AN INVESTIGATION OF THE FACTORS AFFECTING THE MUSICAL CREATIVITY OF HIGH SCHOOL STUDENTS

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A Dissertation presented to
The Graduate Committee in the Mason Gross School of the Arts
Rutgers, The State University of New Jersey
in partial fulfillment of the requirements for the degree

DOCTOR OF MUSICAL ARTS
Graduate Program in Music Education
written under the direction of William L. Berz and approved by

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New Brunswick, New Jersey
January 2014

Abstract

The purpose of the study was to investigate factors that affect the creativity of high school students' musical compositions. It sought to identify common characteristics of students whose musical compositions were judged more or less creative. The subjects in this study were high school students ($N = 48$) in grades 9-12 of a large suburban high school in central New Jersey.

Three research questions were addressed: 1) Is there any difference in Musical Creativity scores based on Instrumental Music Experience as defined by a) Years of Instrumental Lessons; b) Number of Instruments Played; c) Piano Skill; and d) Guitar Skill? 2) Is there any difference in Musical Creativity scores based on School Music Experience as defined by a) Participation in a School Ensemble; b) Music Theory Class experience; and c) Number of Music Classes taken? 3) Is there any difference in Musical Creativity scores based on Non-School Music Experience as defined by a) Participation in a Rock Band; and b) Years of Participation in a Rock Band?

Subjects completed three composition tasks ranging from closed (strict guidelines) to open-ended (free composition). Four judges rated the compositions using Amabile's (1983) *Consensual Assessment Technique* as adapted to musical composition by Bangs (1992) with reliability ranging from .64 to .83.

The Instrumental Music Experience variables of Years of Lessons on Primary Instrument, Total Years of Lessons, and Number of Instruments Played had significant positive correlations with Musical Creativity. There was also a significant positive correlation between level of Piano Skill and Musical Creativity scores, and those students

with piano experience scored significantly higher for Musical Creativity than those without.

The School Music Experience variables of Participate in a School Ensemble, Music Theory class, and Number of Music Classes showed significant positive relationships with Musical Creativity scores. Those student identified by the Non-School Music Experience variable Participate in a Rock Band scored higher on the Free-Compose project and for overall Musical Creativity. A greater number of Years in a Rock Band also showed a significant positive correlation with musical creativity scores.

Acknowledgements

This work would not have been accomplished without the generous help and support of family, friends, and colleagues.

Thank you to my colleagues at Hillsborough High School, as well as the faculty, staff and administration of Hillsborough School District for their support of this study and creating a school culture that fosters the advancement of professional knowledge. Special thanks to my principal, Karen Bingert. You are a constant example of the best this profession has to offer.

Thank you to all the people who leant their professional knowledge to this endeavor by reading, editing, discussing, suggesting, and listening to compositions, especially Barbara, Marie, Aurora, and Barrie. Your expertise is and always will be greatly appreciated.

I would also like to extend gratitude to my colleagues in the music department. It is a pleasure to work with a group of dedicated, professional musicians who not only demonstrate passion for the pursuit of musical excellence on a daily basis, but are also willing to share this passion with young people every day.

Thank you to my committee members, especially Dr. William Berz and Dr. Richard Chrisman, who were there from start to finish with words of support and encouragement along the way. Thanks especially to Dr. Berz for helping me push through to the end.

I could not have done this without the love, encouragement, and support of my husband, Anderson, who took care of everything else so I could write, and as always, thanks to my parents for the gift of music.

Table of Contents

List of Tables

Chapter 1: The Research Problem

If one were to select the greatest achievements of humankind, one would likely choose those events or products that exemplify individuals at the apogee of creativity. Those who have demonstrated unconventional thinking are revered as the greatest contributors to society. A list of such individuals might include Einstein, da Vinci, Picasso, Beethoven, Machiavelli, and Voltaire. Creativity, a trait valued the world over, is the catalyst for scientific innovation, increased economic output, and the enrichment of culture through artistic endeavor. It is a necessity for the advancement of civilization.

The desire to foster creativity is a notion dating back to the ancient Greeks (Cropley, 1997). Modern creativity research traces its roots to Galton's (1869/1978) work studying "creative genius." Many more recent educators, researchers, and philosophers have theorized about the importance of creative expression and the creative potential of human beings. Recognizing the value of promoting creativity in education, Piaget stated,

> The principle goal of education is to create men and women who are capable of doing new things, not simply of repeating what other generations have done—men and women who are creative, inventive and discovers, [who] have minds which can be critical, can verify, [rather than] accept everything they are offered. (cited by Jervis & Tobier, 1988, p. 30)

Over the past century, leading educational philosophers and psychologists from Whitehead (1929/1967) and Dewey (1902/1990, 1900/1990) to Piaget (1973), Bruner (1962), Gardner (2003, 2006a, 2006b), Eisner (2005), and Robinson (2006) have recognized the value of creative problem-solving in the classroom.

Several theories have been developed as to the nature and cognitive design of creative development, as well as ways to motivate and enhance one's creativity. A large body of literature has been dedicated to the study and enhancement of creative thinking,

including Amabile (1983, 1996), Baer (1993), Craft, Gardner, and Claxton (2008), Csikszentmihalyi (1996), Gardner (1982, 1993), Guilford (1967), Kagan (1967), Kaufman and Baer (2006), Kaufman, Plucker, and Baer (2008), Kaufman and Sternberg (2006, 2010), Pope (2005), Richards (2007), Runco (1996, 1997, 2003, 2007), Runco and Albert (1990, 2010), Runco and Richards (1997), Sawyer (2012), Simonton (1999b, 2004), Starko (2005), Sternberg (1999), Sternberg, Grigorenko, and Singer (2004), Torrance (1962), and Weisberg (2006) to name only a few. Likewise, there are several refereed journals dedicated solely to the study of creativity and related subjects including *Creativity Research Journal*, *Journal of Creative Behavior*, and *Psychology of Aesthetics, Creativity and the Arts*.

Background of the Problem

The apparent value placed on creativity does not always seem to transfer to American classrooms. Government policies in public schooling over several decades have not always correlated with the research on best practice or consensus in the field of education. Sawyer (2006) contended that while the majority of the world's most developed countries have made a shift from industrial-based to knowledge-based economies, many of the features of today's schools have become obsolete. The entire U.S. educational system needs to be restructured with careful consideration of empirical research on educational innovations that promote student creativity.

Articles in newspapers and news magazines have outlined the dire state of American education versus our international competitors (Ravitch, 2005, p. A25) and cite the cause in terms like "Creativity Crisis" (*Newsweek*, July 19, 2010). Others have warned of the economic consequences if something is not done to encourage and inspire

creative thinking in our classrooms (Friedman, 2009). Some voices in the debate have bemoaned the general state of American schools, blaming the decline in American global competitiveness on the failure of the education system. Governmental policy-makers, school administrators, and teachers have all held responsibility for poor school performance as blame shifts from one group to another.

Debate over American public school policy is currently framed by the standards movement rooted in the *No Child Left Behind Act of 2001*. The general trend in American education has been a shift toward standardized testing in Science, Technology, Engineering, and Mathematics (STEM) and away from curricula featuring creativity and the arts. In a review of creativity research, Hennessey and Amabile (2010) noticed researchers over the past 10 years in the U.S. have not shared the same interest in or concern for investigation of the creative behavior of students in educational settings as their colleagues in Asia. The explained a possible reason for this may be America's recent emphasis on high-stakes testing, while Asian educators and policy-makers shift away from testing, toward creativity-promoting teaching techniques (Hennessey & Amabile, 2010).

Many in both the business and education fields have agreed that creativity will be a necessary skill for future employment and should be an integral component of schooling (Hennessey & Amabile, 2010). In 2006, a consortium of the Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management surveyed 400 corporate employers regarding the skills of new job entrants. The resulting study, *Are They Really Ready to Work?* reported that 81% of those surveyed felt the characteristic of Creativity/Innovation, was a

"very important" skill for 4-year college graduates entering the workforce (Casner-Lotto & Barrington, 2006, p. 16). Creativity was defined as the ability to "demonstrate originality and inventiveness in work; communicate new ideas to others; integrate knowledge across different disciplines." The study also found almost 74% of employers expected Creativity/Innovation to become an increasingly important skill for future graduates.

The 2005 report from the Council of Competitiveness *Innovate America: Thriving in a World of Challenge and Change* warned that "companies that do not embrace innovation [defined as the applied product of creativity] as a core business value will fall to global competition" (p. 4). The report further stated that "a new compact among companies, government, educators and workers is needed to assure a 21st century workforce that can successfully adapt and compete in the global economy" (p. 4).

Definitions of Creativity

Even with a great deal of study, time, and literature dedicated to the subject, especially since the 1950s, the exact nature of creativity has proven elusive. Arguments abound as to what may or may not have been a creative achievement, and opinions change by the decade. Society has struggled to predict the occurrence of creativity, harness its power for the betterment of humankind, and teach it effectively in our schools to foster the next generation of creative thinkers. Many questions regarding creativity have remained unanswered: Is creativity an inborn talent or gift? Can it be learned, developed, or taught? Who are the appropriate judges of creativity?

Sternberg and Lubart (1999) suggested six reasons why researchers may have been reluctant to engage in quantitative, scientific study in the field of creativity in the

past: 1) the mystic and spiritual roots of creativity may "put off" the scientific community; 2) creativity is commercially exploited by those offering popular accounts or theories about the creative thinking process not based in scientific research; 3) early work on creativity was not theoretically or methodologically central to the field of psychology and therefore not respected; 4) creativity is not easily conceptualized or understood, therefore those looking for easily defined research topics may be put off; 5) some approaches view creativity as an extraordinary part of an ordinary thing not necessitating separate study; and 6) creativity has been trivialized or marginalized by unidisciplinary approaches which have viewed only parts of creativity as the whole phenomenon (p.4). Ambiguity in the field has been further compounded because creativity can assume a variety of different meanings depending on the subject, field, or activity one is describing. There are a multitude of activities in which one may have engaged in creative work, and the definition of creativity can be just as subjective as creativity itself. Those who have produced a unique work of art, musical composition, or piece of poetry might all have been called creative. So might the engineer or architect that designed a new skyscraper, those who have led the company in a new direction, created an advertisement to sell a new product, or made a scientific discovery which cured a disease. The definition of creativity has evolved with time and has encompassed everything from the act of creating something unique to the personality traits of creative individuals; from one, overarching factor to many factors in combination.

In defining creativity as "the use of the imagination or original ideas, esp. [*sic*] in the production of an artistic work" (p. 397), the editors of *The New Oxford American Dictionary* (2005) pointed out that the word *creative* has suffered overuse as an

advertising buzzword, often being substituted when one simply means *new* or *different*. Consensus in the modern, scholarly literature regarding creativity finds the standard definition is bipartite: creativity requires both originality and effectiveness (Amabile, 1996; Barron, 1955; Baer, 1993; Csikszentmihalyi, 1996; Runco, 2007; Runco and Jaeger, 2012; Stein, 1953; Sternberg, 1999). A creative person is not just one who produces a new idea or product. The product must be viewed as a valuable contribution in the context of the field in which it was created.

Ultimately, something must be produced from the process of creative thought which may be judged as creative. For the purposes of this study, creativity was defined as conceptualized by Amabile (1983):

> A product or response will be judged creative to the extent that (a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and (b) the task is heuristic rather than algorithmic. (p. 33)

Amabile also specified that the products must be intentional, demonstrate use of imaginative ideas which are novel or original, and the products judged are results of tasks which are heuristic, meaning there is more than one appropriate response, as opposed to those tasks which are logarithmic, having only one correct answer.

Amabile's (1983) definition also recognized the context in which creative products are to be judged by deliberately including "the task at hand." Starko (2005) noted that in the field of education, novelty or originality implies the product must be new or original to the creator, as it would be inappropriate to expect completely novel ideas from young students. Likewise, "appropriate" responses meet some goal or criterion of classroom instruction.

Creativity and the Arts

The arts are a natural pathway to creative learning. In a recent survey of U.S. business executives and school superintendents, both groups (97% and 99%, respectively) agreed that "creativity is of increasing importance in the workplace" (Lichtenburg, Woock, & Wright, 2008, p. 6), and a majority in both groups thought that "a degree in the arts was the most significant indicator of creativity" (p. 8). Likewise, a survey of elementary school principals indicated that they thought the most important educational goal potentially arising from music instruction was developing creativity (Abril & Gault, 2006).

Robinson (2013) argued that rather than narrowing educational focus to just the STEM disciplines, an unfortunate by-product of NCLB, education must give equal weight to the arts, humanities, and physical education in order to educate the whole child. "The arts aren't just important because they improve math scores. They're important because they speak to parts of children's being which are otherwise untouched" (Robinson, 2013, para. 9). The American Academy of Arts and Sciences Commission on the Arts and Sciences publication *The Heart of the Matter* presented the case that the arts and humanities are not only a fundamental part of education and necessary for success in a democratic society, but also that the arts provide opportunities for development of creativity and collaboration (American Academy of Arts and Sciences, 2013). While the U.S. moves away from the arts and humanities, other nations such as China have realized their worth in fostering creativity and innovation and are aggressively promoting them (Nussbaum, 2011).

Musical Creativity

Musical creativity specifically refers to the modes of music-making in which students solve problems and create unique, musical solutions. Decades of research have demonstrated the value of creative musical activities as part of the curricular music experience, and seminal documents in music education agree that creative experiences should be an integral part of music education (Choate, 1968; Thomas, 1970; Madsen, 2000; Music Educators National Conference, 1994). The *Tanglewood Symposium* (Choate, 1968), the *Manhattanville Music Curriculum Program* (Thomas, 1970), and *Vision 2020: The Housewright Symposium on the Future of Music Education* (Madsen, 2000) have each recognized the importance of creative music-making and composition in music education curricula.

Elliott (1995) outlined the modes in which one may be creative in music, including performing, listening and composition. Improvisation and composition are fundamental principles of the *National Standards for Arts Education* (Music Educators National Conference, 1994) and have been the two main activities in which musicians of all varieties, including students, engage in creative music-making. Musical experience is unique in that it involves the whole person, not just intellectually, but also emotionally and kinesthetically (Gamble, 1984). Engagement in music involves intellectual thought, emotional involvement or feeling, and engagement of the body in movement, especially during performance.

Music Technology

Musical creativity can lead to greater musical understanding, and composition in the music classroom is one way that students might engage in creative music making.

Paynter (1997) stated, “composing is not an optional extra; in effect it underpins the whole curriculum, and it is the surest way for pupils to develop musical judgment and to come to understand the notion of ‘thinking’ in music” (p. 18). Though music technology courses at the high school level do not guarantee creative music experiences, classes of this type can be conducive to creative music-making. Webster (2002b) explained how the evolution of technology allows music educators to employ a more constructivist approach than was previously possible when utilizing music technology in the classroom.

> The traditional drill-and-practice techniques that dominated the use of technology until the mid-1980s have been complemented by much more powerful software that uses problem-solving and role-playing techniques…. With today's affordable personal computers, even the youngest children can play along with the computer, make increasingly complex decisions about the composition of the music, or listen to music in new and exciting ways. (p. 43)

Use of technology in music composition has shown high levels of intrinsic motivation among students and fosters more successful experiences due to the often individualized nature of the work. In Gall and Breeze’s (2008) study using the program Dance eJay, 10 and 11-year-olds who did not play traditional instruments reported feeling more control when composing in this situation as opposed to in groups with traditional music class instruments. While those who were less experienced musicians were marginalized in traditional music class composition scenarios, the software environment was supportive of all students’ composing efforts, regardless of whether or not they had formal music skills.

In interviews with students experiencing MIDI technology in classes, Airy and Parr (2001) found 1) it gave students a musical voice when they had previously not been able to express themselves through composition; 2) students enjoyed working independently on their own projects; 3) it legitimized student compositions in

contemporary music; 4) even though students felt that the sound and feel of real instruments was not captured by MIDI, there was music for which MIDI sounds were appropriate. The music sequencing software programs offered options of traditional notation as well as graphic interfaces with the music through the matrix editor. This allowed students to work in the mode in which they were most comfortable, and facilitated success on the part of students who could not read traditional notation (Airy & Parr, 2001).

Understandably, much of the writing focused on music technology has been centered on personal computers. More recently, mobile devices such as smartphones and tablets are increasingly found in schools. Computer applications, or "apps," for handheld devices such as smartphones and tablets have made this technology more accessible than ever before. The technology-savvy music teacher realizes the benefit of creating music files on the computer for school demonstration, ease of music notation, revision, layered instruction, practice with tempo adjustment, or perhaps even performance.

Music educators charged with teaching music composition have resources available now through sequencing and notation programs with a variety of choices for MIDI interfaces. This enables students with little in the way of music performance skill to excel at composition. Williams (2012) suggested music technology classes are a way to meet the needs of "the other 80%;" the average percentage of students who do not participate in regular school ensembles. Music technology also opens the world of music to students with disabilities who may not have the capability to play a traditional instrument (Azeredo, 2007; Challis, 2009; McCord, 1999). Williams (2007) stated, "specifically in relation to music learning, technology is opening new doors to musical

creativity and expression, accessible to the non-performer and non-reader of traditional music notation…" (p. 2). A MIDI keyboard attached to a computer with a sequencing program becomes an open palette of sounds that are immediately available for recording and playback. Students can "remember" a song and reproduce music instantaneously. Many of the barriers which existed in the past that prevented students from having a creative compositional experience have been eliminated through innovations in music technology.

Measuring Creativity

If musical composition is to be taught in schools, it seems logical, given the current standards movement, that assessment and evaluation will become increasingly important. With this in mind, the question arises of how to evaluate creativity in its many manifestations. In attempts to better understand the nature of creativity, many measurements and tests of and for creativity have been developed. Two of the most predominant in the field are Torrance's (1962, 1974) *Torrance Tests of Creative Thinking (TTCT)* and Amabile's (1983, 1996) *Consensual Assessment Technique (CAT)*. Consensual Assessment is based on the philosophy that experts in a field or domain are the best judges of creativity in that field or domain. This method of assessment elicits creative products from subjects, which expert judges then rate for creativity using a Likert-type scale. The *Dimensions of Judgment* tool developed for CAT has proven reliable across many domains (Amabile, 1983, 1996; Baer & McKool, 2009).

Measuring creativity in student musical composition. This study examined the musical compositions of a group of high school students created in a music technology laboratory and the various factors that may have influenced creativity while students

composed pieces within this instructional setting. Students learned and practiced musical concepts through employing them in electronic music composition, and were encouraged to be musically creative throughout the process. The finished compositions were rated by music educators for creativity using Amabile's (1983, 1996) Consensual Assessment Technique.

Identifying characteristics that enable students to be more creative and those which may hinder students' creativity may help teachers facilitate more successful experiences on the part of all students. Determining which factors affect students' creativity while engaged in music composition may help to provide a framework for future instruction. Additionally, this study seeks to address the lack of assessment of high school students' authentic creative musical products in the field of musical creativity research.

Studying the creative musical work of students in the music technology lab addresses two further issues. Students enrolled in such a class have a wide range of music achievement and previous music experience. The nature of the MIDI workstation enables students arriving at high school with widely varying music experience and abilities to work individually at their own pace and level. The music educator can facilitate a more successful music experience on the part of the student in a one-on-one environment. Second, classes offered in a music technology lab are open to all students interested in music, not just those who play an instrument or sing in a traditional school ensemble. The music technology lab offers a way for the non-traditional music student to participate in a curricular musical experience. Giving credibility to the creative musical expression of all student musicians is a way to begin reaching the non-traditional music student.

Likewise, the music technology lab offers a way for students enrolled in the traditional ensembles to create their own music, expanding their experience beyond the canonical repertoire of the school band, orchestra, or choir. In this way, the creative musical expression of students of both the "school band" and "garage band" cultures can be guided by the teacher-professional, or teacher-facilitator, for education of the whole young musician, validating their individual musical choices.

Research Purpose and Questions

The purpose of the study. The purpose of the study is to examine the musical creativity of high school students' authentic music products created in the music technology lab setting and discover if a relationship exists between creativity ratings and selected music experiences of students.

