to educate students and prepare them for 21st century learning. Yet the role of creativity there is not always clear, and varies depending on schools and programs. The findings of this study highlight the importance of creativity and trans-disciplinary thinking skills among effective and successful teachers. Based on this, it would seem that teacher education programs would benefit from an increased focus on creative thinking, and creativity in teaching practices.

Helping pre-service teachers to tap into their own personal creativity is one important way that teaching programs could prepare new teachers to think of themselves as creative

individuals. This study shows that highly creative teachers tend to engage in a variety of creative pursuits and avocations that positively influence their teaching practice. Teacher education students should be encouraged to actively spend time on their own creative hobbies and interests, and incorporate these passions into lessons and activities. This begins to build a bridge early on in a teaching career between personal and professional creativity, and may help new teachers more easily fold creativity into a successful teaching practice.

Including more theoretical knowledge of creativity into the teacher education curriculum may be useful for pre-service teachers, particularly in highlighting the relationship between creativity and student achievement or teacher effectiveness. Some researchers have suggested specific creativity training in teacher education programs (De Souza Fleith, 2000). However, most of the teachers in this study defined creativity as an ongoing mindset and not as a subject that they would treat separately from other aspects of their thinking or teaching practices. Therefore, assimilating knowledge of creativity more fluidly into teacher education programs would make sense, in light of the way that creative thinking organically occurs in practice.

Giving pre-service teachers more opportunities to engage in art/design-based or music-based lesson planning for school subject matters is a possibility to get them thinking about creative teaching. Cross-curricular lessons are effective and motivating practices in creative teaching; thereby, pre-service teachers might be required to take courses in the arts or music, or anything of interest outside of their major specialization in teaching, and integrate this cross-disciplinary knowledge into their teaching coursework. Additionally, teaching courses focusing on the trans-disciplinary skills may be useful in relating how they valuable for creative, critical thinkers overall, and specifically how they are useful in the profession of teaching. Overall, a

theoretical understanding of creativity should connect to practical applications, that give teacher education students the opportunity to consider themselves as creative teachers.

Recommendations for Future Research

This study was an exploratory and descriptive investigation of creativity and trans-disciplinary skills in the thinking and teaching practices of highly accomplished and effective teachers. Because this study provided strong and rich evidence of creativity and trans-disciplinary thinking within the lives and teaching practices of successful teachers, it creates a basis for further meaningful research in this area. Eight nationally recognized teachers were interviewed in-depth in this study, but to examine my findings in a more thorough light, more award-winning teachers could be interviewed on the same issues. Essentially the same study could be replicated with other accomplished teachers, winners of teaching excellence awards at national or state levels, to determine if the same kinds of results and findings occur.

Also, a quantitative lens could be utilized for research on this topic. A quantitative instrument like the one Root-Bernstein used on accomplished scientists could be used to measure personal creativity among professionally creative teachers. Also, a carefully constructed survey instrument could be used to gauge teaching creativity and trans-disciplinary thinking in teachers. Survey data could be collected from a much larger population (perhaps all state-level teaching award winners going back several years), allowing for a larger and more generalizable result.

Since this dissertation study was purely qualitative in nature, this type of quantitative component could also be added to a qualitative interview process. By extending this work into a mixed-methods study, there is an opportunity to gather quantitative findings on teaching creativity and trans-disciplinary skills, which could then be further explained via the interview process.

There are numerous possibilities for research on this subject. Observational research would be a fascinating opportunity to observe the classroom practices of excellent teachers and understand in more detail how creativity plays out in their classrooms. If possible, comparison studies would be valuable, between classrooms that do emphasize creative approaches like the ones noted in this study, and classrooms that use more traditional practices or approaches fostered by the current high-stakes testing climate. Since creativity is a complex but crucial topic in the field of education, and trans-disciplinary thinking skills have not been studied much in teachers, the possibilities for research avenues are limitless.