Research questions. This study will seek to answer the following questions:

1) Is there any difference in scores for Musical Creativity based on Instrumental Music Experience as defined by a) Years of Instrumental Lessons; b) Number of Instruments Played; c) Piano Skill; and d) Guitar Skill?

2) Is there any difference in scores for Musical Creativity based on School Music Experience as defined by a) Participation in a School Ensemble; b) Music Theory Class experience; and c) Number of Music Classes taken?

3) Is there any difference in scores for Musical Creativity based on Non-School Music Experience as defined by a) Participation in a Rock Band; and b) Years of Participation in a Rock Band?

Null hypotheses. Null hypotheses were formulated to assist in analyzing the data.

H_0#1 There will be no difference in Musical Creativity scores based on Instrumental Music Experience as defined by a) Years of Instrumental Lessons; b) Number of Instruments Played; c) Piano Skill; and d) Guitar Skill.

H_0#2 There will be no difference in Musical Creativity scores based on School Music Experience as defined by a) Participation in a School Ensemble; b) Music Theory Class experience; and c) Number of Music Classes taken.

H_0#3 There will be no difference in Musical Creativity scores based on Non-School Music Experience as defined by a) Participation in a Rock Band; and b) Years of Participation in a Rock Band.

Subjects. The subjects in this study were high school students ($N = 48$) in grades 9-12 of a large suburban high school in central New Jersey. All subjects were of approximately equal middle-class socio-economic status. The number of participants reflected number of students enrolled in Music Technology classes in the spring semester of the 2006-2007 school year.

Need for the study. This study attempted to address the need for more research on high school students' authentic creative musical products in the context of composition. It evaluated one method for assessing students' creative musical products. Further investigation into the characteristics of those students scoring both high and low for creativity may: 1) help teachers decide how musical creativity is best nurtured and encouraged when students are engaged in musical composition; and 2) guide teachers in

identifying those students who may need more or less support with different types of composition activities. If music educators are to prepare the next generation of musicians, they must first understand the nature of musical creativity and the factors that affect it.

Limitations of the study. The underlying assumptions of this study were that every individual possesses the capacity for creative musical expression as a basic human characteristic, and that creative musical experiences make valuable contributions towards intellectual growth. To that end, composition, as one of many modes of creative musical expression, should play a significant role in music education. This study did not assume, however, that every student's musical products are necessarily creative.

This study could not take into account the family or home environment of subjects, and whether or not their families were those which valued music experience. The subjects all voluntarily enrolled in the Music Technology elective classes from which the subject pool was drawn, so one may assume a certain interest or intrinsic motivation toward music on the part of all subjects.

Chapter 2: Review of Related Literature

Though the term "creativity" only became common in English dictionaries in the mid-1940's (Weiner, 2000), creativity is a notion that can be traced back to the origins of the Bible and the Ancient Greeks (Cropley, 1997; Runco & Albert, 2010; Weiner, 2000). Its early conceptions were often surrounded by mysticism and spirituality, which Sternberg and Lubart (1999) and Weiner (2000) have described in detail. In the past 20 years, creativity research has proliferated as researchers have explored the many different facets, dimensions, causes, and effects of creativity. In a recent review, Hennessey and Amabile (2010) were struck by the wide-reaching scope of suggested literature, with very little overlap of material.

Most recognize the 1950s as the era in which modern creativity research began in earnest. Early notions of creativity were associated with intelligence, and many have identified Francis Galton's (1869/1978) *Hereditary Genius* as the first study of the nature of the creative person. Galton hypothesized that "genius-grade accomplishments" tended to run in families because these abilities were genetically transmitted. Runco and Albert (2010) credited Terman's (1924) studies of intelligence using the Spearman-Binet test and Cox's (1926) hisotriometric research of 300 eminent individuals as being both a direct result of Galton's work as well as influential on the creativity research that would follow in the 1950's and beyond.

The theories of Spearman (1927) and Thurstone (1938) also shaped the history of creativity research, which at first was focused on intelligence. Spearman proposed a two-factor theory of intelligence: one general factor operating across all domains, referred to as *g*, or general intelligence, and other domain-specific skills, or *s*, that contribute to

intelligent performance on domain-relevant tasks (Baer, 1993). Thurstone initially tried to disprove the existence of *g* by proposing seven "primary mental abilities," but later acknowledged the seven abilities played important roles in general intelligence (*g*) (Bachelor & Michael, 1997). These studies inspired decades of research isolating creativity from intelligence and spurred the debate over domain-relevant versus general creative ability which continues today.

The "Six P's" of Creativity

Eysenck (1997) postulated there are different ways of defining or viewing creativity:

> Behavior can be called creative if the outcome is novel, original, surprising, and unusual or unique, and a trait of creativity can be postulated as a dispositional construct making possible such behavior and differentiating people who show much, a modicum, or little creativity. (p. 41)

He continued to describe the scale to which creativity can be measured and characteristics of creative people:

> The *creative person* can be described as the person who frequently shows creative behavior as defined, even though such creativity may only be on a small scale. In contrast, creativity may only be spoken of in terms of great achievements or the outcome of the workings of genius. Creativity writ large presupposes trait creativity, but it also requires much else. It demands high intelligence, persistence and hard work, strong motivation, special musical, artistic, verbal or mathematical abilities; it demands proper background and teaching, social support, and much else. (p. 42)

There are many factors at work in defining creativity which involve personality, motivation, and social background of the creator, as well as societal or environmental factors.

Because "creativity" is complex in nature, creativity theories by necessity are limited in scope to particular aspects or facets of the phenomenon. These viewpoints have

been alliteratively described as *person*, *product*, *process,* and *place.* Place is often referred to as "press," short for environmental pressure (Runco, 1997). This model has been recently extended to include *persuasion* and *potential* (Kozbelt, Beghetto & Runco, 2010). Some theorists have felt individuals must be persuasive, or change the way others think, to be recognized as creative. Person, product, process, place/press, and persuasion can all be examined on a continuum from unfulfilled creative *potential* to the recognized creative ability of eminent individuals. Many theories have addressed multiple "P's" in their attempt to elucidate the complex nature of creativity.

Levels of Creativity

The terms "Big-C" and "little-c" have commonly been used to distinguish between the creativity of eminent individuals and the creativity of everyday life (Csikszentmihalyi, 1996). Big-C creativity might refers to a major work that has changed a domain or field, such as a Mozart symphony, a painting by Picasso, or Einstein's Theory of Relativity. Little-c creativity is more appropriately applied to the work of students or non-eminent individuals, such as a music students' first attempt at writing a sonata, a painting completed in an art class, or new solution to a problem at work. Similarly, Baer (1993) identified three measures of creativity: real time, multi-stage, and paradigm-shifting. Real-time and multi-stage creativity are different levels of Csikszentmihalyi's (1996) little-c creativity. Paradigm-shifting creativity resembles Big-C creativity, and refers to creative performances which result in fundamental changes in the nature of a domain. These are the performances of those people considered to be creative "geniuses."

Kaufman and Beghetto (2009) proposed four levels of creative achievement: mini-c, little-c, Pro-c, and Big-C. They found it necessary to distinguish those individuals who are professional-level but may not achieve eminence as "Pro-c" creators. These four levels of creative achievement make it easier to distinguish in literature between the Cézanne, the professional (but non-eminent) artist, the hobbyist who paints for enjoyment, and the elementary school student working on a water color painting (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009; Kozbelt, Beghetto & Runco, 2010).

Current Theories of Creativity

Kozbelt, Beghetto, and Runco (2010) have recognized 10 major categories of theories in creativity research: Developmental, Psychometric, Economic, Stage and Componential Process, Cognitive, Problem Solving and Expertise-Based, Problem Finding, Evolutionary, Typological, and Systems. Many theories could fall under two of more classifications; however this provides a useful, organizational framework. A few small adjustments must be made to adapt this framework to the field of musical creativity research. Although closely related, there are differences to be articulated between Stage and Process theories and Componential theories of creativity, as a great deal of research has occurred in each of these areas. The study of general creativity research has been organized as such for the purposes of this study: Economic, Evolutionary, Problem Solving and Expertise Based, Problem Finding, Typological, Cognitive, Developmental, Stage and Process Theories, Systems Theories, Psychometric Theories, Componential Theories. This not only articulates the differences between Stage and Process and Componential theories, but also arranges the research by increasing degree of relevance

to the field of music and this study in particular; the first five categories not as closely related as the latter six. Additionally, while not theoretically based, researchers have investigated neurological responses to creative activity. Within these classifications, theories are scientifically oriented, with the goal of empirically describing creative phenomena, or metaphorically oriented, attempting to provide representations of creative phenomena. Some identify with only Big-C creativity, while other address the range, and each views creativity through the lens of one or more of the six P's.

Economic theories. Sternberg and Lubart (1992, 1999) developed an "investment" theory of creativity in which, "creative people, like good investors, buy low and sell high in the realm of ideas" (Sternberg, 2012, p. 5). Society tends to ignore innovative ideas and find opposition to the status quo annoying. Though an idea may be unpopular at first, the creative person will convince others of its value, then move on to other novel ideas. This person demonstrates a habit of creativity and possibly the fortitude to move against the crowd as he or she tries to move a field through creative contributions.

The investment model holds that creativity is relatively, though not entirely, domain-specific, and is comprised of intelligence, knowledge, thinking styles, personality, motivation, and environment (Sternberg & Lubart, 1999, Sternberg, 2012). Beine (2007) found evidence supporting the investment theory studying innovative professionals in diverse fields. Shared traits among the creative individuals (banker, engineer, teacher, judge, social worker, postal worker, web designer, etc.) included: consistent risk-taking, incubation techniques, personal adversity, professional passion, and empathy.

Rubenson and Runco (1995) described markets for creativity, and how they provide benefits or impose costs which elicit or inhibit creative behaviors. Florida (2002) recognized some classes of societies, or even cities and countries can be more or less tolerant of unconventional behaviors, fostering creativity to greater and lesser extents.

Sternberg (2006) asserted that "creativity is as much a decision about and an attitude toward life as it is a matter of ability" (p. 7). Though it is a trait that is obvious in young children, it may be harder to find in older children and adults whose creative potential may have been suppressed by a society favoring intellectual conformity (Sternberg, 2006). Sternberg (2012) described varying assessments for creativity developed with colleagues based on the components of the investment theory of creativity in hopes of redefining creativity assessment.

Evolutionary theories. Theories of creativity have been developed based on both the Darwinian and Lamarckian theories of evolution (Kozbelt, Beghetto and Runco, 2010). Of these, Simonton's (1999a, 1999b) Darwinian Theory of creativity, supported by historiometric inquiry, is probably the most comprehensive. Simonton examined the lives of famous individuals in an effort to create general laws or statistical regularities that "transcend names, dates, and places of history" while attempting to "evaluate conjectures or predictions about what personality traits, developmental experiences, or contextual factors might contribute to exceptional achievement" (Simonton, 1997a, p. 4). Based on his study of eminent individuals, Simonton's (1999a) two-stage model of the creative process involves blind generation of ideas, with selective retention and elaboration, then elaboration of chosen ideas into creative products to be judged by

society. Creators have no control over how their works are judged by society and should not be considered good judges of their own work.

Simonton (1999a) identified three important factors contributing to eminence: 1) being precocious and beginning to produce early; 2) generating a relatively large number of products on a regular basis; and 3) longevity. Simonton (1997a, 1997b) also recognized that creative genius operates in a social environment; therefore creators must communicate their ideas in order for mere originality to become genuine creativity.

Simonton's primary method of research is historiometric inquiry, which gives a fairly objective picture of creative achievements when viewed from afar, but cannot examine creativity in the present. The limitations of historiometric research include: the availability of good historical information and adequate raw data; reliance on conjecture based on writings or surviving work as subjects are often long deceased; creativity often cannot be studied as a process, only as a product; there are often gaps in information; the inability of the researcher to administer a personality inventory or intelligence test; and the creators are not available to answer questions on their work (Simonton, 1999b).

Problem Solving and Expertise-Based theories. Some theories of creativity attempt to describe problem-solving processes and emphasize the importance of expert knowledge. Theories in this vein hold the view that domain-expertise is a necessary condition for significant creative achievement and that creative thought ultimately stems from mundane cognitive processes (Ericsson, 1999; Weisberg, 1999, 2006). Kozbelt, Beghetto and Runco (2010) described a number of studies supporting the ideas that: a) experts in a domain are more adept at problem-solving because they remember domain-relevant patterns better; b) ill-defined problems may be broken down into a set of well-

defined problems; c) ill-defined problems may also be more relevant to creative achievement, for example, writing a symphony or designing a house; and d) Big-C instances of creativity often occur after application of 10 or more years of domain-specific expert knowledge.

Questions have arisen in this vein of research as to the ambiguous nature of the definition of a creative problem. “Problem” can have many definitions. (Runco, 2007). While a unique architectural design might be a creative solution to the problem of needed office space, a dancer may solve the problem of a psychological issue from the past through creative, expressive dance. Csikszentmihalyi (1988) referred to this as abreactive originality or abreactive catharsis.

The Propulsion theory of creativity describes how experts or eminent individuals move or change a domain with their creative contributions. It presents a way to classify creative contributions (Sternberg, Kaufman & Pretz, 2001). There are eight different classifications into which a creative product may fall: replication, redefinition, forward incrementation, advance forward incrementation, redirection, reconstruction/redirection, reinitiation, and integration. The first four types of contributions represent achievements that stay within the framework of an existing paradigm. For instance, replication strives to reproduce the work of the past and maintain the status quo. The latter four types of contributions seek to reject or replace the current paradigm. A contribution classified as integration would be one which merged two diverse domains to create a new idea.

Problem Finding theories. Problem finding theories of creativity are concerned with how creators come to realize there is a problem to be solved and how they are motivated to use their experience to understand the problem. Both Guilford (1950) and

Torrance (1962) emphasized the importance of creative individuals being sensitive to and identifying problems to be solved. Getzels (1975, 1979) pointed out that the quality of a solution depended on the quality of the problem. In a study of 31 college art students, Getzels and Csikszentmihalyi (1976) found that artists who were more creative handled more items and manipulated them more before drawing. Exploratory behaviors predicted success in the art world in later years (Csikszentmihalyi & Getzels, 1989). Researchers have identified problem-finding skills which include problem construction, identification, definition, discovery, perception, and generation (Runco, 2007, p. 16).

Typological theories. Another way researchers have attempted to understand creativity is by describing systematic differences or variations in creators' personalities, work methods, career trajectories or other individual characteristics and posit typologies. Kozbelt, Beghetto and Runco (2010) cite many examples, most notably Galenson (2006), who proposed two different personality types of creators: seekers and finders. Seekers proceed by trial and error, have difficulty declaring a work "finished," and struggle through the creative process. They tend to show continuity in their stylistic development, improve with age, and are less likely to produce standout works early in their careers. "Finders" have clear goals from the beginning, make detailed preparations, work efficiently, and easily decide when a project is finished. They can make abrupt changes in style and often make noteworthy contributions early in their careers.

Other notable work includes that of the Institute of Personality Assessment and Research (IPAR), established at the University of California, Berkeley in 1949. Research done at the IPAR sought to identify personality variables in creative individuals and describe the relationship between creativity and intelligence ratings. Seminal studies on

personality and creativity conducted at the IPAR include Barron (1972), Gough (1975), Helson (1999), and MacKinnon (1965).

Runco (2007) summarized the research on personality describing creative people as having combinations of the following traits or tendencies: autonomy, flexibility, preference for complexity, openness to experience, sensitivity, playfulness, tolerance of ambiguity, risk taking or risk tolerance, intrinsic motivation, psychological androgyny, self-efficacy, and wide interests and curiosity (p. 314). Feist (2010) concluded:

> The cognitive traits (openness and cognitive flexibility), social traits (norm-doubting, nonconformity, independence, extraversion-introversion, aloofness, hostility, coldness, and dominance, self-confidence/arrogance), motivational-affective traits (drive, persistence, intrinsic motivation, and positive affect) and clinical traits (psychoticism, latent inhibition, and schizotypy) all function to make creative thought, behavior, and achievement more probable. (p. 125)

With regard to intelligence, findings have shown that 1) highly creative individuals tend to have above-average IQ, often above 120; 2) creativity is only weakly correlated with IQ above 120, though it may be more highly correlated with IQ below 120; and 3) correlations between creativity and IQ are variable, ranging from weak to moderate (Sternberg & O'Hara, 1999). Feist (2010) concluded that decades of research have shown that creative people have distinguished themselves from others. "Being high or low in certain personality dispositions makes creative thought and behavior more or less likely" (p.125).

Cognitive theories. Cognitive theories of creativity seek to explain the thought mechanisms that occur as creative ideas are reached. Mednick (1962) was one of the first to explore associative theory, or how thoughts and ideas are chained together. He found that original ideas tend to be remote, and creative individuals are better at finding these ideas. The first things a person thinks of are typically not unique; people come to original

ideas only after exhausting those that are the most obvious. To assess creative thinking, Mednick (1962) designed the Remote Associates Test (RAT) which solicits verbal responses to analogies.

Guilford's (1967) Structure of Intellect Model (SOI) proposed that intellect or conscious thought was composed of many different small units which people possessed in varying degrees. By 1980, he had developed assessments for and had identified 180 different units of thought (Bachelor & Michael, 1997). He is best known for classifying those which contribute to creativity, which he viewed as a combination of divergent and convergent thinking ability. Guilford (1967) described creativity as the interaction of eight traits, including sensitivity to problems, synthesizing, analyzing, complexity of conceptual structure, evaluation, originality, flexibility, and fluency. While Torrance (1967) continued study of divergent thought processes, Cropley (2006) asserted that both convergent and divergent can contribute to creativity.

The Geneplore model (Finke, Ward & Smith, 1992; Ward, Smith & Finke, 1999) characterized creative cognition as composed of the interplay of generative thought processes with exploratory thought processes. The generative processes include retrieval of various types of information, associations, and combining concepts and images to form candidate ideas, or preinventive forms. The creative potential of chosen ideas is then developed through exploratory processes, such as modification, elaboration, and consideration of the implications (Ward & Kolomytes, 2010).

Analogical thinking is another cognitive theory of creativity in which structured knowledge from a familiar domain is transferred or applied to a novel or less familiar domain. Ward and Kolomytes (2010) cite several examples of analogy in creative

endeavors, such as Rutherford's use of the solar system as a model for the hydrogen atom and Robbins, Bernstein, Laurents, and Sondheim's adaptation of Shakespeare's *Romeo and Juliet* to the context of 1950's gang conflict of *West Side Story* (p. 104). Dunbar (1995) identified three different types of analogies, and observed that anecdotal accounts of distant analogies facilitating discovery may be overstated; they may be more useful in communication of ideas rather than in their formulation.

Developmental theories. Developmental theories of creativity seek to explain the roots of creativity and suggest how to design environments conducive for individuals to reach their creative potential. Feldman (1999) identified seven dimensions for study of creative development: 1) cognitive processes; 2) social/emotional processes; 3) family aspects: growing up and current; 4) education and preparation: formal and informal; 5) characteristics of the domain and field; 6) social/cultural contextual aspects; and 7) historical forces, events, and trends (p. 171-172). Feldman argued that an adequate analysis of creative development involves at least these seven dimensions, however no researcher could begin to do more than a fraction of the work necessary to account for all of them.

Several studies have touched on one or more of these dimensions. Galton (1869/1978) reported that first born children had a developmental advantage and were more successful. Goertzel and Goertzel (1976) examined the lives and family backgrounds of creative people, and suggested that particular developmental experiences correlated with creativity. Parents of creative children were creative in some ways themselves, tended to expose their children to diverse experiences, and allowed their children an optimal amount of independence (Albert and Runco, 1989)

Gardner's (1993) study of seven creative individuals identified developmental patterns across the lives of eminent creators in very different domains. Among the patterns he found were that the individuals had trouble forming and maintaining close friendships or deep emotional relationships, the families of the creators tended to be neither rich nor poor, they lived in places away from major cities, but not removed from the influence of the field in which they would become a creator, as children the individuals were taught moral values and expected to adhere to them, and when their interests and strengths emerged in a family context, they were supported and encouraged.

A few studies have examined the relationship between play and creativity (Ayman-Nolley, 1999; Pearson, Russ & Cain Spannagel, 2008; Russ & Schafer, 2006). Other developmental studies of creativity have suggested a U-shaped curve representing creative development (Albert, 1996, Keegan, 1996). In Gardner's (1982) research with visual artists, this curve was marked by a period of high creativity in early childhood, followed by a slump during the middle years from which a small percentage emerge to become creative adult artists.

Stage and Process theories. A number of theories have attempted to identify the thought processes that occur during creative work. Wallas (1926) proposed a seven stage theory of the creative thought process: 1) encounter (a problem or challenge is identified); 2) preparation (information is gathered); 3) concentration (an effort is made to solve the problem); 4) incubation (ideas churn in the person's head); 5) illumination (what seems to be the solution becomes apparent); 6) verification (the individual checks out the apparent solution); and 7) persuasion (the individual attempts to convince others that the product really does solve the problem (Cropley & Cropley, 2008, p.361). Wallas'

model is usually referred to as a four-stage theory of the creative thought process in modern research, in which the creator passes through the phases of preparation, incubation, illumination, and verification. Barron (1988) proposed a four-stage model based on the gestation cycle of the creative idea: conception, gestation, parturition, and bringing up the baby.

Cropley and Cropley (2008) posited that seven stages are an appropriate model for teaching and studying creativity. To account for the various dimensions of and activities involved in creativity, including both convergent and divergent thought processes, their model is composed of: 1) preparation; 2) activation; 3) cogitation; 4) illumination; 5) verification; 6) communication; 7) validation. They note that production of a novel product may not follow these stages linearly, and the process can be broken off at any stage (Cropley & Cropley, 2010).

Other models of creative thought process have been proposed by Bandrowski (1985), Fritz (1991), Isaksen and Trefflinger (1985), Koberg and Bagnall (1981), Osborn (1953), Parnes (1992), and Rossman (1931). The main variations in these theories are the degree to which creators' thoughts are subconscious or conscious, and whether the process is linear or can be begun or ended at different stages of the cycle.

Systems theories. Systems theories view creativity as emerging from a complex array of many components, the interaction of which must be taken into account when considering creative achievements. Gruber (1981, 1988) and Gruber and Wallace (1999) proposed an evolving-systems approach when studying the lives of eminent creators. In-depth study of a person's purpose, knowledge, and affect yields understanding of individual differences and how eminent creators accomplish their work. Gruber's (1981)

analysis of the life of Charles Darwin suggested developmental changes in his knowledge system, goals which guided his behavior, and the moods which influenced projects undertaken. Gruber and Wallace (1999) indicated much more knowledge about creativity could be gained from focusing on one eminent individual's life and work than looking for commonalities among many creators.

Csikszentmihalyi (1990) proposed three dimensions to creativity: a creative idea produced in a creative situation that is valued and transmitted to a culture or community. All three must be present for a creative idea, product or discovery to take place.

> A person who wants to make a creative contribution not only must work within a creative system but must also reproduce that system within his or her mind…the person must learn the rules and the content of the domain, as well as the criteria of selection, the preferences of the field….(Csikszentmihalyi, 1996, p. 47)

Experts in the domain act as gatekeepers, deciding which novel, creative ideas are accepted for future transmission. This accounts for the waxing and waning of creativity over time and why creative individuals may not be recognized as such during their lifetimes. Cultures are conservative for good reasons and it takes an effort to change traditions. "No culture could assimilate all the novelty people produce without dissolving into chaos" (Csikszentmihalyi, 1996, p. 41).

In analyzing the motivation behind creative activity, Csikszentmihalyi (1990) identified "flow." Flow is a metaphorical term derived from the "almost automatic, effortless, yet highly focused state of consciousness" respondents describe while being deeply immersed in work they enjoy (Csikszentmihalyi, 1996, p. 110). An individual's involvement in creative activity evokes the "flow" experience and therefore is intrinsically motivating. Csikszentmihalyi's (1990) research has identified nine main characteristics of the flow experience which appear to remain constant across domains.

Psychometric theories. Psychometric theories are largely focused on scientifically measuring creativity with assessments. The years following Guilford's 1950 address to the American Psychological Association saw the emergence of a great deal of empirical study on creativity, including Guilford's own development of the Structure-of-Intellect (SOI) model of intelligence and the divergent-production model of creativity which distinguished creativity and intelligence (Guilford, 1968). The model is based on the theory that divergent thinking, the ability to develop many different thoughts and ideas, is central to creativity.

Guilford argued against general intelligence, that people can be very good or very bad at any combination of different components of intelligence. He and his associates devised tests to measure and demonstrate different mental abilities via factor analysis. He identified creativity as the interaction of eight of these mental traits or abilities, including sensitivity to problems, synthesizing, analyzing, complexity of conceptual structure, evaluation, originality, flexibility, and fluency (Guilford, 1967). These divergent-thinking production factors were grouped into four categories: 1) fluency, the ability to produce a large number of ideas; 2) flexibility, the ability to produce a wide variety of ideas; 3) originality, the ability to produce unusual ideas; and 4) elaboration, the ability to develop or embellish ideas and to produce many details (Guilford, 1967).

Building on Guilford's work, Torrance (1966, 1974, 1990) developed the *Torrance Test of Creative Thinking* (TTCT), which solicits oral, written, and drawn responses to various, open-ended questions. The responses are scored in terms of four criterion components: 1) fluency, the production of a large number of ideas; 2) flexibility, the production of a large variety of ideas; 3) elaboration, the development,

embellishment, or filling out of ideas; and 4) originality, the use of ideas that are not obvious or banal, or that are statistically infrequent (Sternberg & Lubart, 1999). The TTCT has had both positive and negative effects on the field. The tests are easy to administer and facilitate research because they are brief and objectively scored. Critics of the TTCT argue that paper-and-pencil tests inadequately capture or measure creativity (Amabile, 1996; Sternberg & Lubart, 1999). Furthermore, evidence suggests that the sub-scale scores for the four components are highly inter-correlated and do not represent discrete divergent thinking component skills, yet scores from these tests seem to have become the "de facto operational definition of divergent thinking" (Baer, 1993, p.16).

Componential theories. Some researcher views creativity as a combination of many skills or thought processes, including domain-relevant skills, general abilities, and both convergent and divergent thinking skills. Cropley (2006) viewed creativity as composed of both divergent and convergent thinking, and asserted that "…converting mere novelty into effective novelty (i.e., creativity) requires both generation (via divergent thinking) and also exploration (via convergent thinking)" (p. 398). Divergent thinking is necessary for the generation of many new ideas, but these ideas must be considered carefully within the domain to determine which might be both novel and valuable, hence, creative.

Most componential theories recognize both domain-relevant knowledge and creativity-relevant skills or abilities as important. Debate in the field of creativity research ensues as to the degree which creativity skills developed in one domain may be transferable to work in an alternate domain. Baer (2010) made the following insight: "…the talents, knowledge, skills, motivation, traits, propensities, and so forth that

underlie creative performance (a) vary depending on the kind of work one is undertaking, (b) are similar across related fields or kinds of creative work, and (c) become progressively dissimilar as one moves to increasingly disparate fields of endeavor…" (p. 338). Baer (1993) also noted that expert analyses of creative products in studies favoring a task-specific view have indicated that creative performance on one task does not predict creative performance on other tasks. Results of studies conducted with subjects of all ages utilizing those skills that might be considered falling into the same domains (i.e., writing stories and writing poetry) have shown little correlation between creativity ratings, providing strong evidence against the existence of a general creative capacity as recognized in the divergent thought model. Creativity-relevant skills appear to be narrowly applicable, perhaps of use only on specific tasks (Baer, 1993; Baer & McKool, 2009).

Amabile's (1983, 1996) social psychological model proposed that creativity is comprised of creativity-relevant skills, domain-relevant skills, and task motivation, which can be affected by situational or motivational factors. Amabile (2012) later expanded this theory to four components: three within the individual (domain-relevant skills, creativity-relevant processes, and intrinsic task motivation), and one component outside the individual (the social environment in which the individual is working). Creativity has both temporary states and enduring traits and is not an innate characteristic, rather a variable aspect of performance, a potential of all individuals, and a separate trait from intelligence (Amabile, 2012).

The creativity-relevant skills described by Amabile (1983, 1996) include cognitive style, working style, uninhibited risk-taking, ability for deep levels of

concentration and exploration of new cognitive pathways, ability to take a new perspective on a problem and come up with many unusual ideas, and use of the imagination in new ways. Domain-relevant skills include factual knowledge, technical skills, and special talents enabling one to solve a particular problem or task. These skills may be viewed as a set of cognitive pathways one can take to solve a certain problem. The more common or practiced the pathways, the greater the chance for producing something new or developing a new combination of ideas. Domain-relevant skills rely on education, experience, in-born talent, and basic intelligence (Amabile, 1983; 1996).

The third and fourth components, and primary focus of Amabile's work since proposing the componential model of creativity, are intrinsic task motivation and the social or situation factors affecting the creative environment. "People are most creative when they feel motivated primarily by the interest, enjoyment, satisfaction, and challenge of the work itself – and not by extrinsic motivators" (Amabile, 2012, p.4). Extrinsic factors in the environment often serve as obstacles to intrinsic motivation, however those extrinsic motivators that confirm peoples' competence can serve to enhance creativity (Amabile, 2012).

Amabile, Hennessey, & Grossman (1986) suggested teachers have little control over the innate abilities and personal characteristics of students and therefore must focus on that which they could change: the social environments influencing creative performance. The domain or field (the classroom) is an area over which the teacher has a great deal of influence, and it is easier to foster creativity by changing the classroom environment than by changing the individual.

Consensual Assessment Technique. Amabile's (1983) examination of creative products found creative performance was sensitive to a number of situational factors which made approaches to creativity assessment similar to the TTCT inappropriate tools for measurement. She developed the *Consensual Assessment Technique* (CAT) which allows the evaluation of creative products of individuals within many different domains across a variety of situations. The assessment technique is based on the premise that "a product or idea is creative to the extent that expert observers agree that it is creative" (Amabile, 1983, p. 31). The CAT relies on the subjective opinion of "expert" judges, or those who are well-versed in the domain in which the products were created. The task yielding the creative products to be assessed must be heuristic in nature as opposed to algorithmic so there are many possible correct answers or products. The judges rate the products on Likert-type scales for several different aspects or dimensions of creativity.

The CAT has been tested in studies by Amabile and others in at least 53 different studies across a variety of domains (Amabile, 1996). Amabile's (1982) original work has been successfully transferred to studies on creative writing (Ebersole, 1994), creative behavior in an organizational setting (Marsnik, 1997), dramatic performance (Myford, 1989), engineering design (Coleman, 2010), humor (Reynolds, 1988), industrial design (Christensen, 2006), interior design (Barnard, 1992; Park-Gates, 2002), military plans (McClary, 2009), musical composition (Auh, 1997; Bangs, 1992; Brinkman, 1999; Barker, 2003; Daignault, 1997; Hickey, 1995, 2001; Mannarelli, 2000, Menard, 2009), personal narratives (Baer, Kaufman, & Gentile, 2004), scientific creativity (Mohamed, 2006; Jarvis, 2009), video game design (Buelin-Biesecker, 2012) and the visual arts

(Baumgarten, 1994; Kane, 1992). A review of CAT studies by Baer and McKool (2009) showed very little to no significant difference in score based on race, ethnicity or gender.

In a study of the creative drawings of European Americans and Chinese college students, Chen et al. (2002) showed high consensus between American and Chinese groups of judges and great similarity in the creativity of drawings of the two groups. This demonstrated the possibility of cross-cultural use of CAT. While it has been shown to be reliable, Long (2012) raised questions as to the validity of the Consensual Assessment Technique, noting that high reliability is not evidence of validity, and Cronbach's alpha is not an appropriate measurement of reliability as Amabile (1982, 1996) suggested. Long (2012) explored three groups of judges' responses to differences in creativity ratings finding little evidence to support the validity of CAT.

Neurological research. With the development of and increased accessibility to technology, particularly of functional magnetic resonance imaging (fMRI), research has begun to focus on creativity at a neurological level. Research studies have investigated which parts of the brain are activated during creative activities, how people can still be creative when certain areas of the brain lose function, which parts of the brain help people solve different types of problems, which parts of the brain work together during creative activity, and which creative behaviors activate which different areas of the brain (Bowden & Jung-Beeman, 1998, 2003; Jung-Beeman & Bowden, 2000; Mell, Howard, & Miller, 2003; Miller, Boone, Cummings, Read, & Mishkin, 2000, Miller & Hou, 2004; Moore, Bhadelia, & Billings, 2009). While there is much more research to be done in this area, scientific breakthroughs are allowing ever more detailed study in this field.

Musical Creativity

Though studies of musical creativity date back to the 1940s, the field is relatively new and a large body of research was not developed until the 1970s and 1980s (Webster, 2002a). Webster (2009) outlined current research trends, categorizing studies as either theoretical, practical application, or empirical. Recent studies of creative musical thinking have either: 1) questioned the assumptions of previous generations; 2) listened to children's voices and value the meaning they ascribe to compositional experience; 3) sought to understand children's thinking through their invented notation; 4) developed new approaches to assessment of creative musical products; 5) studied collaboration and group composition; 6) explored the pedagogy of composition teaching; 7) speculated on and experimented with the role of music technology in musical creativity; and 8) described models of creative thinking (Webster, 2009, p. 424).

While a number of studies have touched on a number of areas of general creativity research, the majority would be categorized as Cognitive, Developmental, Stage and Process, Systems, Psychometric, or Componential. Cognitive and Developmental studies are closely related to Stage and Process research, as many of the investigators focus not only on how subjects progress though the compositional process, but also on what or how they are thinking while they complete the creative work and how this may exemplify their developmental level. Those studies that are centered on Componential and Systems theories are also closely related, as both take into account the environment and/or factors affecting the motivation behind composition.

Historiometric research in musical creativity. While evolutionary theories of creativity have not been applied to musical creativity *per se,* researchers have

investigated creativity from a historiometric perspective, identifying how composers worked, why creative works became famous, and factors that influenced the lives of eminent composers through studying their work and writings about their lives. Haas (2008) studied the development of the careers and creative expertise of Cole Porter and Irving Berlin, finding evidence of both productive and reproductive creativity. Lapidaki (2007) studied the parameters of the composition processes of eminent twentieth- and twenty-first century composers, making suggestions for music educators in guiding young composers.

Simonton (2009) summarized what has been learned from the historiometric research on composers thus far, including his own work. Composers are most frequently firstborn children, likely born near a center of musical activity; they began musical study early and progressed quickly; tended to be highly prolific in their professional careers; their first masterpieces emerged at a young age; their last masterpieces often emerged toward the end of their lives; their single most acclaimed composition tended to occur either in their late 30s or early 40s; and once the composer made a name for himself with his greatest works, his standing with posterity tended to be secure (pp. 1077-1078).

Economic theory of musical creativity. While not much work has been done in the area of applying economic theories of creativity to the field of music, Carluccio's (2012) study of three popular bands of the 1990s seems to support Sternberg and Lubart's (1999) investment theory of creativity. The three musical groups investigated each had different reactions to the pressures of gaining popularity. For the band the Red Hot Chili Peppers, the rise to fame spurred their evolving musical style, causing them to move from one idea that became popular, the musical style which made them famous, to another less

popular idea, in this case, a new style of popular music. The other bands were less successful in adapting their musical style to changing trends.

Musical creativity and the brain. The field of brain research with regard to musical activity is extensive. The increasing availability of ever-more complex technology, including electroencephalogram (EEG), magnetoencephalography (MEG), positron emission tomography (PET), and functional magnetic resonance imaging (fMRI), has allowed researchers to explore the anatomical and functional basis for musical creativity on live subjects in the act of making music. Levitin (2007) explained in detail much of the research on how individuals respond to and behave during musical experiences from a neurological perspective.

Researchers concerned specifically with neurological function during creative musical acts include Berkowitz (2009) and Limb & Braun (2008), who investigated brain activity during improvisation. Leng (1990) tried to explain the way the brain is used and how it functions during composition, while Amaducci, Grassi, & Boller (2002) explored the influence of disease on the brain of the composer. Lotze, Scheler and Birbaumer (2006), Brattico and Tervaniemi (2006), and Belardinelli (2006) have also presented studies of how the brain, parts of the brain, or neuronal networks behave while engaged in creative musical behavior, as well as extensive reviews of concurrent research in the field.

Typology and musical creativity. While many studies have investigated the characteristics of subjects relative to their musical creativity and personality traits related to general creativity, few studies have examined musical creativity relative to specific personality traits. One such study is Swanner (1985), who found that excitability,

aggression, independence, anxiety, self-confidence, curiosity, and imagination in subjects aged 8 and 9-years-old were significantly related to musical creativity as measured by Webster's (1994) *Measure of Creative Thinking in Music-II* (MCTM-II).

Cognitive study of musical creativity. Cognitive studies of musical creativity attempt to explain subjects' thinking or understanding and the cognitive procedures and strategies adopted by subjects at different stages of development while engaged in musical composition. These studies often solicit verbal responses which may be indicative of understanding, thinking processes, or developmental stage. Key studies in this area include Barker (2003), Burnard and Younker (2002), Davies (1992), Daignault (1997), Glover (1990), Gromko (1994, 1996), Major (2007), Martin (2002), Mellor (2008), Swanwick and Franca (1999), and Wiggins (1994). Conant (1988) studied the effect of composing with computer software, finding gains in three of four dimensions of children's cognitive processes. Koutsoupidou and Hargreaves (2009) demonstrated the effects of improvisation activities on the development of children's creative thinking in music as measured by the MCTM-II while Burnard (2006) explained how children make meaning in music as composers. After a review of the related research, Webster (2002a) advanced a Model of Creative Thinking Process in Music, which represents intentions, processes, and products, and incorporates both convergent and divergent thinking as well as enabling skills and conditions.

Creative musical development. Researchers who address the issue of musical creativity from a developmental standpoint are concerned with the various ways subjects manifest musical creativity at different stages of cognitive development and what thought processes or behaviors may be indicative of these stages. These studies address questions

regarding the age at which subjects begin to make creative musical decisions, the strategies employed in musical composition by children at various ages or stages of cognitive development, and the progression of creative musical development. Several have sought to find differences in the compositional processes of or strategies employed by subjects within and between different age groups ranging from young children through adult, expert composers. A seminal work in this field was Hargreaves' (1986) *The Developmental Psychology of Music*, which presented a comprehensive overview of theory and practice in the developmental psychology of music until the early 1980s. Hargreaves (1999) also effectively summarized Mary Zimmerman's work in applying the Piagetian model to creative musical development. Key studies in creative development in music include Barrett (2006b), Brophy (2002), Flohr (1979, 1985), Hall (2007), Kiehn (2003), Kratus (1989, 1991, 1994), Swanwick and Tillman (1986), Seals (1989), Swanwick (1991), Younker (2000), and Younker and Smith (1996).

Creative musical Process and Problem-Solving. Those researching creative musical process have been concerned with the steps through which subjects progress when engaged in solving a musical composition problem. Much of this research is closely related to the study of creative musical development and cognition. Wiggins' (2002) work is exemplary of how creative musical processes are integral to cognition or musical thinking. Many have proposed models of the creative musical process, including Collins (2005, 2007), Emmons (1998), Fautley (2005), Kennedy (2002), Kratus (1991), Nelson (2007), Nilsson and Folkstad (2005), and Webster (2002a). Models of creative musical process generally include stages of preparation, incubation, illumination, and verification; however there are many variations. The models presented are both linear and non-linear

designs, through which subjects' progress may be sequential, non-sequential, or even recursive.

Other studies have identified the strategies used throughout the music composition experience, or have described the experience relative to an existing model of compositional process, the products created, or subject characteristics. These include Allsup (2002), Beegle (2006), Davis (2005), DeLorenzo (1989), Folkestad, Hargreaves, and Lindstrom (1998), Hewitt (2002), Kennedy (2004), Kratus (2001), Ladanyi (1995), Nath (2007), Seddon and O'Neill (2003), Tsisserev (1998), and Wiggins (2003). These are useful in determining how students produce creative ideas and go about solving composition problems.