Limitations and Delimitations

Several limitations in this study may have influenced the results. The degree of openness and honesty with which the participants in this study discussed their impressions and views on creativity in the classrooms could have caused the data to be misconstrued. Speaking with each participant for 90 minutes to 2 hours opens up the conversation to interesting and detailed discussion. But the sense of openness may lead to offering more discussion of creativity in their classrooms than what they actually experience. Conversely, my gaining some familiarity with the participants may lead to over-interpretation by me as the researcher. I attempted to account for these issues by using a mixture of open-ended and specific questions on creativity, to allow freedom in honest discussion as well as the chance to address the specific research questions. Also I engaged in extensive use of direct quoting, to give the reader a sense of the level of detail in the actual data alongside my interpretations.

Another related limitation is that, in being asked about topics of creativity, the participants may have felt compelled to answer questions on creative thinking skills in more affirmative ways than what actually reflected their thinking. I attempted to control for this to

some extent by asking for specific or detailed examples of how such skills were used in their practice.

Also, the fact that these interviews took place via recorded phone conversations could have affected the data. Informed consent of recording was always done, yet it is possible that the nature of phoned or recorded discussion might affect the interview content. In addition, my personal ideas or views on creativity could have affected the interpretation. This is always a possibility in qualitative interpretative analysis, and I attempted to utilize qualitative research techniques to address these limitations.

A delimitation of this study is that I confined my interviewees to a narrow sample of specific National Teacher of the Year winners and finalists, who are not necessarily representative of the overall population of teachers. A further delimitation is that the teachers I interviewed from this group had responded to my request to interview them on creativity. This also limits my sample to teachers inclined toward positive attitudes about creativity in teaching. While this specified and small sample inhibits generalizability, statistical generalizability was not a focus or goal of this study. My intent was to hone in on the creative practices, avocations and thought processes of a particular group of exceptional teachers. A small and precise sample was a function of that.

Summary

The purpose of this research was to contribute to the literature on creativity in education. The focus was on how creativity impacts the personal and professional work of highly effective and accomplished teachers. Research has shown that the most successful and accomplished people in any discipline tend to have varied creative interests and avocations, which influence

their thinking overall. This was found to be true also of the highly accomplished teachers in this study.

Prior research in education has suggested a link between creative and effective teaching, or asserted that they are one in the same. This research revealed that such skillful teachers actively cultivate a constant mindset geared to creativity and are always ready to draw on ideas from varied sources and inspirations. They implement creative approaches that utilize real-world learning, cross-curricular connections, and are willing to take intellectual risks. Additionally, the trans-disciplinary skills of observation, patterning, abstracting, embodied thinking, modeling, play, and synthesizing were highly valued elements in successful teaching practices.

The teachers interviewed in this study indicated a strong focus on creativity in their teaching practices and in their lives overall. Educational literature has previously noted that such creative teachers are highly significant in the academic growth, learning outcomes, and overall development and well-being of their students. As one of the teachers in this study framed it:

I think that ultimately what students will gain from your class is not necessarily just the content knowledge or the concepts. It is how you approach it, that's how students will pull away those bigger, creative lessons they'll take into the real world, which is pretty essential in this day and age.

Creativity has become a subject of intense interest in education, yet the current state of educational policy does not necessarily uphold its importance or give it appropriate attention in the development of policy or curriculum initiatives. This research sought to better understand some of the elements of the personal and teaching creativity of excellent teachers, and it offers some implications for how this can serve the field of teaching and research going forward.

APPENDIX A: Semi-Structured Interview Protocol

Open-ended Warm-up Questions

1. Tell me a little about where you teach. *(Possible probe: Tell me about your classroom, setting, students)*
2. What inspired your motivation to teach? *(Possible probe: Did you start out in teaching or a different field?)*
3. Tell me what it's like to be a teacher today. *(Possible probe: What are some of the challenges and rewards of this profession today)*

Creativity and Teaching in General

4. How do you define "creativity"? Or what does it mean to be creative? *(Possible probes: What does creativity mean in the general sense of the word? How do you define or judge creativity in teaching practice?)*
5. How do you come up with a creative idea for a lesson or a teaching practice?
6. As someone who has been noted as an accomplished teacher, what do you think makes a teacher effective or successful in the classroom?
7. What do you think makes a lesson or a teaching practice successful for you?
8. What are some of your favorite examples of the creative lessons that you have done with your students? *(Possible probe: What kinds of lessons or teaching practices do you find that your students have responded to very well?)*
9. Are there sometimes connections between different subjects or areas of interest? Can you talk a bit about this?
10. Do you have any outside interests or creative pursuits that you spend time on outside of your professional life? *(Possible probes: Tell me a little more about these hobbies/avocations. What do they mean to you, or how have they enriched your life?)*
11. Do your activities or creative work outside of teaching ever factor into your thinking about your classroom or students? *(Possible probes: In what ways does this tend to happen? Are there inspirations in avocations that inspire your teaching?)*
12. In what ways do creative ideas come to you? *(Possible probes: Could you tell me a little bit about a specific creative project or activity outside of teaching? How did the idea or*

inspiration come to you? Have you noticed a particular place or activity that seems to bring about creative ideas?)

Trans-disciplinary Creativity and Thinking Skills

Preface: I have some questions about specific types of thinking skills related to creative thinking or problem solving. I will briefly define and explain each skill before asking some questions about it and how it relates to your thinking, teaching, or creative activities. (Sidenote: Separate notes of definition/examples of trans-disciplinary skills summarize each skill separately before the question).

Perceiving/Observing

13. Do you consider keen *Observation or Perception*, as being an important mental skill in your teaching? Can you tell me about some examples? Are there any other ways, outside of teaching, that you consider observation/perception to be a useful mental skill? (*Possible probe: Do some of your creative interests or activities outside of teaching require the skill of careful observation?*)

Patterning

14. Do you ever use *Patterning* (recognizing and creating patterns) as a mental skill in your teaching? Can you tell me about some examples? Are there any other ways, outside of teaching, that you see Patterning as a useful mental skill? (*Possible probe: Do find that you recognize and create patterns in some of your creative interests or activities outside of teaching?*)

Abstracting

15. Do you ever use the skill of *Abstraction* (concentrating on one key aspect of something) in your teaching? Can you tell me about some examples? Are there any other ways, outside of teaching, that you consider Abstraction to be a useful mental skill? (*Possible probe: In some of your creative interests or activities outside of teaching, do you ever think or work with Abstraction?*)

Embodied Thinking

16. Do you feel that *Embodied Thinking*, as a skill, has been something you have used in your teaching? Can you tell me about some examples? Are there any other ways, outside of teaching, that you consider Embodied Thinking to be a useful mental skill? (*Possible probe: Do you ever find that your creative thinking in general, has physical aspects or is connected to physical senses?*)

Modeling

17. Do you ever find that *Modeling* is a skill that you use in your teaching practice? (This could include sketches, diagrams, drawings, structures or any formal/informal physical structures that you use.) Can you tell me about some examples? Are there any other ways, outside of teaching, that you consider Modeling to be a useful mental skill? (*Possible probe: Do you ever use models of any kind in your creative projects or*

interests outside of teaching?)

Play

18. Do you see any value in the idea of “Play” in your teaching practice (not just as a playground activity, but in giving students the chance to “play around” with ideas or concepts)? Can you tell me about some examples? Are there any other ways, outside of teaching, that you have found the concept of Play to be useful? *(Possible probe: Can you tell me about any creative activities or interests outside of teaching where you’ve come up with something by just “playing around” with ideas?)*

APPENDIX B: Instrumentation Cross-Reference

Research Questions		Interview Protocol Items
Question 1	Does creativity play a significant role in the teaching practices of accomplished teachers, and if so in what ways?	Questions 5-8
Question 1a	What does “creativity” mean to these accomplished teachers? How do they define creativity? Is it an important part of effective teaching practice.	Question 4
Question 1b	What are some examples or elements of “creative” teaching in the classrooms of these successful teachers?	Question 8
Question 2	Do successful, accomplished teachers engage in creative practices and avocations, and do these avocations impact their thinking and teaching?	Questions 10-12
Question 2a	What kinds of interests and/or creative pursuits do these accomplished teachers engage in?	Question 10
Question 2b	Do these successful teachers feel that their avocations and interests influence their teaching practice, and in what ways?	Questions 11, 12
Question 3	Are trans-disciplinary thinking skills used by accomplished, successful teachers?	Questions 13-18
Question 3a	Do these thinking skills help them to be more effective, creative teachers? In what ways are these thinking skills important to teaching?	Questions 13-18
Question 3b	How do these accomplished teachers use trans-disciplinary thinking skills in their teaching practice and what are some classroom examples?	Questions 13-18
<p>Note: Questions 1-3 on the interview protocol were “warm-up” questions, designed to start the conversation on teaching and build discussion rapport. They do not necessarily correspond to research questions noted above.</p>		