In studying the creative musical process, researchers are shedding light on how composers of all ages solve the musical problem at hand. The basic underlying assumption in this line of research is that every subject's work is inherently creative. Generally, studies of this genre are reluctant to pass judgment on the resulting creative product. Brinkman (1999), Daignault (1997), and Hickey (1995) are examples of a small number of studies which compared compositional processes employed by subjects whose work was judged more or less creative.

Systems theories of musical creativity. Studies investigating musical creativity from a systems perspective relate the phenomenon to the larger picture of the creative person, the resultant product, and the surrounding environment. Much of this research can be linked to motivational research in musical creativity, as both extrinsic and intrinsic motivation to create are sensitive to environmental factors. Byrne, MacDonald and Carlton (2003) investigated the motivational aspect of the creative system by using

Csikszentmihalyi's concept of flow as an assessment tool. A significant correlation was found between scores on the *Experience Sampling Form* indicating flow experiences and creativity ratings on group compositions, indicating that creative composition can occur within a small group of students who are likely to be in a flow experience. The researchers suggest that students felt relaxed and less anxious because the task was a learning vehicle and not part of an assessment for a grade and that flow can be used as a possible way to manage the learning environment.

Several other researchers have studied the work of eminent or professional composers and the environmental systems surrounding their work processes (Barrett, 2006a; McIntyre, 2006; Snowden, 1993). Barrett's (2006a) study of the creative relationship between the composer-teacher and student-composer suggested the eminent composer may not be a lone seeker of information, but a member of a "thought community" and the teaching and learning process in composition may be a form of creative collaboration. McIntyre (2006) applied Csikszentmihalyi's systems model to Paul McCartney's work on the composition "Yesterday," recognizing the equal importance of the person, domain, and field. Snowden (1993) studied eight American composers and the factors surrounding their participation in a successful organism-environment relationship.

Psychometric measures of musical creativity. Psychometric studies of musical creativity seek to elicit a creative response from subjects, usually through composition or improvisation, then place a judgment on the creativity of the response, usually quantifying it on a numerical scale. Doig (1941) was the first to study children's creative musical products, however a body of research did not develop until the 1970s. Much of

the early research in musical creativity has been fueled by and founded in Guilford and Torrance's work in divergent thinking (Baltzer, 1990; Gorder, 1980; Holliger, 1989; Josuweit, 1992; Schmidt & Sinor, 1986; Vaughan, 1971, 1977; Vold, 1986; and Webster, 1977, 1987, 1990, 1994).

The first music-specific measurement tool developed was Vaughan's (1971) *Test of Musical Creativity* (TCM), followed by Webster's (1977) *Measures of Creative Thinking in Music* (MCTM) for high school age students, and the later adaptation for elementary school children, MCTM-II (1987). Based on the *Torrance Tests of Creative Thinking* (1974), Vaughan's (1971) TCM and Webster's MCTM (1977) and MCTM-II (1987) measure divergent thinking factors of musical creativity. Instead of soliciting oral, drawn, and written responses as the TTCT does, the MCTM solicits compositional, analytical, and improvisational responses which are scored for fluency, flexibility, originality, and elaboration.

Though the field of musical creativity assessment seems generally to have moved toward *Consensual Assessment Technique* (CAT), studies founded in divergent thought have been influential in shaping the body of research in musical creativity. Both Vaughan's (1971) and Webster's (1977, 1987) tests are still used, and until recently, the MCTM and MCTM-II have been the most common assessments of musical creativity. The measures have been shown reliable, with several researchers employing them often in conjunction with other measures of musical or general creativity. Amchin (1995), Baek (2009), Baltzer (1990), Boehm (1999), Dingle (2006), Gorder (1976), Hickey (1995), Hickey and Webster (1999), Josuweit (1992), Koutsoupidou and Hargreaves (2009),

Schmidt and Sinor (1986), and Swanner (1985) are among those who have used these tools successfully.

Criticism of Measures of Divergent Thought. Researchers have raised questions regarding the divergent-thinking model as a measure of general creativity (Amabile, 1996; Cropley, 1997; Plucker & Renzulli, 1999; Plucker & Runco, 1998) as well as its application to musical creativity (Bangs, 1992; Hickey, 1995, 2001). The three major concerns regarding the divergent-thought model measures of creativity are that they: 1) do not assess qualities that correspond to real-world creative performance (construct validity); 2) assess a narrow range of abilities that are inappropriate to label as indicative of "creativity;" and that 3) the scoring of such tests is purportedly objective, when in fact many scoring procedures are subjective (Amabile, 1983, p.25). Hennessey and Amabile (1987) stated that most creativity tests like the TTCT measure creativity-relevant skills such as a child's basic ability to take a new perspective on a problem, come up with many unusual ideas, and use their imagination in new ways, but ignore domain-relevant skills. Hickey (2001) commented, "In addition, these paper-and-pencil divergent thinking tests do not capture the greater and more complex instances of real-life creative endeavors" (p. 235).

A key element of judging creative musical products is soliciting creative responses (products) which are authentic representations of subjects' musical creativity. Csikszentmihalyi (1996) and Amabile (1983) concur that creativity occurs within a domain; Elliott (1995, 2005) similarly stated that music-making, including performing, listening, and creating, occurs within a musical or cultural context within the domain of music. The TCM and MCTM elicit creative musical responses in the form of

improvisation or composition tasks foreign to the nature of students' musical practice. Such tests are more apt to measure the adaptability of music skills or music achievement to a music problem-solving situation rather than measure musical creativity. Ideally, for valid, accurate assessment of musical creativity, students should be asked to create in a domain-specific environment in a music practice with which the student is fluent.

Componential Theory Applied to Musical Creativity

Consensual Assessment Technique. In the early 1990's researchers began adapting Amabile's (1983) *Consensual Assessment Technique* (CAT) to studies of creative musical products. These studies typically use audio recordings of musical compositions completed by the subjects which are rated by experts in the domain using the *Dimensions of Judgment* tool designed by Amabile (1983). While it has become a common research method, CAT is not applied consistently across the field. Researchers have used different numbers of judges with varying levels of expertise, and have employed a multitude of different forms of the measurement tool. While some have implemented the *Dimensions of Judgment* in almost its entire form, others have had judges rate products using just two or three of the original 23 dimensions. Regardless of the number of dimensions used for rating, CAT has been shown to be a reliable method for the evaluation of creative musical products (Auh, 1997; Bangs, 1992; Barker, 2003; Brinkman, 1999; Daignault, 1996; Hickey, 1995, 2001; Priest, 2001; Robinson, 1994; Yannon, 2011).

CAT and MCTM-II. Hickey (1995) and Yannon (2011) compared subjects' consensual assessment scores for creativity with their scores on Webster's (1994) MCTM-II. Neither study found significant correlations between CAT scores and MCTM-

II composite or subscores of fluency, extensiveness, originality, and syntax. Hickey (1995) compared CAT ratings $N = 21$ fourth and fifth grade subjects using the three dimensions of creativity, craftsmanship, and aesthetic appeal, while Yannon's (2011) investigation of $N = 75$ fifth grade students used the dimensions of creativity, aesthetic appeal, and technical goodness. Hickey (1995) concluded that the two tests measure different aspects of creativity or that one test or the other does not really measure musical creativity.

Appropriate judges for the *Consensual Assessment Technique*. Hickey (2001) examined the reliability of CAT by comparing the reliability ratings of different groups of judges including teachers, composers, theorists, seventh-grade children, and second-grade children when rating musical compositions by $N = 12$ students in fourth and fifth grades. The study examined the scores for differences between or relationships among the different groups of judges, while seeing which group was the most reliable. The judges included $N = 17$ music teachers, $N = 3$ composers, $N = 4$ college music theory professors, $N = 14$ seventh grade students, and $N = 24$ second grade students. Music teachers rated compositions on three dimensions: creativity, craftsmanship, and aesthetic appeal. Music theorists and composers used an 18-item version of the *Dimensions of Judgment* (DOJ) similar to Bangs (1992) adaptation of Amabile's (1982) original design. Seventh- and second-grade students rated compositions on a two-item scale for "liking" and "creativity," with icons employed to help second-grade students understand the continuum.

Inter-judge reliability for all groups using mean creativity ratings was .48, while reliability for all groups minus composers was .78. Inter-judge reliabilities for each

group's creativity ratings were: composers, .04; all music teachers, .64; general choral music teachers, .81; music theorists, .73; seventh-grade children, .61; and second-grade children, .50. Significant correlations were found between the groups of music teachers and music theorists and between the two groups of children. The study concluded that CAT is a moderately reliable technique for measuring the creativity of children's compositions, and that general/choral music teachers seem to be the best "experts" to rate children's musical compositions. Menard's (2009) investigation corroborated Hickey's, finding similarly that teachers were highly reliable at judging high school students compositions on three dimensions. Student groups were moderately reliable when assessing their own compositions and composers proved to be the least reliable. Hickey (1995) attributed the lower reliability level as compared with Bangs' (1992) study to the many different forms of the test used and the small number of compositions studied. Hickey also suggested that judging compositions within a genre or musical context might prove more successful.

Priest (2006) examined the reliability of consensual assessment when judges rated compositions under the varying conditions of audio only, audio and score, and score only. Undergraduate students enrolled in a music fundamentals class, elementary general music teachers, and instrumental music teachers rated five compositions performed on the soprano recorder for musical creativity and craftsmanship. Each of the music teachers rated the compositions under one of the three different conditions. Reliabilities of all groups ranged between .89 and .97, with instrumental teachers in the audio only condition being the most reliable. Both groups of teachers rating the score only were the least reliable.

Webster and Hickey (1995) found judges have higher reliability ratings when given global, open-ended, implicit rating scales for musical compositions. Four independent, expert judges with extensive teaching experience rated 10 audio recordings of student compositions using two different rating scales. One had implicit ratings (e.g. questions related to the judge's personal definitions of creativity or craftsmanship) and the other had explicit, specific criteria for rating. Both forms had questions related to global and specific characteristics of the musical composition. Reliability was higher overall for the implicit ratings, and significantly higher for items related to the global characteristics of the piece.

Characteristics Related to Musical Creativity

Motivation. The most complete adaptation of Amabile's (1983) Componential Theory of Creativity, the application of *Consensual Assessment Technique* and the original *Dimensions of Judgment* (DOJ) tool to the field of music is Bangs' (1992) study of the effect of intrinsic versus extrinsic motivation on children's creativity in the musical compositions of $N = 37$ third grade students. Compositional ratings from pre- and post-motivational treatment indicated a significant positive change in creativity scores for the intrinsic motivation group ($r = .57$, $p = .004$), a significant negative change for the extrinsic motivation group ($r = -.56$, $p = .017$), and no significant change in scores for the control group. Bangs (1992) suggested that the motivation behind creative composition in music is an important factor in musical creativity which should be explored more deeply.

Wolfe and Linden (1991) also investigated of the relationship between musical creativity and intrinsic motivation for music. Results of the study indicated third grade

children who demonstrated high intrinsic motivation for music, measured by their choice to play with musical instruments rather than other toys, scored higher on the MCTM-II.

Other factors, such as parental support can increase intrinsic motivation for music. Sichivitsa's (2007) survey of $N = 130$ choir members at a large public university showed that students whose parents were involved in music and who supported their musical activity developed better self-concepts in music. This in turn made them more academically and socially comfortable in choir, they valued music more, and developed higher motivation to participate in various musical activities in the future.

While Amabile (1983, 1996) and Hennessey and Amabile's (1987) early work suggested that competition and extrinsic reward was detrimental to creativity, other studies have found these factors might increase creativity in certain circumstances. Clydesdale (2006) found evidence to suggest competition can increase motivation and creativity in musical competition. In an historiometric study of the work of the Beatles, circumstances surrounding the composition of hit songs indicated that healthy competition between band members and extrinsic rewards contributed toward the group's success. Eisenburg (1996) found similarly that the piano improvisations of participants under a competition condition were rated higher on the dimensions of creativity, complexity, technical goodness and overall liking than those created in a non-competition condition.

Use of music technology has also shown to increase motivation in musical composition. Ladanyi (1995) found that the opportunity for individual composition afforded by the nature of digital music equipment provided an ideal environment for intrinsic motivation. Emmons (1998) reported that students found the computer easy to

use and motivating to their composition process, and Gall and Breeze (2008) reported high levels of motivation due to the nature of the computer and software used in their study. The software program allowed all students to successfully participate in composition, as well as enabled students to compose in contemporary styles.

IQ, Age, Gender, Formal and Informal Music Experience. Several factors have been shown to affect creative performance or creative process in different circumstances and test conditions. Many studies that suggest students' previous musical performance experience is not significantly related to their ability to function creatively as composers. In her work with nine preservice music teachers, Kennedy (2004) found students reported their earlier music training was both enabling and constraining in the compositional process.

Webster (1979) studied the relationship between the three modes of creative behavior in music as measured by the MCTM (improvisation, composition, and analysis) and selected subject characteristics of $N = 77$ high school students who had participated in school music groups but had no systematic training in creative music skills. While Webster found IQ and gender were significantly related to improvisation ($r = .37$, $p < .05$ and $r = .28$, $p < .05$ respectively), no significant relationships were found between musical creativity scores and age, grade level, performance medium, or piano lesson background. Webster (1979) found music achievement scores correlated significantly with all modes of creative behavior (improvisation, $r = .41$, $p < .05$; composition, $r = .27$, $p < .05$; and analysis, $r = .49$, $p < .05$) and was the single best predictor of each mode. Webster concluded that creative potential in music cannot be necessarily associated with age, grade level, or performance medium. Though instrumentalists and those with both

instrumental and vocal backgrounds scored somewhat better on all three criteria measures of the MCTM, results were not statistically significant.

Auh (1997) explored the characteristics of $N = 67$ fifth- and sixth-grade subjects as related to musical creativity. Students composed a melody on an Orff alto xylophone, which was rated on five dimensions by three expert judges. Auh found significant correlations between musical creativity and informal musical experiences ($r = .33$, $p < .01$); music aptitude- tonal ($r = .27$, $p < .05$); musical achievement- pitch ($r = .30$, $p < .05$); and academic grades ($r = .29$, $p < .05$), suggesting that informal musical experiences may have played an important role in compositional creativity. High scores for informal music experience supported the notion that students had high intrinsic motivation for music.

Primarily a developmental study, Barker (2003) had $N = 40$ subjects age 8 to 10 years create pentatonic melodies on a MIDI keyboard with a recorded accompaniment. Results indicated subjects' involvement in families' musical and nonmusical activities was related to their consensual assessment creativity scores. While researchers have found relationships between informal musical activities and creativity scores, the relationship between formal instrumental performance and creativity seems only related to the creative process, not the creative product. Hickey's (1995) study comparing students' creativity ratings using both CAT and the MCTM found no relationship between creativity scores on both CAT and MCTM-II and level of musical performance experience. While Mellor (2008) did not rate compositions for creativity, no difference was found in compositional strategies between students with and without formal instrumental music tuition (FIMT).

Alternatively, in giving students a variety of choices of instruments from which to choose for musical composition, Carlin (1997) found that age and formal music training were primary factors affecting compositional processes. Younger and less trained subjects spent more time exploring sounds and combinations of sounds before assembling their composition. Hewitt (2009) explored the compositional processes of N = 760 subjects aged 8 to 12 years as they created 1696 short melodies using a computer application. Older participants and those with formal instrumental music tuition (FIMT) were far less likely to use the exploratory functions of the composition software. Those who were older and had more instrumental experience also worked faster than younger children, initiating more functions in the same amount of time. The range of actions with the computer software became more restrictive for all groups as they became more experienced and familiar with the computer software. These findings corroborate the findings made by Seddon and O'Neill's (2003) in their study of N = 48 adolescents which found students with FIMT spent less time in the exploratory phase of composition. Hewitt (2002) also found similar significant differences between expert and non-expert composers in a study of the compositional processes of music specialist and generalist pre-service teacher's group composition.

Seddon and O'Neill (2006) used the consensual assessment technique in studying 48 compositions created on the computer by students age 13-14 with and without formal instrumental music tuition (FIMT). Both specialist (music) and generalist teachers rated the compositions on three items: overall impression, creativity, and craftsmanship. No significant differences were found between the compositions of students with or without FIMT by either generalist or specialist (music) teachers. These findings supported earlier

research (Seddon & O'Neill, 2001) in a similar study with younger children. Specialist music teachers rated compositions by those students with FIMT higher for the factor of "technical complexity," and examination of the musical parameters of their compositions showed evidence of greater melodic and rhythmic development (Seddon & O'Neill, 2001).

Daignault (1997) examined the compositional processes used by $N = 25$ children aged 10 and 11. Differences were found in compositional strategies between those children whose scores for creativity and craftsmanship fell in the highest and lowest thirds. Piano experience was found to be an important factor, with significant differences found in compositional process variables between pianists and non-pianists. Daignault also reported that a majority of students in the highest creativity group were pianists (71%), while a majority of the subjects in the lowest scoring group (71%) were not. While mean scores for creativity and craftsmanship were not reported for pianists and non-pianists, results indicated that pianists approached the process of composition in significantly different ways than non-pianists. Subjects with high creativity and craftsmanship ratings tended to generate product-oriented improvisations, while those created by subjects with lower creativity tended to be process-oriented.

Priest (2001) collected musical compositions from $N = 54$ non-music major college students enrolled in a music fundamentals class. Eight elementary music educators rated the compositions on four dimensions: creativity, melodic interest, rhythmic interest and personal preference. Subjects were then grouped based on low, middle and high creativity rankings. While Priest (2001) did not systematically collect and analyze music experience data, it did not seem to be a factor in compositional

creativity. Some students with extensive previous musical experience produced compositions with low creativity ratings, while others with little previous experience had highly creative compositions. Students with more formal training who exhibited middle or lower levels of creativity seemed to be more concerned with performance attributes rather than structural qualities.

While literature observes and discusses informal music practices, or those music experiences which occur outside the school or institutional setting, there is little quantitative research to be found on how this experience influences musical creativity, especially that which occurs within an institutional setting. A general dichotomy seems to exist between music which occurs in formalized situations like school, and that which does not. Auh's (1997) and Barker's (2003) studies mentioned above are two examples. Folkestad (2006) recognized the important contributions knowledge of informal music experience has brought and can still bring to the field of music education. He defines the formal music learning situation as:

> …activity [which] is sequenced beforehand…arranged and put into order by a 'teacher', who also leads and carries out the activity. However, that person does not necessarily have to be a teacher in the formal sense, but a person who takes on the task of organising and leading the learning activity, as, for example, one of the musicians in a musical ensemble. (Folkestad, 2006, p. 141)

Whereas in the informal music learning situation "…is not sequenced beforehand; the activity steers the way of working/playing/composing, and the process proceeds by the interaction of the participants in the activity" (p. 141). Both types of music learning can occur inside or outside a school or institution (Folkestad, 2006).

Green (2002) identified the informal music learning practices of musicians who gplay popular music. The fifteen musicians interviewed in the study shared that they had

acquired their music skills and knowledge largely outside the formal educational setting. Practices such as listening to and copying recordings or other musicians, playing instruments with peers, and "picking up" skills from other musicians were classified as informal music learning. Among the informal music learning experiences of almost all participants was joining a band at an early stage in the music learning process. Green suggested some practices from the informal music learning experience might be incorporated in formal music education.