APPENDIX C: Creativity Notes/Evidence from Finalist Applications

Evidence for Creative/Effective Teaching

Alex Kajitani

California 2009 Teacher of the Year

2009 National Teacher of the Year Finalist

- “My "Making Math Cool" conference workshop offers educators creative ways to make math more accessible”
- My contribution to the Hip-Hop Association of America's efforts to help teachers use music to connect with students can be seen in their *Hip-Hop Education Guidebook*.
- Created the "Rappin' Mathematician" CDs and workbook
 - o “I started rapping about all of the math concepts I was teaching, letting the wacky humor flow (realizing that "cool" really was just being myself, as we often tell our students). Unlike the songs on the radio, I used language that was positive, and included messages not only about math, but about believing in oneself, making good decisions, and the importance of school. The songs quickly became legendary throughout the school and district, and, encouraged by my fellow teachers, I recorded them onto an album (and the next year another) so other teachers could use them in their classroom.”
- Profiled by an educational author:
 - o “some of the most creative work I have ever seen a teacher do.”
 - o “has not dumbed-down his curriculum. Instead, he has extracted the content's purest essence and repackaged it in chunks palatable, relevant, and motivational for his students.”
- School superintendant: “Mr. Kajitani is best known around Mission Middle School, the school district, the city, the county, and even nationwide as *The Rappin' Mathematician*. This creative teacher connects mathematics to the students' daily lives via math songs set to hip-hop music.”

Susan Elliot

Colorado 2009 Teacher of the Year

2009 National Teacher of the Year Finalist

- “we must make cross-curricular connections, use integrated technology, and protect our instructional time.”
- “Because my students are at the center of instruction and lessons are creatively designed to meet student needs, benchmarks are never taught the same way twice. I am always learning something new with my students and this generates tremendous energy and enthusiasm.”
- Director of Special Education: “sincere and passionate colleague who brings an infectious level of enthusiasm and inspiration”
- From letter of recommendation: “Her creativity and energy make her absolutely one of a kind.”

- “My lessons and class projects are purposely “loaded” to cover the essentials of a guaranteed and viable curriculum emphasizing cross-curricular connections.”
- “An essential question requires students to research, make cross-curricular connections, think critically and synthesize information.”
- My students “They reflected upon their skills at the end of our unit and expressed pride in their development. In sum, my students were actively engaged in learning. They understood the targets and their creativity demonstrated ownership for learning. They were supported in their interdisciplinary learning, made outside applications, and were fully aware of their skill development and demonstrated progress.”

Anthony Mullen
 Connecticut 2009 Teacher of the Year
 2009 National Teacher of the Year Finalist

- A teacher must project passion in the classroom because this powerful emotion sparks the learning process in children and motivates them to remember key concepts and ideas. Students can feel the energy, enthusiasm, and creativity radiating from a teacher.
- “teaching is an avocation and not a vocation. The professional teacher must transcend existing models of educational theory and philosophy and become an artist and a creator. A teacher must perform his work as though it is art because teachers, like all artists, create. Teachers are entrusted with the imperative task of creating intelligent, ethical, and productive young adults”
- “including forensics, electronics, English, carpentry and horticulture. His lessons are innovative and stimulating.”

Cynthia Cole Rigsby
 North Carolina 2009 Teacher of the Year
 2009 National Teacher of the Year Finalist

- We must work to find an accountability model that nurtures teacher creativity—and lessens the stress that educators and students experience while at the same time reshaping our schools to meet the vision of the 21st century.
- Terry Sanford Award for Creativity and Innovation in Teaching/Finalist – 2005
- “creativity and risk-taking may be ideas of the past if we don’t reform our accountability programs.”
- “I am so passionate about strengthening our profession that there are times I wake in the night with an idea, and go into manic mode trying to implement it”
- “she inspires something in the soul of her students which draws them out to connect with their own stories of life. I think of no more compelling reason to write. Cindi demonstrates those life connections so vibrantly that it opens the door to writing so wide that others are swept in.”
- “Over the past three years, our staff has had the pleasure of taking literacy training with her. As a direct result of our first workshop with Cindi, our physical education teacher was inspired to write down some of his own stories about his love of sports. He connected so deeply to that process that he is writing poetry this year.”

- “she is a reading specialist whose professional task is to remediate high needs students, her work cuts across many academic disciplines.”

Yung Bui-Kincer

Alabama 2010 Teacher of the Year

- Elementary/secondary science teacher who actively implements lesson plans designed to be “creative” and “fun”
- Provides several different examples of her science lesson plans in her online portfolio, all of which incorporate creative or artistic elements, such as drawing, creating physical models, writing stories about topical science ideas, or creating other artifacts related to the science being taught.
- Teacher specifically notes words such as “creative” and “artistic” skills when describing lesson plans, and notes the importance of learning being stimulating, motivating, hands-on and fun.
- Portfolio demonstrating some lesson plan examples, all of which are “creative”:
<https://college.livetext.com/doc/135095?print=1>

Megan Marie Allen

2010 National Teacher of the Year Finalist

Florida 2010 Teacher of the Year

- “I am an inventor, developing creative ways to engage every learner, helping them focus on their education and providing an escape from the daily struggles of poverty.”
- “I am a lover of books and words, one who creates a rich, literate environment full of cozy book nooks, stories, and fantasies that inspire students to become avid readers. I am an actor of adventures, setting sheet-sails high as we travel through 20,000 Leagues Under the Sea, creating a tissue paper and fan "campfire" to make campfire tales come alive, or making a living input/output machine out of a refrigerator box so my students will be able to create their own input/output table.”
- “Ralph Waldo Emerson once wrote: "Insist on yourself; never imitate." I'm far from normal—my students even call me weird! But I love to add my glitz of creativity to make learning an active and engaging experience for my learners. As a NBCT, I reflect daily to make sure I stay creative.”
- “I love to use costumes; I've dressed as a pirate for a writing craft lesson, I've had students work in cooperative groups to design a recycled outfit for a recycled fashion show...I am a very cheesy song writer. My repertoire includes a parody to Beyonce's "Put a Ring on It" written for Florida's writing assessment. My teammates and I dressed as Beyonce to perform, "If you Elaborate, We're Going to Put a 6 on It," 6 being the highest score one can earn. I love to engage students with song, composing songs like "A Grabber Lead" for writing, sung to the tune of the Jackson 5's "I Want You Back." Dancing includes the rounding dance or comma dance for math. My class's new personal favorite is the "Drop the Decimal Like It's Hot" dance for adding and subtracting decimals! I add my positive energy in little ways such as these to foster You Back." Dancing includes the rounding dance or comma dance for math. My class's new personal

favorite is the "Drop the Decimal Like It's Hot" dance for adding and subtracting decimals!"

- "Collaboration and combined creativity multiplies exponentially, and we can learn so much from each other's experiences and ideas, I have worked on cross-grade projects from solar cooking to probability fairs. --- ...providing our students with a minds-on, hilarious review of writer's craft. Across the county I have buddy classrooms composed of teachers I've worked with in the past. Our students mail writing samples, writing responses, and book recommendations to each other."

Sarah Brown Wesseling
2010 National Teacher of the Year
Iowa 2010 State Teacher of the Year

- "My elective writing class composes multi-genre papers and creates podcasts to practice the research process before writing a more traditional piece. My Myths and Legends class creates a superhero for today using all the concepts we've studied throughout the course. Using a mock Facebook page and nominating the character for "Hero of the Year," each student gives an acceptance speech as that hero to receive his reward. My AP students go beyond the traditional curriculum of literary analysis and constantly work to apply literary theory in order to become literary critics. They create storyboards for a film trailer which must convince their audience of a particular "reading" of a film they've studied in seminar groups. They participate in the Grant Proposal Project and culminate their year with a standards-based final portfolio and exit interview."
- "students are more engaged when they see their own passions, questions, and motivations reflected in their work. In each of my classes, you would see learners constructing knowledge through rigorous and relevant inquiry experiences. Students in New Start English might be creating their utopian school by generating surveys, composing a learner's Bill of Rights, rewriting the course descriptions, and composing a school song to match their school's mission. Sophomores read nonfiction books in literature circles, record their discussions and create Public Service Announcements that educate about an issue from their reading."
- "Creating innovative learning experiences provides important context and motivation."
- "I often do guest lectures at Iowa State University in a Technology and Instruction course for pre-service teachers. Each time, I begin and end with a challenge to the students: "You're going to be teaching in the 21st Century, but are you going to be a 21st Century teacher?" Most of them quickly look to their laptops, BlackBerries or Pods, certainly all indicators of being a 21st Century teacher. I then demonstrate how their favorite technologies can be tools towards student achievement, but should never be the culmination of a creative, authentic learning experience... this philosophy means creating a web of rigorous content, real-world experience, and inquiry-based experiences around the learner."