Task Design

An important consideration in the investigation into computer-based composition is the design of the musical composition task. Wiggins (2002) suggested too much structure can inhibit creativity and personal expression, while too little can cause students difficulty because of too many choices (Folkestad, 2004). Some researcher-provided stimula for tasks or constraints on task structure can be very specific, such as pictures, poems, given musical parameters such as pitch set, instruments, length of time, or meter (Auh, 1997; Auh & Walker, 1999; Barker, 2003; Byrne, MacDonald and Carlton, 2003; Carlin, 1997; Daignault, 1997; Gall and Breeze, 2008; Griffin, 2010; Gromko, 1996; Kennedy, 2004; Kratus, 2001; Nilsson & Folkestad, 2005; Seals, 1989; Smith, 2008; Yannon, 2011; Younker & Smith, 1996). Others offer completely unstructured or open-ended tasks which often invite the participants to "compose a piece which sounds good to you" (Auh, 1997; Burnard, 2006; Emmons, 1998; Folkestad, Hargreaves, and Lindstrom, 1988; Hewitt, 2009; Hickey, 1995; Kratus, 1985; Mellor, 2002, 2008; Nelson, 2007; Seddon and O'Neill, 2001, 2003; Stauffer, 2002, Swanwick & Franca, 1999; Tsisserev, 1998; Younker, 2000). Many studies have examined musical creativity under varying

constraints imposed by the task structure (Beegle, 2006; Brinkman, 1999; Burnard, 1995; Burnard & Younker, 2002; Doig, 1942; Hall, 2007; Hauser, 2012; Kaschub, 1999; Kennedy, 2002; Kratus, 2001; Laczó, 1981; Martin, 2002; Priest, 2001; Smith, 2008; Swanwick, 1988; Swanwick & Tillman, 1986).

In Barrett's (1996) examination of the compositions of $N = 137$ children age 5 to 12, directions on the task were that the piece should have a beginning, middle, and an end. The results indicated that even the youngest children in the study could make musical and aesthetic decisions about the structure of their compositions. Nilsson and Folkestad (2005) found that unstructured (open-ended) tasks were more likely to be viewed by the children as school tasks than the other tasks they completed, and that the task itself was one of five phenomena that might take precedence in the children's music-making as they composed.

Smith (2008) investigated the effects of various levels of researcher-imposed task structure on the compositional products of $N = 12$ elementary school recorder students age nine to 10 years. The subjects each completed six composition tasks which ranged from unstructured, in which the students were simply asked to create a piece of music on their soprano recorder, to highly structured, for which the students were given poems from which to choose and asked to "create a song out of the poem by making up a piece of music on your recorder that people could sing" (p 163). Using an adaptation of Amabile's (1996) *Consensual Assessment Technique*, four musician judges ranked them for musicality, which was defined to include craftsmanship, originality, imagination and idiomatic recorder sound.

Results suggested a relationship between the type of task and the musicality of the resulting compositional products. The poem task (most structured) led to compositions ranked higher in musicality, while the pieces created with the least amount of imposed task structure were often the lowest ranked in musicality. The amount of time children spent on each of the tasks was not significantly different and was not a factor in creating works of higher musicality.

Data from post-compositional interview indicated that different children preferred different types of task structure. Smith (2008) indicated that children with some formal musical background preferred to create pieces when they were given relatively few parameters to include in their pieces. This may not hold true for older subjects or those with more musical experience. The diversity of opinion regarding task structure is similar to findings by Brinkman (1999) and Kaschub (1999). Subjects in Brinkman's study showed a significant preference for the open-ended task. Smith (2008) suggested that it is probably best to use a variety of task structures when working with young composers. This is consistent with van Ernst (1993) and Burnard (1995), who found different students like different amounts of structure, and Hickey (2003) who suggested that "offering a variety will allow all students a chance for success" (p. 44).

More structured tasks may enable beginning composers to create pieces that have more musicality, however once students understand the principles of balance, repetition and contrast, they might be more successful at unstructured tasks (Smith, 2008). Smith (2008) offered:

> Task structure issues should be of concern to teachers who work with beginning composers: however, it is likely that good compositions can occur under many differing conditions of task structure. The effectiveness of the results probably

> depends, at least to some degree, on the preferences and experiences of the students and their teachers. (p. 173)

Nilsson and Folkestad (2005) suggested that teachers need to be prepared to vary their methods in order to be supportive of children's compositional efforts.

Wiggins (1999) suggested giving students "Enabling Parameters" (p. 33) for musical compositions. These should be limited to one, broad, over-arching idea, like ABA form, a metric idea (a section in duple meter or triple meter), textural idea (melody and accompaniment, or a canon), or a harmonic structure (teacher provides a chord sequence).

In studying the work of $N = 8$ in-service music teachers working with classes of 11- to 16-year-old students, Leung (2004) found that success in designing creative music projects for the classroom depended on 10 teaching strategies: 1.) the nature or selection of the creative task (melody writing, sound project, or rearrangement and performance of existing musical pieces); 2.) integration of performing and listening activities in creating music; 3.) connection between lessons; 4.) provision of assessment criteria for the creative task; 5.) negotiation for the creative task; 6.) music teachers as musical models; 7.) provision of sufficient time; 8.) musical conceptualism; 9.) provision of ongoing feedback during the creative process; and 10.) encouraging two-way communication between teacher and students.

Chapter 3: Methodology

Subjects

The subjects ($N = 48$) in this study were high school students in grades 9-12 of a large, suburban school district in Central New Jersey. All subjects were of approximately equal middle-class socio-economic status and were chosen based on their enrollment in a music technology elective class during the spring of 2007. Students registered for Music Technology and Application through their guidance counselor, who assigned them to the course for reasons ranging from the student's need for a computer or arts elective for fulfillment of graduation requirements to the student's having a general interest in the topic of study.

Guidance counselors assigned students to one of two levels, Music Tech A or Music Tech B, based on prior musical experiences. Class A was intended for students with little or no previous musical experience; those familiar with music notation (how to read treble and/or bass clef staves) and who had some type of instrumental music performance experience were assigned to the B level class. Instrumental experience of those students in the B level class varied from formal study in the school band and private music lessons to recreational playing of an instrument at home. Students in the A section received remedial instruction in reading music notation and playing the piano keyboard prior to beginning composition projects.

The school's scheduling computer assigned students to one of four different class periods (two of the A section and two of the B section). Class size was limited to 13 due to the number of available MIDI computer stations in the Music Technology lab. Students attended class for 50 minutes every school day from February through June.

Music Experience Questionnaire

Each student completed a *Music Experience Questionnaire* at the beginning of the semester. The questionnaire was designed to gather as much information as possible regarding subjects' musical background. The information gathered included any piano or keyboard experience the subject had, the level of this experience, the subject's music reading ability, the number of instruments each subject played, how long they had studied each instrument, whether they had taken formal lessons on an instrument, how many music classes the subject had taken, any extra-curricular musical activities in which the subject had participated, whether students performed music outside of school, and approximate number of hours spent per week engaged in music listening and performing. (See Appendix A.)

Students' names and experience were kept anonymous and separate from the compositional data collected to avoid bias in judgment. Assent was obtained from the students to use their compositions in the research study (See Appendix B), parental permission was secured for use of student work in the study (See Appendix C), and permission was obtained to complete the study on school premises (See Appendix D).

Course Content

During the semester, students completed several units of study with the objective of building music skills and knowledge as applicable in a music technology setting. After receiving instruction on a given musical objective, students practiced their new knowledge and skills by creating a musical composition using the computer. Objectives included study of the musical concepts of form, timbre, pitch sets, harmony, rhythm,

texture, style, and expression, as well as how to implement these musical constructs in composition using computers and music software.

Skills were built throughout the semester, beginning with recording and arranging fully notated music provided by the teacher, in which students recorded several lines of written music but used the computer to manipulate timbres, rhythms and tempi for arrangement, to composition of an open-ended piece in a style of the students' choice without any musical material provided by the instructor. This provided variety in task structure, as recommended by Hickey (2003), Nilsson and Folkestad (2005), and Smith (2008). It also built students' confidence in composing and expressing their musical ideas throughout the semester, and decreased the apprehension felt by some students at having to provide all the musical material for a composition. As students gradually became more competent using the available software and hardware, more comfortable manipulating musical elements, and more confident presenting their musical ideas, they enjoyed more freedom of choice in completing music composition tasks.

Classroom Environment

The classroom environment was one of encouragement and support of the students, and met many of Leung's (2004) suggested strategies for designing creative music projects. Listening examples representative of the concepts under study and their implementation in electronic compositions were integrated into instruction and frequently discussed in class. The music teacher often acted as a musical model, providing examples of successfully completed activities or similar projects. There was connection between lessons, with music concepts being linked together in the curriculum. New lessons and assignments built on and incorporated previous skills and knowledge. Assessment rubrics

were provided with assignments so students knew what was expected from the start, and requirements for projects were negotiated with students as they learned their strengths and weaknesses throughout the semester.

While the teacher presented new information and concepts to the group, students worked individually at MIDI computer stations completing their assignments. Due to the nature of the class and the small number of students, the teacher was able to act as facilitator, listening, guiding, and helping students while they worked at their own pace. The amount of time given to complete each unit of study was dependent on the complexity of the task, but usually ranged from one to two weeks. Projects had due dates, but extra time was afforded to those students who needed it, and the teacher was available before and after school for extra help. Upon completion of each of the class projects, students shared their compositions with the class in an atmosphere of supportive group critique. Students' commented on what they liked about their peers' compositions and made suggestions for further improvements.

MIDI Workstation

Students completed all of their composition assignments using Cakewalk's SONAR Home Studio 4XL software running on Dell computers with the Windows XP operating system. The stations utilized Korg X5-D keyboards as the MIDI interface with the workstations networked together via a Yamaha Piano Lab Master Controller. The piano lab configuration, with headphones and microphones, enabled the teacher to communicate individually with each student while listening to their work. The SONAR software allowed students to record and manipulate MIDI data alongside audio files and effects, giving students the option of both MIDI and live instrumental and sound

recording. The software and hardware components were leading brands with excellent functionality when the study was conducted in 2007.

Compositions

Eight composition tasks were completed by the subjects during the semester: Drum Beats, Canon, Video Game Music, Commercial, Blues, Melody, Tone Poem, and Free-compose. The Canon, Blues, and Free-compose tasks were selected from the course assignments for examination in this study because they were representative of work from the beginning, middle, and end of the semester. This allowed examination of a range of the creative work accomplished by the students. The assignments also exemplified the spectrum of compositional freedom represented in task structure.

Canon composition. The first composition recorded as part of this research was a student arrangement of Pachelbel's "Canon in D." As this was one of the earliest composition assignments in the semester, the primary objective was to familiarize students with the MIDI workstation and the software sequencing program. Secondarily, students with little music reading and decoding experience were provided an opportunity to practice these skills. The assignment also enabled those students with little piano experience an opportunity to practice note entry at the computer through the piano keyboard interface.

The assignment required students to read both the treble and bass clef staves and record their playing of six eight-bar phrases of Pachelbel's "Canon in D" on the keyboard into the Cakewalk SONAR Home Studio 4XL sequencing program. Upon completion of recording the musical material provided by the teacher, students were instructed to create their own arrangement of the piece. They could play the phrases as many times as they

liked, in any order, in any combination, at any tempo, and with any MIDI instrumentation of their choice. Students were also asked to compose a new 8-bar melody of their own that fit the harmony and phrase structure.

During the instructional unit, the teacher played recordings of different arrangements that had been completed by professional musicians from a wide variety of traditions ranging from classical to popular. In this way, students were exposed to a variety of creative solutions. Students were reminded that they could incorporate ideas learned in previous lessons including drum beat patterns that were personally aesthetically pleasing. Because the piece of music had already been adapted to many genres including pop, the limitation of keeping within the classical tradition was not applicable.

This preparatory exercise with established guidelines enabled the students to be musically creative without becoming overwhelmed by having to provide all of the musical material for a composition, thereby reducing possible anxiety at having to complete such a large task on their own. (See Appendix E.)

Blues composition. The second composition collected from the students for this study was a piece of music written in the blues style. Before beginning work, students listened to various examples of the blues, including several performances by Bessie Smith and B. B. King. As this was a style of music with which many students were unfamiliar, preparatory work included writing an AAB blues lyric, study of the blues scale, the 12-bar chord progression, and the instruments traditionally used in the style. Upon completion of introductory work, students recorded a 12-bar blues walking bass and chord pattern into the computer over which they improvised a melody using the blues

scale. Although any MIDI instrumentation was allowed, subjects were encouraged to choose those instruments which sounded authentic to the style and to use a different timbre for each of the three elements within the composition: the walking bass pattern, the chord pattern, and the improvised melody. Students had the option of including a vocal recording of their lyrics as part of their composition.

This composition task had fewer guidelines than the canon project, as there was only one line of music for the students to record note-for-note: the walking bass line. Though the chords were provided, the rhythms, tempi and instrumentation were chosen by the students. The term "improvisation" was used frequently throughout the assignment to indicate the melody line of the composition. While improvisation is an integral component of the musical genre, it was understood that once a musical line was decided upon and recorded, it became composition and was no longer improvisation. (See Appendix F.)

Free-composition. The third composition collected from the students was an open-ended assignment completed near the end of the semester. The directions to the students were, "Using the skills you have learned throughout the semester, compose a piece of music in your own style approximately three minutes in length." The students were allowed to choose the style, genre, tempo, instrumentation, texture, and tonality of their music. As this was a culmination of work completed throughout the course, students were expected to incorporate skills learned in previous assignments such as writing melodies with 8-bar phrasing, ABA form, major and minor tonalities, as well as use of both MIDI data and wave files of recorded acoustic sounds. No musical material was provided by the instructor.

Collection of Compositions

As students completed each of the composition tasks throughout the semester, it was common practice to share their completed work with classmates. The researcher digitally recorded the musical compositions from the computer while subjects shared their work with their peers. Students were offered the opportunity to have digital recordings of all their work from the semester on compact disk. The recorded music files from the three selected compositions for study were saved separately onto compact discs by the researcher for creativity rating.

Consensual Assessment Technique

The *Consensual Assessment Technique* method of evaluating creativity is based on the premise that "a product or idea is creative to the extent that expert observers agree that it is creative" (Amabile, 1983, p. 31). This theory holds that experts in a field or domain are the best judges of creativity in that field or domain. In contrast to psychometric measures of creativity, which are often standardized, paper and pencil tests, development of the *Consensual Assessment Technique* has enabled measurement of a wide variety of creative products (Amabile, 1996; Baer & McKool, 2009).

Assessments of musical creativity such as Vaughan's (1971) *Test of Musical Creativity* (TMC) and Webster's (1977) *Measures of Creative Thinking in Music* (MCTM) are based on the *Torrance Tests of Creative Thinking* and the divergent-thought model of creativity. They require subjects to complete certain, pre-designed, creative musical tasks which are likely foreign to the musical practice of the subjects. These tests have been criticized as measuring the adaptability of music skills or music achievement to a music problem-solving situation rather than musical creativity.

A key element of judging creative musical products is soliciting creative responses (products) which are authentic representations of subjects' musical creativity. For valid assessment of musical creativity, students should be asked to create in a domain-specific environment in a music practice with which the student is fluent. It is not possible to use methods such as the TTCT, TMC, or the MCTM to measure the creativity found in this context.

The nature of consensual assessment makes it flexible and highly adaptable to a number of different types of creative products. This is largely because it relies on the subjective opinion of expert judges familiar with the domain in which the products were created and because products from a single task are judged relative to each other. Evaluation of authentic representations of students' musical products is only possible using consensual assessment technique.

The 48 responses for each of the three composition tasks were recorded on compact disk and given to four expert judges for creativity rating. Each of the judges received the responses for each task in a different random order, as suggested by Amabile (1996). The judges also received explanations of each composition assignment, directions for rating the compositions, and evaluation sheets.

Judge selection. Amabile (1996) outlined several guidelines for using the *Consensual Assessment Technique*. She stressed that in selecting judges, the researcher must be confident that they "…be familiar enough with the domain to have developed, over a period of time, some implicit criteria for creativity, technical goodness, and so on" (p. 42). She continued to state that judges do not need to possess the same background or

level of experience. Their selection should be based only on their familiarity with the domain (Amabile, 1996).

Additional methodological guidelines include instruction that judges make their assessments independently.

> The integrity of the assessment technique depends on agreement being achieved without attempts by the experimenter to assert particular criteria or attempts by the judges to influence each other. Thus, the judges should not be trained by the experimenter to agree with one another, they should not be given specific criteria for judging creativity, and they should not have the opportunity to confer while making their assessments. (Amabile, 1996, p. 42)

Further, judges should be instructed to rate the products relative to each other on the dimensions in question, not against some absolute standards for work in their domain.

The four judges in this study were chosen based on their experience teaching high school student musicians. One was an instrumental music teacher, another a vocal music teacher, and two had experience in teaching both vocal and instrumental music as well as music theory. The music teaching experience of the judges ranged from 4 to 25 years. All four judges completed their assessments individually over their summer vacation and were not aware of the identities of the others. For judges' instructions, see Appendix G.

Number of judges. Consensual Assessment studies have obtained acceptable levels of reliability with as few as two judges (Amabile, 1996) and as many as 24 (Hickey, 2001). While studies have used a wide ranging number of judges, those with a greater number are likely to have higher reliability. Research studies employing many judges tend to rate fewer products for creativity on a measurement tool with as few as three dimensions. Hickey (2001) had 24 children rate 12 compositions on two dimensions, "Liking" and "Creativity," while Amabile, Hennessey and Grossman (1986) had 3 judges rate the creativity of 115 children's stories on 23 dimensions. Bangs (1992)

obtained acceptable reliability using three judges to rate the creativity of children (*N* = 37) who each completed two musical compositions. Four judges were used in this study to obtain acceptable reliability while maintaining a reasonable amount of data for analysis.

Dimensions of Judgment Tool

This study used Bangs' (1992) 19-item adaptation of Amabile's (1983) *Dimensions of Judgment* tool to rate 144 musical compositions. Initially designed for visual art projects, Bangs' (1992) changes to Amabile's tool were made to account for the temporal nature of music. To make judging easier for the study of musical creativity, Bangs (1992) grouped the nineteen dimensions into those related to the overall creativity-relevant dimensions of the piece (the first nine items) and dimensions related to the musical aspects or craftsmanship of the piece (the remaining ten items). This was to decrease fatigue when listening, allowing judges to complete ratings in one or two hearings of each composition.

Compositions were rated on a 1-5 scale for the following dimensions: creativity, novel use of instruments, novel musical idea, liking, overall aesthetic appeal, worth hearing again, effort evident, freedom, meaningfulness, movement, form, variety, pleasing use of sounds (timbre), pleasing use of texture, overall structural organization, detail, accuracy of performance, expression, and complexity. (See Appendix H for the *Dimensions of Judgment* tool.) The judges listened to the assignments and rated each composition relative to the other entries for that task using the *Dimensions of Judgment* tool for consensual assessment. Judges were instructed to use their own subjective definition of creativity to rate the compositions and to use the entire spectrum for judging

each dimension on the measurement tool. Judges completed their assessments individually and were encouraged to take breaks to avoid fatigue. For judges' instructions, see Appendix G

Data Collection

All of the judges' scores for each composition were entered into the Statistical Package for the Social Sciences (SPSS). Subjects received a creativity score for each composition task as well as an average creativity score for their performance on all three tasks. Descriptive statistics were calculated using the the judges scores for each of the composition tasks as well as the average creativity scores across all three tasks. Inter-judge reliability was calculated for each of the composition tasks as well as for average creativity scores across the three tasks using both the Intraclass Correlation Coefficient and Cronbach's alpha. While Amabile (1983, 1996) suggests Cronbach's alpha is an appropriate measure for inter-judge reliability using the Consensual Assessment Technique, Intraclass Correlation Coefficient is the conventional means for measuring this statistic. Both will be calculated and the results compared.

In parallel with the judges' valuations for creativity, responses from the *Music Experience Questionnaire* were coded and categorized for entry into SPSS with corresponding subject creativity scores. A description of the subject pool was obtained that included whether students had played the piano, how students rated their piano proficiency on a 1-5 Likert-type scale, the instruments each subject had studied and how long, the number of years subjects had taken music lessons if any, the number and type of music classes subjects had taken, whether subjects had engaged in musical activity outside of school, the nature of musical activity engaged in outside of school, how long

they had engaged in this activity, and the estimated amount of time subjects spent engaged in musical activities each week. One-Way ANOVA, independent samples *t*-tests, and Pearson product-moment correlations were used to test the null hypothesis for each of the research questions.

With regards to the first research question, musical creativity scores were compared with students' Instrumental Music Experience as defined by a) the number of Years of Instrumental Lessons they had taken; b) the total Number of Instruments Played; c) their level of Piano Skill; and d) whether they had Guitar Skill. The second research question examined musical creativity scores relative to School Music Experience, which was defined by a) Participation in a School Ensemble; b) Music Theory Class experience; and c) Number of Music Classes taken. The third research question looked for any difference in musical creativity scores based on Non-School Music Experience as defined by a) students' Participation in a Rock Band; and b) number of Years of Participation in a Rock Band. Results of the analysis are reported in Chapter Four.