Michael Geisen
2008 National Teacher of the Year
Oregon 2008 Teacher of the Year

- from toty article - “Unifying teaching and learning through creativity, collegiality, community interests as well as individual, and just a bit of what he calls “craziness”, defines Michael Geisen’s approach to working with, in his words, “my fellow human beings...my students.”
- “In my teaching I strive to bring together creativity and science, to unite my students into a community, and to help each person in this community connect with the big ideas of science.”
- “Some of my lessons are based on ideas that colleagues or students have shared with me, but many of them I simply dream up while in the shower or while driving to work. However they originate, I try to put a bit of myself, a bit of Prineville, and a good dose of humor and creativity into each activity, project or assignment.”
- “when students are interested, they start to ask real questions. And when they ask questions, they’re on their way to becoming great scientists and learners. This enthusiasm becomes contagious...even the non-mathematical/non-scientific kids get into it when creativity and science fuse together.”
- “developed a capstone project that gave students a chance to apply their new knowledge about energy and electricity into an “Electric Creation” of their own making. “
- “found another way to help students integrate science and creativity into a service project that is both beautiful and educational: we have shrunk the geographic enormity of Oregon into a 150’ long courtyard outside of the science wing. The courtyard has long been considered the bane of aesthetics at the middle school...so the science teachers and students decided to take matters into our own hands and create an outdoor learning laboratory that was both beautiful and a scientifically accurate model of the native vegetation zones from the Oregon coast to the high desert...we transformed the courtyard into a place of beauty and pride, complete with trees, shrubs, native grasses, walkways, benches, topography and a drip irrigation system.”
- Philosophy of teaching includes unifying science, creativity and aesthetics, and to unite students into a community that connects with the big ideas of science.

Robert Stephenson

Michigan 2010 Teacher of the Year

- “I strive every day to be authentic, caring, creative...”
- “I believe that all learners require hands-on opportunities to understand the world around them, and honor the Confucian saying, "I hear and I forget. I see and I remember. I do and I understand." With that in mind, curriculum is presented with unique activities that encourage students to experiment, manipulate, observe, hypothesize, and synthesize their learning.”
- “At any given moment students may build series and parallel circuits, videotape commercials, dissect owl pellets, write travel brochures, design Power Point slide shows, make colloids and polymers, study chromatography, play math games, act out plays, explore cultural artifacts, gather Internet research and post their learning, write songs, or read peer-authored books.”
- As one who loves to learn and teach, I would advocate for the *preservation of innovation and creativity in the classroom*. One of the things that sets the United States apart from

other countries is our innovation and creativity, which is fostered by the dedicated educators within our schools.

- In the 21st century, it is imperative that we continue to honor this ideal within the classroom in order to meet the future demands for originality in the work force. Innovative classroom experiences foster higher student achievement. Students become flexible, motivated, independent thinkers who are capable of reasoning and solving unfamiliar problems.
- Encouraging and promoting creativity in the classroom is what educators have unknowingly done for years, but now is the time to reflect and honor how it is done and pledge that we will not squeeze it out in exchange for teaching designed only to satisfy standardized assessments. Higher order thinking skills result from engaging methods of instruction that exploit student curiosity and offer relevant open-ended challenges.

Kelly Kovacic

California 2010 Teacher of the Year

- “I believe students learn best when they analyze historic and current events and then form their own opinions through critical thinking. For instance, when teaching governmental policy towards Native American tribes, I have my students examine sources (e.g., documents, journals, music, dances, etc.) from the perspectives of the federal government, the settlers, and the Native Americans. I continue to bring the content back to the issue of humanity and the importance of mutual understanding and respect.”
- “Teaching history is about storytelling. It is about making the past come alive. Being a student in my classroom ... is an opportunity to enter a world of fascinating individuals, amazing examples of strength and courage, scandalous corruption and treason, war, peace, and everything in between. It is a chance to learn not only about the victors but also the victims; to learn not only about success but also disaster. A student in my classroom is provided a direct connection to our past.”
- “Her close attention to detail, her innovative lesson planning, her belief in individualizing instruction, and her sensitivity is evident in the... work her students do. One of the projects she assigns her students at the end of the AP U.S. History class is "The Decades Project." Students select a decade and depict it visually, or in written or oral fashion.”

Lewis Chappelle

California 2008 Teacher of the Year

- “The only way I can explain the profession to the “non-teachers” in my life is by using the analogy that it is like putting on a different Broadway show everyday – a seven and one-half hour show at that. This is not just a show to watch, but one of interactions with the audience members who challenge, inspire, and encourage. It is a careful blend of improvisation and scripting, constantly morphing itself to fit the moment and never failing to surprise.”
- “My classroom is full of everyday stories like these that describe my philosophy of teaching. One day is never like the rest. ... When you walk into my classroom, it looks like Santa’s toyshop in the North Pole, with groups of students working on different projects all over the place. There are natural wood butcher-block workstations carefully scattered throughout the room with beautiful dark red rolling office chairs at each table.

At the front of the room is a large robot competition playing field that is rarely quiet. There are robots, computers, electrical training centers, large printers, and mechanical doodads in every nook and cranny.”

- Teaches engineering – incorporates robotics, sound editing software in a musical context, 3-d modeling software, etc – all to connect with students geared toward more “creativity”.

June Teisan

Michigan 2008 Teacher of the Year

- “...to encourage a sense of wonder in the world around them, to invite students to tap into their talents and express their unique personalities in innovative ways is a source of joy for me.”
- “Effective science instruction at the middle school level has a certain flavor of “managed chaos,” and your heart’s gotta be in it as you ‘go with the flow.’ I love the off-kilter antics and mercurial personality quirks of my little darlings, and I think my students pick up on that sentiment.”
- “What could be to some a ho-hum microbiology unit is transformed into a food safety investigation, complete with several labs for my concrete-operational thinkers, short video clips for the visual learners, and in-depth sessions exploring websites like a food safety tutorial on the web..”
- Coordinating these types of experiences (students may choose from a range of options to show their grasp of content - creating a brochure about proper hand washing or evaluating the safety of their home kitchen) pave multiple avenues for students to make sense of core curriculum. I make up goofy songs and sing them off-key because students will stop what they’re doing long enough to listen to the directions I needed to clarify (to the tune of Old MacDonald or Blue’s Clues).
- “Albert Einstein could have been exhorting us today with his comment, “Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.” Educators for the new millennium face multiple challenges to public education armed with knowledge and ready to power the imagination of students!”
- “RocketMath!, funded by a grant from the local natural gas company, students will do the work of aeronautical engineers as they test straw rockets, calculate trajectories, and construct and launch their own solid-fuel rockets.”
- “building educational experiences that foster student creativity, innovation, cooperation, ingenuity, vision and resourcefulness . . . all traits vital for success in our global community!”

Thomas Smiegal

North Carolina 2008 Teacher of the Year

- “I worked to develop a curriculum that would make Earth Science relevant to our students and developed objectives that could be taught in a way that would allow creativity and rigor.”

- “My style is about making my lesson invigorating. Worksheets out of ancient filing cabinets do not teach students. Students need opportunities to discover who they are as thinkers and learners. They like to be challenged with real-life scenarios and develop solutions to problems”
- “My philosophy is about empowering my students by giving them the opportunity to be leaders in the classroom, school and community. This philosophy encourages me to be creative everyday with my lessons, whether in Teen Leadership or Earth Science. Being creative is not just thinking outside the box. It is about thinking outside of the room that the box is in.”
- “After receiving the NASSP grant...(it) allowed me to be flexible in presenting creative ideas to help our ninth graders reach success.”