Chapter 4: Results

Subjects

Subjects (*N*= 48) in the study were selected from the student body of a large, suburban high school in central New Jersey. Fifty-eight percent (58%) of the subjects were male, while 42% were female, and their average age was 16.67 years. While the participants were in grades 9-12, students in grade nine composed only 10% of the group, while 63% were in grades 11 and 12. The previous music experience of the subjects varied greatly, from those students for whom the class in which the study was conducted was the only music class they had taken in high school (27%) to those who had taken multiple courses and/or had participated in performance ensembles (73%). Almost half of the subjects (48%) had taken three or more music classes.

Subjects on average played three musical instruments. While 17% had not taken any instrumental lessons, 73% had taken at least one year of lessons on an instrument, with 58% having taken 3 or more years of lessons. Fifty-six percent (56%) of the subject pool had participated in a school ensemble, while 31% had spent 5 or more years in a school ensemble. Fifty-eight percent (58%) reported they played the piano, while 48% reported they played the guitar.

Creativity Scores

Each of the subjects completed three compositions which were rated by three expert judges on the nineteen-item *Dimensions of Judgment* tool. Each composition received a total score for musical creativity, and each subject received an overall Musical Creativity score which was as average of their scores on the three compositions.

Creativity scores were analyzed and compared using Statistical Package for the Social Sciences (SPSS). Musical creativity scores were analyzed for normalcy and homogeneity of variance, and approximated normal distributions for all compositions. Table 1 shows subjects' mean creativity scores and standard deviations as rated by each of the expert judges on all of the compositions.

Table 1

Judges' Mean Creativity Scores for Compositions

	Canon		Blues		Free-Compose		Average of three compositions	
Judge	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	77.88	8.56	79.75	13.17	79.69	11.24	79.11	7.25
2	56.76	17.71	46.74	15.49	56.22	18.76	53.24	12.47
3	53.22	11.80	55.52	13.40	62.38	14.37	57.04	9.16
4	62.03	18.13	54.99	19.20	60.42	18.12	59.14	14.69

Judge 1 scored consistently higher for creativity than the others, with a mean of 79.11 (SD 7.25), while the rest of the judges' mean scores fell between 53 and 63 with the exception of Judge 2 on the Blues compositions.

Though judges were encouraged to use the entire scale for rating all compositions, Table 2 shows the entire range was not consistently employed. Judge 2 used the lowest score only on the Blues and Free-Compose tasks, while Judge 4 used it only for the Blues, and Judges 1 and 3 did not employ the lowest score at all. Minimum scores on composition tasks ranged from 19.00 to 53.00, while maximum scores ranged from 73.70 to 95.00. The highest scores were given on the Free-Compose task, while the lowest were given on the Blues composition (see Table 2).

Table 2

Judges' Minimum and Maximum Scores for Compositions

	Canon		Blues		Free-Compose		Average of three compositions	
Judge	Min.	Max.	Min.	Max	Min.	Max.	Min.	Max.
1	53.00	93.20	29.60	93.60	34.00	95.00	59.73	89.80
2	31.10	92.20	19.00	73.70	19.00	85.30	26.93	76.40
3	34.00	84.40	25.00	87.60	28.00	95.00	32.93	81.07
4	30.20	94.00	19.00	90.80	25.80	94.00	29.63	89.57

An average of the four judges' scores was taken to create a Musical Creativity mean score for each subject for each composition, as is reported in Table 3. An average of the Musical Creativity scores across the three composition tasks was taken to calculate an overall mean Musical Creativity score for each subject across all composition tasks, reported in Table 3. Musical Creativity mean scores were highest for the Free-Compose task and lowest for the Blues.

Table 3

Mean Musical Creativity Scores for All Compositions

Descriptives	Canon	Blues	Free-Compose	Average of three compositions
Mean	62.47	59.23	64.68	62.13
SD	10.26	12.23	12.73	9.30
Min	43.53	23.15	26.70	37.31
Max	82.90	84.85	88.68	84.21

Reliability

While the judges seemed to use the measurement tool differently, the inter-judge reliability reached acceptable levels and internal consistencies were quite high. The

Intraclass Correlation Coefficient as calculated by SPSS was used to determine internal consistency of the judges' ratings for the *Dimensions of Judgment* measurement tool. This will be referred to as inter-judge reliability for scores on the three compositions and Musical Creativity mean scores. Amabile (1996) used Cronbach's alpha to calculate inter-judge reliability, having found this method simple and straightforward, with results similar to the Intraclass Correlation Coefficient. While the results are the same, Cronbach's alpha is based on the assumption that "judge" is a fixed effect: the same judges rating the same compositions would again give the same ratings. Calculations showed inter-judge reliability for both measures to be the lowest for the Canon at .64 and highest for Musical Creativity mean scores at .83. Reliability scores for all compositions are reported in Table 4, indicating the 19-item form of the *Dimensions of Judgment* is a moderately reliable instrument for measuring high school students' creativity in electronic musical composition under certain task structures.

Table 4

Inter-judge Reliability for Creativity Scores

Composition	Reliability
Canon	.64
Blues	.79
Free-Compose	.80
Musical Creativity	.83

Music Experience and Creativity

Creativity scores were analyzed with respect to the descriptive data reported on the *Music Experience Survey* to investigate relationships between music experiences and musical creativity scores. One-Way ANOVA, independent samples *t*-tests, and Pearson product-moment correlations were used to test the null hypothesis for each of the independent variables with respect to creativity scores. Variables were categorized by those which pertained to Instrumental Music Experience, School Music Experience, and Non-School Music Experience. Variables reported under Instrumental Music Experience include: Years of Instrumental Lessons, Number of Instruments Played, Piano Skill, and Guitar Skill. School Music Experience variables reported are: Participation in a School Ensemble, Music Theory Class experience, and Number of Music Classes taken. Non-School Music Experience includes Plays in a Rock Band and Years in a Rock Band.

Instrumental Music Experience. In this study, the students collectively played 144 instruments from all families including two students who studied voice. Students played an average of three instruments, with two subjects reporting they did not play any instrument and one student who reported playing eight instruments. Frequencies of instruments studied are reported in Table 5 from highest to lowest.

Years of Instrumental Lessons. In addition to the instruments they played, subjects reported the number of years they had taken lessons on each instrument. The instrument on which students had taken the greatest number of years of lessons was considered their primary instrument. Years of Lessons on Primary Instrument ranged from 0 to 11, with a mean of 3.70 (SD 3.30). The Total Years of Lessons taken on all instruments was calculated by adding the number of years students had taken lessons on

all instruments they played. This ranged from 0 to 29.50, with a mean of 5.63 (SD 6.37). Correlations were found between creativity scores and Years of Lessons on Primary Instrument as well as Total Years of Lessons, with a weak correlation also found between the Number of Instruments Played and Musical Creativity scores. Correlations are reported in Table 6.

Table 5

Instruments Subjects Reported Playing

Instrument	n	% of group	Instrument	n	% of group
piano	28	58.33%	voice	2	4.17%
guitar	23	47.92%	banjo	1	2.08%
drums	15	31.25%	bagpipes	1	2.08%
clarinet	13	27.08%	baritone saxophone	1	2.08%
alto saxophone	11	22.92%	bass clarinet	1	2.08%
bass guitar	11	22.92%	cello	1	2.08%
violin	7	14.58%	euphonium	1	2.08%
flute	4	8.33%	French horn	1	2.08%
mallet percussion	4	8.33%	harp	1	2.08%
trumpet	4	8.33%	mellophone	1	2.08%
harmonica	3	6.25%	oboe	1	2.08%
recorder	3	6.25%	sitar	1	2.08%
acoustic bass	2	4.17%	tenor saxophone	1	2.08%
trombone	2	4.17%	Total	144	

To investigate whether the number of years of instrumental study affected creativity scores, subjects were placed in one of three groups according to the number of years they had studied their primary instrument (the instrument on which they had taken

lessons the longest). Groups consisted of those students with less than one year of instrumental lessons, those who had taken one to five years of instrumental lessons, and those with six or more years of instrumental lesson experience. A one-way ANOVA showed no significant difference in scores for any of the compositions or for overall Musical Creativity scores $F(2, 45) = 2.12$, $p = .13$ (two-tailed). While there is a correlation between years of lessons and creativity scores, the number of years of lessons a subject has taken does not seem to affect musical creativity scores.

Table 6

Correlations between Creativity Scores and Instrumental Experience Variables

Variable	Canon	Blues	Free-Compose	Mean Creativity
Total Years of Lessons		.33*	.36*	.38*
Years Primary Instrument		.29*	.36*	.37*
Number of Instruments				.31*

*Correlation significant at $p \leq .05$; **Correlation significant at $p \leq .01$ (two-tailed)

Piano Skill. More than half of the subject pool (58%) reported that they played the piano. Investigation into Piano Experience revealed that subjects with experience had significantly higher Musical Creativity scores compared to those students without $t(46) = 2.52$, $p = .02$ (two-tailed). Students with Piano Experience also scored significantly higher for creativity on the Blues composition versus those who had none $t(46) = 2.67$, $p = .01$ (two-tailed). Subjects' mean creativity scores by Piano Experience are reported in Table 7.

Subjects rated their Piano Skill level on a Likert-type scale (1-5). Average Piano Skill rating was 3.31 (SD .98) with a minimum rating of 1.00 and a high of 5.00. Significant correlations were found between subjects self-reported Piano Skill level and Blues, Free-Compose, and mean Musical Creativity scores, which are reported in Table 8. No significant correlation was found between Piano Skill level and creativity scores on the Canon.

Table 7

Mean Creativity Scores for Students With and Without Piano Experience

		Canon		Blues		Free-Compose		Musical Creativity	
Piano	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Yes	28	64.43	9.28	63.00	9.86	67.11	11.32	64.84	7.91
No	20	59.74	11.17	54.00	13.51	61.28	14.06	58.34	9.96

Table 8

Correlations between Creativity Scores and Piano Skill

Variable	Canon	Blues	Free-Compose	Mean Creativity
Piano Skill		.44**	.48**	.48**

*Correlation significant at $p \leq .05$; **Correlation significant at $p \leq .01$ (two-tailed)

Piano Skill groups were created according to ability level of low (self-rated 1-2), average (self-rated 2.1-3.9), and high (self-rated 4-5) for analysis of creativity scores. One-way ANOVA showed significant differences in scores between groups for Blues, Free-Compose, and Musical Creativity. See Table 9 for ANOVA results.

Scheffé post hoc analysis showed students in the high Piano Skill group scored significantly higher on the Blues composition, Free-Compose project and for mean Musical Creativity than those in the low Piano Skill group. Students in the average piano skill group also scored significantly higher than the low group on the Free-Compose project. Mean creativity scores are reported in Table 10 by Piano Skill group.

Table 9

Analysis of Variance for Piano Skill Groups

		Sum of Squares	*df*	Mean Square	*F*	*p*
Canon	Between Groups	155.46	2	77.73	.730	.488
	Within Groups	4792.78	45	106.51		
	Total	4948.24	47			
Blues	Between Groups	1511.16	2	755.58	6.156	.004
	Within Groups	5523.04	45	122.73		
	Total	7034.20	47			
Free-Compose	Between Groups	1907.15	2	953.57	7.520	.002
	Within Groups	5706.38	45	126.80		
	Total	7613.53	47			
Mean Creativity	Between Groups	935.62	2	467.81	6.722	.003
	Within Groups	3131.94	45	69.60		
	Total	4067.55	47			

Guitar Skill. Almost half of the subject group (48%) reported they played guitar. Independent samples *t*-test showed no significant difference in scores for those students who played the guitar versus those who did not on any of the composition tasks or for mean Musical Creativity scores $t(46) = .664$, $p = .51$ (two-tailed).

Table 10

Mean Creativity Scores by Piano Skill Group

		Canon		Blues		Free-Compose		Musical Creativity	
Group	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD
High	21	64.51	9.19	64.24	7.93	69.20	10.93	65.98	7.52
Avg	16	61.00	10.73	59.21	14.08	66.56	10.96	62.26	8.46
Low	11	60.71	11.74	49.78	11.36	53.31	12.31	54.60	9.62

School Music Experience. Subjects reported whether they participated in a school Performance Ensemble, their Years of Participation in a Performance Ensemble, whether or not they had taken a Music Theory Class, and the Number of Music Classes they had taken while in high school.

Participation in a School Performance Ensemble. Fifty-six percent (56%) of the subject pool reported participation in a Performance Ensemble, while 44% did not. An independent-samples *t*-test showed that subjects in a performance ensemble scored significantly higher for creativity on the Blues composition versus those who did not, with mean scores of 62.31 (SD 12.62) and 55.32 (SD 10.76) respectively, $t(46) = 2.03$, $p = .05$. There was no significant difference in scores for any of the other composition tasks or Mean Creativity $t(46) = 1.32$, $p = .19$ (two-tailed), and no relationship was found between the Number of Years in a School Performance Ensemble and creativity scores ($p = .29$).

Music Theory class. Twenty-five percent (25%) of the subjects had taken one or more high school Music Theory classes. An Independent samples *t*-test showed a significant difference in mean scores on the Free-Compose task for those students who had taken Music Theory versus those who had not. Students with Music Theory

experience had a mean score of 73.48 (SD 7.68) on the Free-Compose task, while those who had not taken Music Theory had mean score of 61.74 (SD 12.79), $t(46) = 2.99$, $p = .004$. There were no significant differences in Canon, Blues or Mean Creativity scores.

Number of Music Classes. There was a significant positive correlation between the Number of Music Classes students had taken and Musical Creativity scores. the Number of Music Classes taken ranged from 1.00 to 5.00, with a mean of 2.52 (SD 1.27). The music class in which the study was conducted was the first and only high school music class for 27% of the subjects, while 23% of the subjects had taken four or more music classes while in high school. Significant correlations are reported in Table 11.

Table 11

Correlations between Creativity Scores and Number of Music Classes

Variable	Canon	Blues	Free-Compose	Mean Creativity
Number of Music Classes	.29*	.34*	.51**	.49**

*Correlation significant at $p \leq .05$; **Correlation significant at $p \leq .01$ (two-tailed)

Non-School Music Experience. Several of the students who participated in the study reported that they played in a "rock" or "pop" band outside of school (38%). Types of rock bands varied by style and intent but included groups students formed with their peers to "jam" in their basement, to perform at Battle of the Bands competitions, or local performance venues, to record original music, and church praise bands. Students who reported they played in a rock band scored significantly higher for creativity on the Free-Compose task versus those who did not, $t(46) = 3.41$, $p = .001$ (two-tailed). Students who played in a rock band also scored significantly higher for Musical Creativity, $t(46) =$

2.30, $p = .026$ (two-tailed). Musical Creativity scores by Rock Band participation are reported in Table 12.

Table 12

Mean Creativity Scores for Students Who Do and Do Not Participate in a Rock Band

		Canon		Blues		Free-Compose		Musical Creativity	
Rock Band	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Yes	18	64.47	10.93	61.39	9.52	71.98	11.10	65.94	8.21
No	30	61.27	9.83	57.97	13.60	60.30	11.72	59.85	9.29

The number of Years Playing in Rock Band correlated with creativity scores on the Free-Compose task and overall Musical Creativity. Correlations between Years in a Rock Band and creativity scores are reported in Table 13.

Table 13

Correlation Between Creativity Scores and Years Playing in a Rock Band

Variable	Canon	Blues	Free-Compose	Mean Creativity
Years Playing in a Rock Band			$.54^{**}$	$.40^{**}$

*Correlation significant at $p \leq .05$; **Correlation significant at $p \leq .01$ (two-tailed)

Summary

While the judges scored compositions differently for creativity, using varied minimum and maximum scores, the inter-judge reliability was acceptable for all compositions and Musical Creativity scores except for the Canon. The Dimensions of Judgment tool as adapted by Bangs (1992) to musical composition is a reliable tool for measuring the creativity of high school students' electronic musical compositions.

Students who participated in the study had a wide range of music experience. Some had never played an instrument while others had taken many music classes and had several years of instrumental lessons. Independent variables in all three categories of Music Experience showed relationships to creativity scores. The Instrumental Music Experience variables of Years of Lessons on Primary Instrument and Total Years of Lessons had significant positive correlations with creativity scores on multiple compositions and the Number of Instruments Played had a significant positive correlation with Musical Creativity. There was also a significant positive correlation between level of Piano Skill and musical creativity scores. The level of Piano Skill had a significant effect on musical creativity scores for certain compositions, and those students with piano experience scored significantly higher for musical creativity than those without.

Variables investigated related to School Music Experience also showed relationships with musical creativity scores. Those students who identified they Participate in a School Ensemble scored significantly higher on the Blues composition. Students who had taken Music Theory class scored significantly higher on the Free-Compose project, and there were significant positive correlations between the Number of Music Classes students had taken and creativity scores.

The Non-School Music Experience variable examined in this study identified students who Participate in a Rock Band. These subjects scored higher on the Free-Compose project and for overall Musical Creativity. A greater number of Years in a Rock Band showed a significant positive correlation with musical creativity scores.

Chapter 5: Discussion

Creativity has been recognized throughout recorded history as one of the most important factors in the advancement of society. Philosophers, psychologists and educators since the time of the ancient Greeks through the present have debated its nature, attempted to describe the phenomenon, and sought to predict its occurrence. From its mystical roots in antiquity to modern scientific study, research on the nature of creativity crosses many fields and there is still no well-defined consensus surrounding what it means to bring something new—be it an idea, a work of art, or product—into being.

The subject is of particular interest in both academic and popular settings in modern society. While the notion of creativity seems to be highly valued in certain elements of modern society—in corporate America for example—specific theories about what is creative, how creativity is to be encouraged, and its connection to the study of human intelligence are numerous and at times contradictory. Philosophers and social scientists alike continue to examine the subject looking to define and classify what constitutes creativity. In the meantime, companies like 3M, Pixar, Apple, and Google are recognized for being especially successful in part because they have put theory into practice, embracing a culture of creativity in the workplace. These companies and others like them have found success by relinquishing the rules of the traditional business or corporate environment and encouraging their employees to work in settings optimized for creative thinking.

Given the value assigned by many to creativity in the workplace, it might be surprising that leading educators and politicians cannot agree on the value of creativity in

the school system and how it should be taught to prepare students for future success. Current trends in education place an enormous amount of value on concrete, objective goals that can be easily assessed. This is due in part to the current standards movement and emphasis on teacher accountability. Education policy is driving educators to produce measureable, data-driven results centered on common assessments and standardized testing. Rather than fostering creativity and innovative teaching, political leaders are pressuring educational policy makers to hold teachers accountable for student learning with numerically measurable results.

Yet educators from the past like John Dewey and current thinkers like Ken Robinson find fault with such rigid thinking. Assuming that schools move away at least in part from the standards movement, a greater emphasis on fostering creative thought in schools might increase. A focus beyond just the STEM subjects (Science, Technology, English and Math) to include the arts also seems a logical path for fostering creativity. The arts by their very nature are creative, especially when they are taught as found in the greater world of art regardless of its cultural context.

The arts generally and music specifically need to exist within the larger fabric of schooling, and must exist in a way which engages all students, not just those who choose to participate in traditional school performance ensembles. There must be clearly defined goals, solid methodology, and creative approaches to assessment. An important first step in music education would be to define and explore notions about musical creativity, building on the knowledge that exists in the field.

A great deal of research in the field of musical creativity did not develop until the 1970s. Since then, many have examined both the process and resulting products of

engagement in creative musical behavior. Many of those who have examined the creative musical process have been reluctant to place a judgment on the product, however, and those who examine the creative musical product have not always solicited authentic representations of musical creativity from subjects' musical practice. Some studies have solicited musical products created under circumstances students have never before experienced, while others have likely been a more accurate assessment of students' music achievement rather than their creativity. Several studies have solicited authentic products from subjects only to study the creative process, with no judgment placed on the creative product. While it is valuable to understand the process of creativity, it is also important to recognize which processes lead to more or less creative results.

This study investigated the relationship between the music experiences of high school students and their musical creativity scores on compositions completed in the music technology laboratory. As students arrive in high school with varying musical backgrounds and experiences, discovering factors which affect creativity may enable teachers to facilitate more successful creative experiences for students. The investigation found that the previous music experiences of students may affect their musical creativity when composing at a MIDI station in the music technology lab. Relationships were found between creativity scores on musical compositions and independent variables addressed by each of the research questions.

The Compositions

All students completed the composition tasks, and each brought a unique solution to the musical problem presented. The music technology lab seemed an ideal venue for studying musical composition, as the students were able to work individually at their own

pace within a supportive environment. Due to the nature of the work, the teacher was able to act as a facilitator, assisting individuals as needed. When students finished their work, they shared their music with their peers who offered constructive critique to be considered for their future projects. The students had positive and encouraging comments for each other's work, even when some projects seemed to still need improvement.

The MIDI computer station with Cakewalk's SONAR Home Studio XL software enabled the students to explore a variety of musical options, and was helpful for students who may not have been strong music readers. Several different interface windows, including a matrix editor and event list editor in addition to the notation editor allowed students to easily view and change graphic representations of their music. The copy and paste functions of the software as well as the ability to slow down and speed up the tempo helped students who lacked technical facility on the keyboard practice small selections of music, play them one or two times correctly, then repeat them as needed throughout the piece. The ability to quantize helped those who had difficulty maintaining a steady tempo keep their music tracks synchronized. Many synthesized and sampled sound selections were available from which to choose, as well as the ability to record audio files of live performance, allowing students the possibility of mixing real and synthesized instruments. While the students did not all employ the entire range of options available in the software, they did use those features which enabled them to successfully complete the composition tasks. While some chose to use many features, others limited themselves to a few with which they were comfortable.

Consensual Assessment of Musical Compositions

With reliabilities ranging from .64 to .83, the Dimensions of Judgment tool developed by Amabile (1983) and refined for musical composition by Bangs (1992) was a reliable method for judging the creativity of high school students' electronic musical compositions. The expert judges, familiar with the work of high school level students, found similar compositions to be of greater or lesser creativity, demonstrating that creativity in the musical composition of high school students is something that can be reliably quantified by teachers. The judges had moderately high levels of internal consistency in evaluating the Blues and Free-Compose composition tasks as well as Average Creativity.

The tool was shown to be less reliable when used for the Canon composition task, which had a reliability of .64. This could be due to the nature of the task and the limited amount of freedom inherent in the task design, as well as the timing of the Canon task within the curricular work of the semester. The design of the Canon composition assignment required all students to record the same 48 measures of music into the computer as the base of the composition. Once that was completed, students were encouraged to make the music "their own" by changing tempo, instrumentation, musical style, and the organization of musical phrases. Use of the same musical material as the foundation for the composition may have been a confounding factor for judges when rating the compositions relative to each other. Although each composition was musically different, the judges heard the same core musical material 48 times, and the compositions may have not been different enough for the judges to effectively rate their creativity.

Timing of the assignment and its placement in the semester may have also contributed to the judges not being able to distinguish creative differences as well on this project as they did the Blues and Free-compose tasks. The Canon composition occurred early in the semester, as the students were learning how to use the computer software. As they were in the early stages of familiarizing themselves with the available software options, there may not have been as much variety apparent as in later compositions which occurred when students were much more confident and comfortable with the software. Additionally, the Canon composition was the second project of the semester, occurring immediately after the Drum Beat assignment in which the students learned six standard drum beats, two of them in 4/4 time. The students were encouraged to incorporate knowledge and skills gained from previous assignments into each new assignment. In arranging the Canon which was notated in 4/4 time in an aesthetically pleasing style, many of the students incorporated one of the two 4/4 drum beats patterns they had learned in the previous assignment, contributing to a lack of variety in the group of compositions.

The measurement tool was much more reliable when used with the Blues and Free-compose composition tasks, illustrating its adaptability to multiple types of creative musical assignments. Both tasks had limited structure imposed by the task design and occurred later in the semester, when students had developed more familiarity with the possibilities available in the computer software. This seems to support the validity of the measurement device for use with creative products in that it was most reliable when subjects were allowed the greatest amount of freedom to express their musical ideas and least reliable when rigid structure was imposed on the creators.

The versatility of the tool in adapting to varying composition tasks such as the Blues and Free-compose assignments may be due to the fact that the Dimensions of Judgment evaluates many facets of the musical work, including items related to both the creative as well as the technical aspects of musical composition. This adaptability seemed inhibited when all the musical examples were required to play the same note set, and students were limited to choices of timbre, tempo, expression, and style. Further research might investigate which of the 19 dimensions prove more or less reliable across different types of task structure. Fewer items, and items related to only the global aspects of the piece being rated, as suggested by Webster and Hickey (1995) may prove more reliable.

Creativity and Music Experience

The data collected from the *Music Experience Questionnaire* showed the subjects brought a great deal of varying music experience to this study. Many of the students played multiple musical instruments and had participated in music making both in and outside of school. Results of analysis of this data with respect to the three research questions demonstrated that variables from each of the three types of music experience examined in the study, Instrumental Experience, School Music Experience, and Non-School Music Experience, may have contributed to creative musical performance on the composition tasks.

Research Question 1: Instrumental Music Experience. Instrumental Music Experiences in this study were defined by Years of Instrumental Lessons, Number of Instruments Played, Piano Skill, and Guitar Skill. The number of Years of Instrumental Lessons subjects had taken and their level of Piano Skill both showed significant positive relationships with musical creativity scores.

Years of instrumental lessons. The total number of years students had taken instrumental lessons ranged from 0 to 29. This number may seem odd when considering the subjects were high school students, the oldest of whom was age 19; however many subjects had taken instrumental lessons for a number of years on multiple instruments. One student reported having played eight instruments, while having taken instrumental lessons on four of them.

The number of Years of Lessons subjects had taken on an instrument showed a positive correlation with creativity scores. A greater number of years of lessons correlated with higher creativity scores on the Blues and Free-Compose tasks, as well as Average Creativity scores. More experience studying musical instruments seemed to enable students to be more creative in musical composition. No difference was found when students were broken down into subgroups by the number of years of instrumental lessons they had taken, however this likely due to the size of the sample. Further investigation using a larger sample with a greater number of more evenly distributed subgroups might provide insight into how many years of lessons or what level of instrumental proficiency might make a difference in students' creativity when completing musical composition tasks such as those in this study. The scope of this study did not allow for proficiency rating on all the instruments that students reported having studied, only the number of years they reported having taken instrumental lessons. Because students' proficiency develops at different rates, further investigation might reveal what level of instrumental proficiency enables them to be more creative when engaged in this type of musical composition.

Piano skill. Piano skill seemed to be the factor with the greatest effect on creativity scores. Students with piano experience had significantly higher musical creativity scores than students without, and students with a higher level of piano skill scored significantly higher for creativity on the Blues and Free-Compose tasks. Those students who rated themselves in the "high" piano skill group agreed they were skilled pianists and could play the piano well with both hands. A higher level of Piano Skill can mean many things, but may indicate that these students had a greater technical facility or were more comfortable with the piano keyboard interface than those with lower piano skills, thereby placing them at an advantage for composition at a computer with a piano keyboard as the MIDI interface.

The class in which the study was administered included lessons on familiarity with the piano keyboard as well as practice exercises over to facilitate composition through the MIDI interface. Additionally, most of the students had been in the school district since middle school, where they received piano keyboard instruction in their general music classes in both seventh and eighth grades. These combined experiences were not equalizing factors when using the keyboard as a MIDI interface for composition. More experience with the sounds and relationships between the keys, even tonal relationships based on white keys and black keys allowed students who were more familiar with the instrument greater freedom of expression.

This factor was not apparent in the Canon composition where there was no significant difference in creativity scores. This may be due to the fact that the creative decisions for this task were based on choices of timbre, tempo, and musical style, all manipulations which could be achieved through using the music software. In the Canon,

less emphasis was placed on students' generation of musical material, as the students were required to provide only one melodic phrase that harmonized with the musical lines given in the assignment. Those students who were not fast music readers and were uncomfortable entering the notes on the assignment sheet by playing them on the piano keyboard in time with the metronome could avoid using the MIDI keyboard entirely by pointing and clicking with the mouse to enter pitches of various durations.

The Blues and Free-compose tasks required the students to generate most or all of the musical material for the composition, and those with greater familiarity with the piano keyboard were able to bring more choices to their compositions, thus be more creative. Even students in the average piano skill group, having only slightly more skill than the low level group, scored significantly higher for creativity on the Free-Compose assignment. The results are further supported by the evidence that students who reported playing the piano regardless of skill level scored higher for creativity on the Blues assignment and had higher average creativity scores than students who reported they did not play the piano at all. When students over the entire range of piano skill were grouped together, the results showed that even some prior experience on the piano, regardless of how much, gave students an advantage over those with none.

Level of piano skill was self-reported and though there were identifiers on the Likert-type scale to help students rate themselves, it was left to individual students to interpret the scale and assess their playing ability. While this easily separated students into subgroups of low, middle, and high skill levels, it may not have been an accurate measurement of each student's capabilities at the piano. Given that piano skill seems such a strong factor in creative musical composition in this setting, a more accurate

measurement may be appropriate. Further research in assessing piano skill on a more objective scale in relation to creativity scores may illuminate how much skill is necessary for creative musicianship, especially when the MIDI interface used for composition is a piano keyboard.

Summary. While subjects' instrumental experience as evidenced by the number of years of instrumental lessons and level of piano skill affected musical creativity scores in this study, this has not been found in earlier studies, especially for measurements of creativity that do not use the piano keyboard as an interface. Webster (1979) found no relationship between piano lesson background and musical creativity as measured by the MCTM, and Hickey (1995) found no relationship between students' level of musical performance experience and both CAT and MCTM creativity ratings. Seddon and O'Neill (2001, 2006) also found no difference in CAT creativity ratings between students with and without formal instrumental music tuition (FIMT). Mellor (2008) did not examine creativity scores, but found no difference in compositional strategies between those students with and without formal instrumental music tuition. While Priest (2001) did not systematically analyze data related to music experience, those with extensive instrumental experience were found in both high and low scoring creativity groups, and those with little experience were distributed similarly.

Others have found that piano or other formal instrumental experience significantly affects subjects' creative musical processes and products (Carlin, 1997; Daignault, 1997; Hewitt, 2002; 2009; Seddon & O'Neill, 2003; 2006). The only conclusion to be drawn from this apparently conflicting research is that instrumental music experience may or may not be a factor in musical creativity, depending on the type of creative task and the

nature of such experience. Researchers and educators must carefully take into account the music experiences students bring with them and design creative tasks aimed at facilitating student's success.

In this study, the nature of the MIDI interface for composition, the piano keyboard, seems to have enabled those with more piano skill to be more successful. Piano skill analyzed in conjunction with the data gathered on instrumental music lessons leads to questioning the efficacy of using the piano keyboard as the sole MIDI interface for creative composition at the computer. The correlation between years of music lessons and creativity scores suggests students may acquire some of the skills necessary for creative composition in their instrumental music lessons. Had students been able to use their primary instrument as the MIDI interface rather than the piano keyboard, they may have scored equally well for creativity. Likewise, if a MIDI interface other than the piano keyboard had been utilized, students with a greater amount of piano skill may not have scored as highly as they did in relation to the other subgroups. More research is certainly warranted in this area, with a variety of instruments available as MIDI interfaces.

The piano keyboard seems to have become the de facto MIDI interface in the school music technology lab setting. There are many advantages to this practice: cost, adaptability to multiple uses, and polyphonic recording capabilities among them. As devices such as electronic drums and MIDI wind controllers which approximate instruments like the clarinet and saxophone become more pervasive, greater flexibility of interface would be possible. Teachers should be encouraged to incorporate such devices as cost permits. Technology is poised to take on the role of the great equalizer as students are able to use the instruments on which they have the most skill to demonstrate their

musical creativity in electronic composition. Perhaps even new interfaces not based on acoustic instruments, but graphic interfaces such as those on tablets will be developed that will allow even greater opportunities.

Research Question 2: School Music Experience. School Music Experience in this study was defined by Participation in a School Ensemble, Music Theory Class experience, and the Number of Music Classes students had taken throughout their high school career. Students in this study participated in one or more of the 12 different music classes offered in the school curriculum including the traditional choir, band and orchestra performance ensembles, and specialized elective music classes such as guitar and music theory. Additionally, students had the opportunity to participate in more than six co-curricular music activities. Many students had participated in these ensembles and activities for a number of years. Significant positive relationships were found between creativity scores and Participation in School Ensemble, Music Theory Class experience, and Number of Music Classes taken.

Performance ensemble participation. More than half of the subjects in the study (56%) participated in one or more of the high school's six curricular performance ensembles. Students who were members of a performance ensemble scored significantly higher for creativity on the Blues composition than students who were not; however there was no significant difference for any of the other creativity scores.

It should be noted here that in teaching the 12-bar Blues form in preparation for this assignment, the connection was made with how the form continued being used in jazz, and examples of both genres were provided as listening examples. Also, several of the students participated in one of two different jazz performance groups offered as co-

curricular music ensembles after school. These groups used the 12-bar blues format as an instrumental warm-up at every rehearsal, with students taking turns improvising. Those students who participated in other (non-jazz) ensembles performed on the same concert program as the Jazz Band and Jazz Ensemble, and were frequently present as audience members at performances. These factors contributed to a large number of the subject pool being familiar with this style of music, with many performing it every week.

Due to the size and nature of the subject pool, it was not possible to examine creativity scores relative to participation in specific performance ensembles. As participation in a performance ensemble only affected creativity scores on the Blues composition, and two of the performing ensembles in the school performed this style of music exclusively, it seems possible that students' familiarity with this genre may have affected musical creativity scores. While no connection has been established between musical performance and compositional creativity, further research might indicate that greater familiarity with a genre of music, especially through performance, may increase an instrumentalist's creative ability in that style. Theorists and researchers have recognized the important of the component of domain-relevant knowledge in creativity, and performance experience in particular musical styles increases one's musical syntax in that genre or style. It may be interesting to explore the relationships between musical composition and performance in different genres or musical styles.

An important consideration relevant to this research study is that the performance ensemble curriculum in this particular high school did not emphasize improvisation or composition. Students were not specifically taught skills for creative musical composition during their participation in performance ensembles, except in the co-curricular jazz

groups where improvisation was weekly practice. However, students in these performance ensembles gained some skills which enabled them to be more creative composers. This holds implications for writers of music education curricula and the teachers who implement it. While there is consensus that creativity is an essential component of music education (Choate, 1968; Madsen, 2000; Thomas, 1970), and there seems to be a general value placed on the educational benefit many feel the arts lend to general creativity, evidence suggests that creative music making is not common practice in music classrooms (Schopp, 2006; Persky, Sandene, & Askew, 2001). Perhaps if creative activities had been part of daily or weekly practice in school performance ensembles, those with experience in this area may have scored higher for musical creativity on all composition tasks, not just the Blues composition. More research might help music teachers, especially performance ensemble conductors, incorporate creative musical experiences in ensemble rehearsals.

Music theory class. Students who had taken a Music Theory class in school scored significantly higher ($p = .004$) on the third composition task, the Free-Compose assignment, than other students. It is possible that students gain valuable tools for creative musical composition in when studying music theory. Harmonic analysis and study of musical structure may provide students the tools necessary to better approach an open-ended musical composition such as the Free-compose task. Students' choice to take a music theory class may also indicate a high level of intrinsic motivation for music, which has been shown to contribute to musical creativity (Bangs, 1992; Wolfe & Linden, 1991).

Number of music classes. Correlation data showed that taking greater number of music classes correlated with higher creativity scores on all compositions as well as Average Creativity. Students with fewer music classes or little school music experience were less able to express their musical creativity than students who had more experience. These students who lack music experience may not be less musically creative; they may just not have the tools or training to express their creative musical ideas. It follows naturally that students should not be judged or graded for creativity until they have had sufficient experience with the necessary tools to be creative.

Summary. Students who had participated in school performance ensembles, taken a music theory class or who had taken a greater number of music classes all seemed to be at an advantage when expressing their creative musical ideas. These results seemed to indicate that participation in school music classes and ensembles may help build the necessary skills for musical creativity even though creative music experiences may not have been part of the school music experience. Performing music literature, practicing with others, experiencing and becoming more familiar with music syntax on a daily basis may make students more able to translate sounds and musical ideas into creative composition. While these students may or may not actually be more creative than students with less school music experience, the skills gained through music classes enabled them to express musical creativity more effectively through composition.

Consensual assessment technique can account for some situational factors in subjects' creation of products, but it cannot account for varying levels of music experience or music achievement. Although not investigated in this study, previous studies have found correlations between musical creativity scores and music achievement

(Auh, 1997; Webster, 1979). Others have found relationships between formal music experience such as school music classes and performance ensembles and musical creativity scores (Carlin, 1997; Daignault, 1997; Hewitt, 2002; 2009; Seddon & O'Neill, 2003; 2006). Students may be acquiring the tools required for creative musicianship in their high school music experience as they accumulate more music classes.

The results seem to support Amabile's (1983) theory that domain-relevant knowledge is a key component of creativity. While it would be a mistake to assume that having taken a greater number of music classes equated to more musical knowledge, it seems the more students immersed themselves in studying the domain of music, the more able they were to express their creative musical ideas. Those students who sought out more musical experiences in high school seemed better equipped to handle creative musical composition situations. Further investigation might explore any possible relationship between music achievement and high school students' scores for musical creativity as measured by consensual assessment technique as well as which types of music knowledge enable students to be more successful in creative musical composition.

Research Question 3: Non-School Music Experience. The third research question sought to identify any difference in scores for musical creativity based on Non-School Music Experience as defined by Participation in a Rock Band and the number of Years of Participation in a Rock Band. Thirty-eight percent (38%) of the students reported they played in a rock or other type of non-school musical group. These ensembles varied from church praise bands to rock groups that performed at local shows; some students composed for their bands. Typically the music that was performed in this setting was rock or some other popular style. Collectively, these students scored

significantly higher on the Free-compose task (p = .001) and had higher Average Creativity scores (p = .026) than those who did not participate in a rock band or similar musical ensemble outside of school. A greater number of years playing in a group outside of school also had a positive correlation with creativity scores on the Free-Compose task and Average Creativity.

Summary. These results indicate that getting together to play music with friends outside of school may help students develop the tools necessary for becoming creative musicians. Figuring out songs as a group leads to understanding of musical form and structure, understanding each musician's role in the band may lead to an understanding of the basics of musical texture, and forming a "sound" for a band is indicative of musical style. These students also have a degree of musical understanding from having picked up a musical instrument and trying to play, most likely outside of school. Students in this group scored well on the Free-Compose assignment, where without many guidelines to follow they had the most freedom to express their musical ideas.

Participation in music groups outside of school is often considered informal music experience, although Folkestad (2006) has recognized that these types of experiences can be both formal and informal in nature, the differentiating factor being whether they are planned, sequential experiences or not. The experiences described by the subjects in this study can be considered informal in nature, and the results support Green's (2002) research on the informal learning practices of popular musicians.

While scholarly literature has discussed the importance of informal music experience, there is little quantitative research in this area. This may be because it is hard to measure such experiences. Two such studies are Auh (1997) and Barker (2003), who

found relationships between children's compositional creativity and informal musical experiences, suggesting that such experiences may play an important role in compositional creativity. The research in this area may be somewhat limited because although teachers and researchers have a fairly good idea of what happens in the school or institutional setting while studying musical creativity, they have little knowledge about what happens outside of this setting.

The school is an environment over which the teacher and researcher have a certain degree of control. Experiences outside of school are extremely varied and difficult to describe because researchers and teachers have no control over them and little means to observe them. Researchers need to find a comprehensive way to examine this experience to determine what types of experience enable students to be the most creative and the extent of the effect of these experiences on musical creativity. The music technology lab seems to present an ideal place for formal and informal music education practices to meet, as suggested by Green (2002, 2008).