Andrea Peterson

Washington 2007 Teacher of the Year

- “Music is an amazing opportunity for children to experience pattern development. Melodic and rhythmic patterns are internalized actually creating connective pathways in a student’s brain. These pathways transfer to other subjects, enabling our children to achieve more complex patterns in math, reading and other subjects.”
- “It is truly exciting to see how my music teaching can transfer back to other classrooms.”
- “Because I compose many of the musicals my students perform, they see me struggle through the creative process. I share my frustrations, creative road blocks and bursts of creative energy with my students, inspiring them to achieve their own goals of excellence.”
- “As a music specialist, it is my responsibility to teach my students, not only music, but reading, writing, math, social studies, science and anything else I can find a way to meld into the music curriculum. This needs to be the attitude of every teacher, every parent and every community.”
- “Through lesson studies done in my school, I have had the opportunity to teach symmetry, geometrical sense, inference and prediction. Some of these lessons have had nothing to do with music, but have had everything to do with teaching in a way that’s best for kids....State test scores in all areas have steadily increased since instituting Lesson Study.”
- “Teaching is an amazingly complex combination of science and art. Scientifically, teachers must know how to teach to students’ individual learning styles, breaking down the components of knowledge and skill into attainable pieces. Artistically, teachers must be able to inspire their students to excellence, showing them a world that is bigger than their own.”

Tamra Tiong

New Mexico 2007 Teacher of the Year

- From school principal - “At any time you could observe Ms. Tiong differentiating lessons to match the wide range of needs of her students. She uniquely incorporated creativity and ingenuity to match the students’ “must learns” with music, songs, drawing, sketching and movement.”

- “My philosophy of education involves recognizing, valuing, and addressing the needs of students of various cultural, linguistic, and socio-economic backgrounds; of learning styles, abilities and preferences; of multiple intelligences, interests, personalities, and family types. I use much movement, music, art and compassion to achieve this.”
- “They (students) need their classroom experiences to be interesting, meaningful, and relevant so that their brains say, “Oh, I see!” instead of “So what?” They need teachers who will take them beyond mere recall of facts, providing opportunities for critical thinking, analyzing, synthesizing, comparing, evaluating, and applying. They need to learn how to have conversations with texts, how to agree or disagree with an author or character, how to acknowledge confusion and forge through it, and, ultimately, how to determine their own truths.”
- “...my goal as a teacher is to do everything I can to keep this sense of wonder alive, to encourage all children to question and learn, explore with all their senses, to revel in both the complex and the simple things of the world, to celebrate their uniqueness.”

APPENDIX D: Recruitment Letter

Date

Dear _____,

I am writing to ask for your participation in an in-depth phone interview, as part of a dissertation research study on creativity among highly skilled and accomplished teachers (i.e. Teacher of the Year award winners). As one of relatively few teachers who have received the “Teacher of the Year” award, you are part of a unique cadre of the most notable and most effective teachers in the country. Your participation in this research study is an opportunity to share your extensive teaching knowledge and skills, helping us to better understand creative teachers and improve the profession of teaching.

The study will explore creativity among teachers such as yourself, and will examine how this creativity contributes to your high level of success and accomplishment in the classroom. I trust you will recognize that your prominent position as a U.S. Teacher of the Year makes your thoughts and contributions an invaluable necessity in this research. Therefore, I hope you will be willing to take part in a telephone interview, as a contribution to the field of education.

If you are willing to participate in an interview, please send a brief reply to me at this e-mail, and the PhD candidate for this dissertation study, Danah Henriksen, will contact you to set up a convenient time to do a phone interview. As a compensation for your time and contribution to this research, you will receive a \$50 gift card to amazon.com, to thank you for your thoughts and your valuable input.

Participation in this study is, of course, voluntary and you may decline to participate at any time without penalty. If you decide to participate and then change your mind you may withdraw at any time without penalty. By using information from uniquely successful teachers to help us better understand creativity and teaching practices among the effective teachers, together we can help improve teaching as a discipline overall.

If you have any questions, please feel free to contact me, Punya Mishra, at punya@msu.edu or 517-353-7211 or Danah Henriksen, at henrikse@msu.edu or 517-256-2344. I look forward to your reply on participation, and thank you sincerely in advance of your contributions.

Sincerely,

Punya Mishra
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