Conclusions

In this study, it was found that a greater amount of music experience enabled students to be more creative in electronic musical composition. This experience was gained both in and outside the music classroom. Differences in creativity scores were found in all three of the variable groups; Instrumental Music Experience, School Music Experience, and Non-School Music Experience. Students who had more years of instrumental music lessons, played more instruments, played piano, participated in a school performance ensemble, had taken music theory and a greater number of music classes and who had participated in a music ensemble outside of school were able to

demonstrate more musical creativity in their composition than their peers who had not had these experiences. The variables seemed to have the greatest effect on the Free-compose task, which was probably the most accurate measure of musical creativity as there was the least teacher-imposed structure. While experience taking instrumental lessons and playing many instruments correlated with higher creativity scores, experience playing the piano appeared to make the greatest difference in students' creativity scores. This is most likely due to the nature of the MIDI interface. Familiarity with the MIDI interface seems to be paramount to this type of creative composition in the music technology lab.

Of the 48 subjects who participated in the study, only two reported having no experience playing a musical instrument prior to enrolling in the Music Technology class. Although open to the entire school population, the fact that most students who took the class were instrumentalists seems to demonstrate that the class was more appealing to students who had already indicated an interest in playing a musical instrument in some capacity, although this experience varied greatly among participants. Additionally, the 46 students who were instrumentalists played a total of 144 instruments; an average of three instruments per subject. Almost half of the students reported they played the guitar and 58% reported they played the piano. Seventy-eight percent (78%) of the students reported they had taken two or more music classes in high school. These factors combined with the nature of the class, a music elective as opposed to a graduation requirement, and the wide and varied music experiences of the participants leads to the conclusion that there was a high level of intrinsic motivation for music among the subject pool.

Motivation is a key component of Amabile's (1983, 1996) Componential Theory of creativity, and intrinsic motivation for music has been shown to contribute to musical creativity (Bangs, 1992; Wolfe & Linden, 1991). Although not addressed in this study, it would be interesting to investigate the level of motivation for music of students enrolled in the music technology class with respect to their creativity scores. It is difficult to measure the level of motivation for music among students, and the *Music Experience Questionnaire* did not survey students' reasons for having enrolled in the class or their level of interest in or enjoyment of musical activities. Wolfe and Linden (1991) measured children's intrinsic motivation for music by the amount of time they spent engaged in voluntary play with musical instruments. As all music classes offered at the high school where this study took place were voluntary, elective classes, intrinsic motivation for music in this group of high school students might be indicated by a large number of music experiences both inside and outside of school.

Wolfe and Linden (1991) studied motivation with respect to Amabile's theory of creativity, however they measured creativity with Webster's MCTM-II. A more appropriate future study might quantify students' total music experience as indicated on the *Music Experience Questionnaire*, looking for a relationship between high school students' intrinsic motivation for music and their creativity scores on music compositions as measured using the consensual assessment technique.

Creative musical composition allows students to demonstrate a different type of musical knowledge than is typically measured and recorded in school classroom situations. In an era when assessment and teacher accountability have become prevalent, consensual assessment offers an alternative means of demonstrating students'

capabilities. The Dimensions of Judgment measurement tool is one option which can be used as an alternate, effective and precise means of assessing high school students' musical compositions. The measurement device gives the music expert, in this case the classroom music teacher, a range of components over which to reliably score musical compositions for creativity.

Musical composition is an important component of the music curriculum as it allows students the opportunity to express themselves while demonstrating musical understanding through their authentic musical products. Giving students the tools they need for creative music composition is the first step in enabling them to become creative musicians. Domain-relevant skills combined with intrinsic motivation for the subject matter support the componential model of creativity as described by Amabile (1983, 1996). More accurate data regarding students' musical background and motivation for music may give a clearer picture as to what level of skill is necessary and what experiences best predict success in creative composition.

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Appendix A

Responder ID _____

Music Experience Survey

MUSICAL EXPERIENCE- Instrument Playing

Rate you skills playing the keyboard on the line below:

1----------2----------3----------4----------5

Cannot find Middle C	One finger picker	I can read the notes and play a simple song	I am pretty good. I can play two hands with practice.	I have skills.

Have you ever played a musical instrument? Circle one: **YES / NO**

If yes, what instrument(s)? (*List any and all*) _____

_____

Have you ever taken lessons outside of school on any of the instrument(s) above?

YES / NO

If yes, what instrument(s)? List the instrument and how long you took lessons:

Instrument:	**How long I took lessons: (approx.)**
_____	_____
_____	_____
_____	_____

List any instruments you **currently** play: _____

_____

Do you **currently** take music lessons outside of school on any instrument? (*Voice lessons count*)

YES / NO

What instrument(s)? _____

Responder ID _____

What other music classes have you taken in school? (*Put a check next to*)

_____ Concert Band	_____Chorale	_____AP Music Theory
_____ Wind Ensemble	_____ Music Theory I	_____ Music Tech A
_____ Concert Choir	_____ Music Theory II	_____ Beginning Guitar
_____ String Orchestra	_____ Advanced Guitar	_____ Music Tech B

_____Other (please specify) _____

If you have been in Choir, Band, or Orchestra, write the number of years you have participated in this ensemble next to the ensemble name above.

CO-CURRICULAR MUSIC ACTIVITIES:

Are you a member of Tri-M music honor society? **YES / NO**

Please check any co-curricular music activities you have or do participate in:

_____ Marching Band	_____School Musical	_____ Pit band (for musical)
_____ Jazz Band	_____ Jazz Ensemble	_____ Other _____

If you have done any of these for more than one year, write the number of years you participated next to the ensemble above.

If you participate or have participated in any other school music activities like Coffee Houses, the Unplugged (acoustic) show, Battle of the Bands, etc, please list below:

_____

_____

Do you currently sing in any choirs or perform on an instrument outside of school? (i.e. at a church or synagogue, club, coffee house/café, etc) Please detail your experience:

_____

_____

Responder ID _____

Have you or do you regularly perform with a band outside of school? (When, how long, did you perform for money or was it just for fun?) Please detail your experience below:

_____

_____

MUSIC LISTENING HABITS:

Approximately how many *hours per week* do you think you play an instrument or sing?

_____ *(Try to be as accurate as possible*)

Approximately how many *hours per week* do you think you spend listening to music? *(intentionally-* not background music like at the mall or noise just to have on)

_____ (*Try to be as accurate as possible- it is impossible to be exact*)

Appendix B

Letter of Assent

Dear Students,

I am Mrs. Micu, the choir teacher here at Hillsborough High School. I am also a student at Rutgers University. In order to complete my degree there, I have to complete a research study on the musical creativity of high school students. You are invited to take part in this study.

If you agree to participate, I will record three of your compositions in the Music Tech Lab this semester and you will be asked to fill out a questionnaire and a survey in class that will take about 20-30 minutes. Your name will be on the questionnaire and the survey only to match them up with your compositions, but at no time will your name ever be linked with your work in publication. Your identity will be kept confidential. You will be asked to write your age, grade, and gender (whether you are male or female) on the form.

Your grades will not be affected in any way by your decision to participate or not participate in the study. Your Music Tech teacher will not be aware of which students are participating in the study and which are not. Participating in this study could help you to understand your own composition process and musical creativity better, and your participation may increase understanding of the factors that influence students' musical creativity. There are no forseen risks to participating in the study.

You may skip any questions that you are not comfortable with, and you may decide to stop participating at any time without any penalty to you. One of your parents will also be required to provide permission for you to participate in the study, and they will be given my phone number in case you or your parents have any questions about the research. They will also have a phone number for the Office of Research and Sponsored Programs at Rutgers University, in case there are any questions about your rights as a research subject. You will be given a copy of this form to keep.

If you agree to participate in the study, please sign below:

Student signature _____ Date _____

Student name (printed) _____ Date _____

Investigator signature _____ Date _____

Appendix C

Informed Consent

Dear Parent,

I am Mrs. Micu, the choir teacher at Hillsborough High School, and the former Music Technology teacher. In addition to teaching at Hillsborough, I am a graduate student at Mason Gross School of the Arts at Rutgers University, and I am currently working on my doctorate in Music Education. As part of this degree, I must complete a research study and dissertation. The title of my research project for this degree is: *An Investigation of the Factors Affecting Musical Creativity of High School Students*.

The Hillsborough School District has given me permission to conduct this research in the Music Technology lab. I am now asking for your consent as a parent to allow your child to participate in the study. To participate, the students will be required to complete two surveys in addition to their normal classroom assignments. These surveys each require about 10-15 minutes to complete, and will be done during regular class time. Three of the compositions they would normally complete over the course of the semester will be recorded from the computer onto a CD to be included in the study. These compositions will be rated by other music educators for musical creativity. There will be no additional class work necessary to participate in the study and participation in (or exemption from) the study will in no way affect your child's grade in the class.

There are no known risks to your child for participating in the study. Your child may benefit from participation in that he or she will think reflectively on their work in music class, possibly yielding better future work. The data collected may also help future students achieve greater success in music composition.

The research conducted will be kept confidential. Confidential means that the research records will include some information about your child, such as their first name and grade in school. I will keep this information confidential by limiting individual's access to the research data and keeping it in a secure location. In addition to me, only the Institutional Review Board at Rutgers University will be allowed to see the data, except as required by law. If a report of this study is published, or the results are presented at a professional conference, group results will be stated. If individual compositions are ever referenced, they will be referred to by pseudonym. At no time will your child's individual work be referenced by name.

If you have any questions about the research, you may contact me at:
Christine Micu
Hillsborough High School
466 Raider Blvd.
Hillsborough, NJ 08844
Tel: (908) 874-0147.

_____
(initial)

If you have any questions about your child's right as a research subject, you may contact the Sponsored Programs Administrator at:

Rutgers University Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559
Tel: 732-932-0150 ext. 2104
Email: humansubjects@orsp.rutgers.edu

Your child's participation in this study is voluntary. Please sign and return the attached permission slip if you are willing to have your child participate. Your support is greatly appreciated.

Sincerely,

Christine S. Micu
****

_____ has my permission to participate in the
(*Child's name*)
research study, *An Investigation of the Factors Affecting Musical Creativity of High School Students* that will be conducted by Christine Micu.

Signature of Parent or Guardian _____ Date _____

Appendix D

Letter of Permission from School

HILLSBOROUGH TOWNSHIP PUBLIC SCHOOLS
379 South Branch Road • Hillsborough • NJ • 08844-3443 • (908) 369-0030

OFFICE OF THE SUPERINTENDENT

November 4, 2005

Rutgers University Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559

To Members of Rutgers University Institutional Review Board:

Please be advised that Christine Micu has discussed her proposal for conducting research utilizing students from Hillsborough High School. Pursuant to our conversation, Mrs. Micu is authorized to utilize the Hillsborough High School premises to conduct her research provided active consent is acquired from the parents of the students in those classes that may be utilized in her research. Mrs. Micu has also obtained the consent of the building principal.

If I can be of any further assistance, please do not hesitate to contact my office.

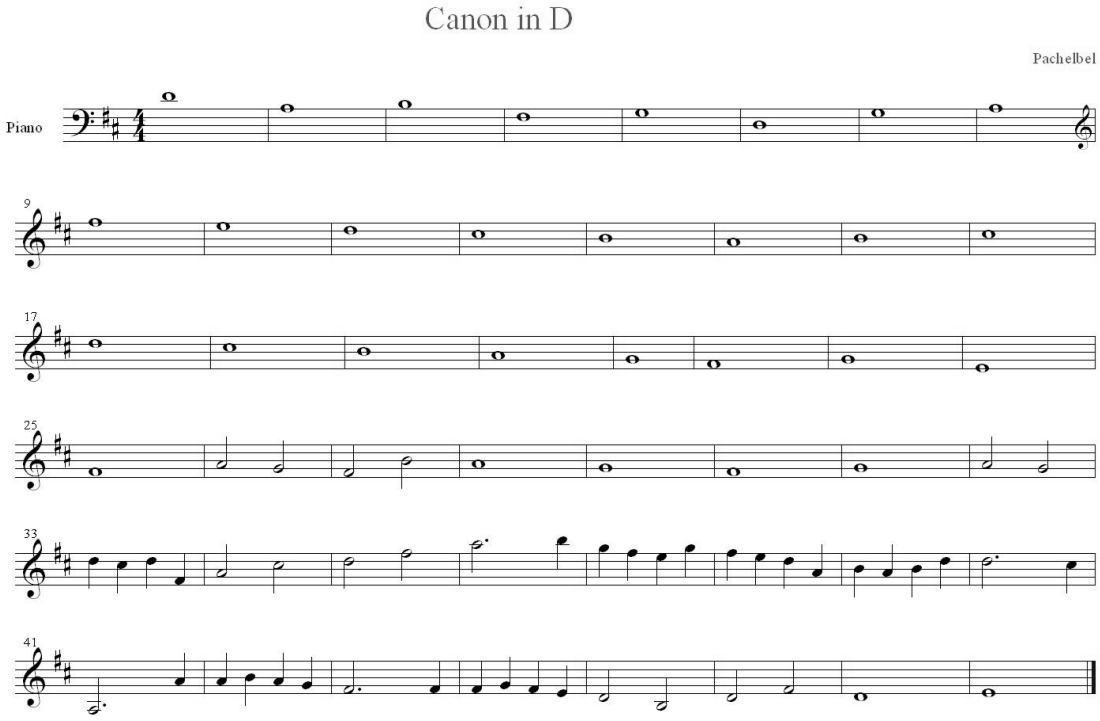
Sincerely,

Karen A. Lake

Karen A. Lake
Superintendent of Schools

Appendix E

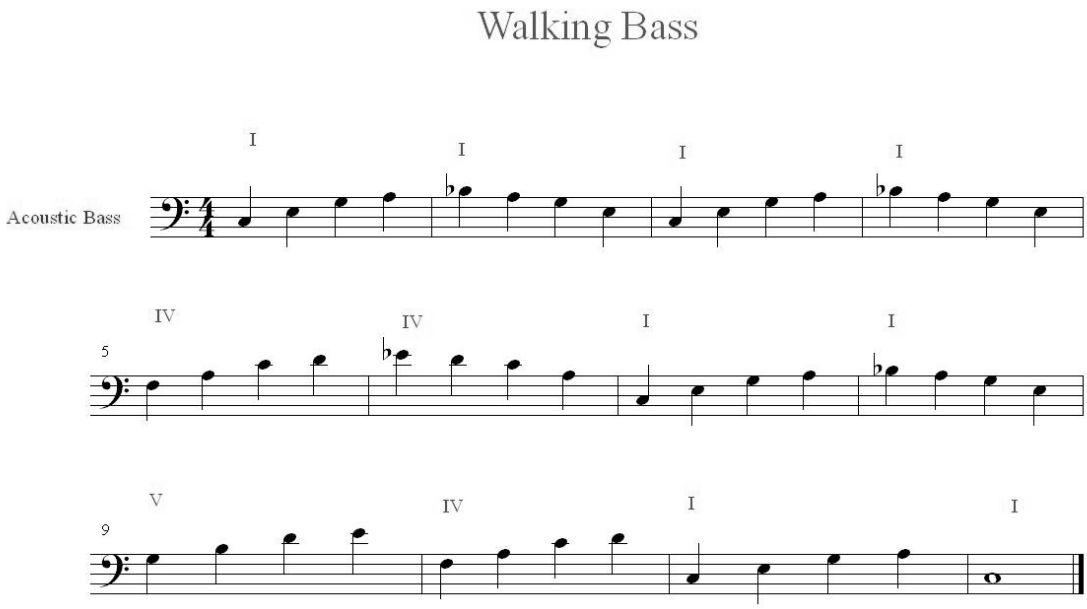
Composition Task One- Canon



Record the lines above into SONAR Home Studio using whatever instruments you would like. You may record them in any order at any tempo, even record them at a slow tempo, then speed it up later on. Make the final arrangement of Canon in D "your own," using any of the elements of music we have talked about so far in Music Tech class. Think about the examples you have heard in class and your own personal "style." How can you make this music representative of your style?

Appendix F

Composition Task Two- Blues



Instructions:

1.) Record the "Walking Bass" line into SONAR Home Studio. You may quantize it to "swing" if you like.

2.) Play the corresponding I, IV, and V chords with each measure on another instrument(s).

Hint What other instruments might you see in a jazz combo?

You can play the chords in any rhythm you like, whole notes or otherwise.

3.) Add a simple drum beat (something "jazzy" or swing).

4.) Improvise a melody on yet another instrument using the Blues scale in C Major.

Appendix G

Instructions to the Judges

Thank you for agreeing to participate and providing your expertise in this experiment. All forms are included in this binder for you. Please read the following directions carefully before beginning to assess the compositions on the CD, and please feel free to contact me at any time with questions.

1.) Each composition is preceded by a spoken ID number. Please write the ID number at the top of the assessment form on which you grade that particular composition.

2.) Place an "X" on the continuum (dash) where you believe that particular composition rates for each component. One is low, five is high. The dashes on the continuum represent 1, 1.2, 1.4, 1.6, 1.8, 2, 2.2, etc.

3.) Please use the entire spectrum for your assessment. Avoid using only the upper end.

4.) Please judge the compositions relative to each other and not against some external standard you may hold for high school students' musical composition.

5.) No time limits were imposed on students; therefore, compositions vary in length.

6.) Do not rate the compositions on quality of the recording. In some cases the recordings may be better or worse, louder or softer. Though the same techniques were used to record all compositions, because of the limits of our technology, some will have recorded better than others and volume adjustment may be necessary.

7.) You may listen to any selection more than once. Please feel free to replay a composition to help you better score.

8.) The first three compositions are practice items. Please read through the *Dimensions of Judgment* and score each these three. If you have any questions, please call me before

going on.

9.) When starting the assessment, do not feel the need to complete it all at once. You may listen to and score several in one sitting, then take a break, come back and score others at another time. Please take a minimum break of 5-10 minutes after each hour of scoring.

Appendix H

Dimensions of Judgment Assessment of Musical Creativity

(as adapted to musical creativity by Bangs, 1992)

Directions: After listening to each student's composition, please rate it according to the following 19 dimensions. Put an "X" on the point (dash) in the continuum that corresponds to your assessment. One is low and 5 is high. You may replay the example on the CD if needed.

1) Creativity	Using your own subjective definition of creativity, the degree to which the composition is creative. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
2) Novel use of instruments	The degree to which the composition shows novel use of the instruments. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
3) Novel musical idea	The degree to which the composition itself shows novel music idea 1- - - - 2 - - - - 3- - - - 4 - - - - 5
4) Liking	Your own subjective reaction to the compositional degree to which you liked it. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
5) Overall aesthetic appeal	In general, the degree to which the composition is aesthetically appealing. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
6) Worth hearing again	If it were possible, the interest you would have in hearing this composition again, or using it for demonstration purposes. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
7) Effort evident	The amount of effort that is evident in the product (composition). 1- - - - 2 - - - - 3- - - - 4 - - - - 5

8) Freedom	The degree to which the composition conveys a sense of originality. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
9) Meaningfulness	The degree to which the work reflects quality sounds or noise. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
10) Movement	The degree to which the composition conveys a sense of motion. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
11) Form	The degree to which the composition uses similar or contrasting instrumental or melodic sections. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
12) Variety	The degree to which the composition shows variety. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
13) Pleasing use of sounds (timbre)	The degree to which there is a pleasing use of sounds in the design. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
14) Pleasing use of texture	The degree to which the composition shows a pleasing use of texture (the use of more tha one instrument or pitch at a time). 1- - - - 2 - - - - 3- - - - 4 - - - - 5
15) Overall structural organization	The degree to which the composition exhibits some unifying feature (i.e. motif, rhythm, melody, etc.) 1- - - - 2 - - - - 3- - - - 4 - - - - 5
16) Detail	The amount of detail in the composition 1- - - - 2 - - - - 3- - - - 4 - - - - 5

17) Accuracy of performance	The degree to which the composition is good technically (not misplaying notes) 1- - - - 2 - - - - 3- - - - 4 - - - - 5
18) Expression	The degree to which the work conveys dynamics, tempo, or high/low contrasts. 1- - - - 2 - - - - 3- - - - 4 - - - - 5
19) Complexity	The level of complexity of the composition. 1- - - - 2 - - - - 3- - - - 4 - - - - 5