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A Quasi-Experimental Study on Creativity Development

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This dissertation has been read and approved as fulfilling the partial requirement for the Degree of Doctor of Education in Curriculum and Leadership.

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A QUASI-EXPERIMENTAL STUDY ON CREATIVITY DEVELOPMENT

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DEDICATION

I dedicate this work to my daughter, Adrianne Ellis Campbell. Always remember to go after what you want and work hard for it. You can do great things with dedication and perseverance. Never give up.

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ABSTRACT

With this quantitative quasi-experimental study, the researcher examined the effect of the implementation of a creativity development intervention on third-, fourth-, and fifth-grade students as measured by the District Screener for Gifted Education in a central Georgia elementary school. Creativity development is of growing concern to U.S. educational and business leaders as jobs require creative ability. Using a two-way repeated-measures analysis of variance, the researcher compared the creativity raw scores from pre- and posttests of all third-, fourth-, and fifth-grade students. The researcher also compared a representative sample of subpopulations using analysis of variance to see if the intervention affected gifted-identified and non-gifted-identified populations in different ways. Results showed significant improvement among all students, and the improvement was sustained over 9 weeks following the intervention. Findings have positive implications for development of creativity in all students. This study will inform educational policy makers of the impact creativity development can have on adolescents.

Keywords: 21st century skills, elementary school students, creativity development

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List of Abbreviations

ANOVA	Analysis of variance
CSR	Creativity Screener Rubric
DSGE	District Screener for Gifted Education
Four Cs	Critical thinking, communication, collaboration, and creativity
Four Ps	Person, process, product, and press
NAGC	National Association for Gifted Children
OECD	Organisation for Economic Co-operation and Development
PBL	Project-based learning
PISA	Programme for International Student Assessment
P21	Partnership for 21st Century Learning
STEM	Science, technology, engineering, and mathematics
STEAM	Science, technology, engineering, arts, and mathematics

CHAPTER I

INTRODUCTION

Background of the Problem

Educators all over the world are preparing students for a future that is uncertain and unknown. As the 21st century progresses, the world becomes more complicated by an extraordinarily fast rate of growing knowledge. Bevins et al. (2012), a collaborative group of multidisciplinary researchers from Virginia, reviewed research from public education; science, technology, engineering, and mathematics (STEM) education; adult education; graduate education; and the research institution at the University of Virginia. Bevins et al. found educational leaders and private sector representatives should "combine efforts in building a skilled, knowledge-based labor force" to meet the demands of a 21st century workforce (p. 9). Students preparing for the workforce need to be autonomous, flexible, creative, and responsible agents of change (Bevins et al., 2012).

According to research and development organizations, the most important economic resource of the 21st century is creativity (Chen & Kaufmann, 2008). Similarly, Zhao (2015) stated that the 21st century workforce needs creative employees rather than those who perform routine tasks. Zhao is an internationally recognized speaker, author of hundreds of articles and 20 books, and an education scholar. He has founded research and development institutions to explore innovative education models and has created schools. Zhao (2015) stated that the foundations of our society that once made America the center for innovations and created the American middle class are being taken away by

misguided reforms. Education in America was once the envy of the world but has lost international standing (Zhao, 2015).

Creativity is one of the multiple criteria used to determine gifted eligibility for select students who are referred and tested for gifted services in elementary school (Georgia Department of Education, 2018). The National Association for Gifted Children (2019) acknowledged that gifted education varies among each state in the United States. U.S. federal law recognized that children with gifts and talents have unique needs that are not always met in the traditional classroom setting (Every Student Succeeds Act, 2015); however, there are no special requirements for serving these students. The National Association for Gifted Children (2019) also acknowledged that participation in gifted and talented programs varies by state and by demographic subgroups.

In the 1950s, legislators in the state of Georgia pioneered the gifted education movement. They were the first state legislature to require programs for intellectually and creatively gifted students in all Georgia public schools (Georgia Department of Education, 2018). Georgia adopted standards based on the recommendations from the revised National Association for Gifted Children PreK-12 Gifted Programming Standards (Georgia Department of Education, 2010). These standards required measuring creativity along with motivation, achievement, and mental ability as cited by the Georgia Department of Education Rule 160-4-2-38. In 1994, the Georgia House of Representatives passed a bill acknowledging creativity as one of the multiple criteria used to determine gifted eligibility (Georgia Department of Education, 2018).

Creativity is an important piece of gifted identification for schools; however, Millar and Dahl (2011) asserted, “The notion that creativity is only for the gifted few is a

myth and must be dispelled" (p. 17). Creativity has become a critical factor in the success of all students, not just for the gifted few. According to Millar et al. (2011), creativity skills will determine if students thrive or survive in the 21st century. Researchers also have concluded that creativity can be developed, nurtured, and fostered through education and training (Millar et al., 2011; Zhou, 2015).

Creative thinking is crucial for 21st century success. Societal problems are more global and multifaceted, requiring creativity and problem-solving skills to find necessary solutions. Skills necessary in the past are still needed but are not enough to compete in the 21st century world (Pink, 2005). According to Kay and Greenhill (2011), the U.S. education system initially focused on preparing students to work in factories, as manufacturing jobs were in excess. Educators should promote student growth in creativity skills to enhance inventiveness, problem-solving and critical-thinking skills, communication, and collaboration skills to provide a better future for 21st century learners (Kay & Greenhill, 2011; Pink, 2005)

This study provides an initial inquiry into creativity development, whether creativity development can be measured, and whether an intervention positively impacted learner outcomes on a standardized divergent-thinking assessment known as the District Screener for Gifted Education (DSGE). As referenced before, researchers have suggested that development of creativity is crucial to student success after graduation. Physical and psychological changes of adolescence can begin as early as ages 9–12, a critical time to develop creative potential (Diener et al., 2016). The findings of this study could impact instructional decisions for the school along with the entire district and increase awareness of the importance of encouraging creativity in all students.

Statement of the Problem

As previously described, Zhao (2015) and Miller et al. (2011) endorsed creativity as an important aspect for a student's future. These same researchers also determined that creativity can be nurtured and developed through education and training. Taking into consideration the role that creativity plays in a student's future, it is unclear why studies are scarce related to creativity development for all students—the entire total student population, not just the students served in a gifted and talented program. Creativity is a vital component in giftedness and the gifted identification process in various states, yet exploration of creativity intervention for all students is limited. This study examined the effect of a program aimed to increase divergent thinking skills, specifically skills in fluency, flexibility, originality, and elaboration, among all third-, fourth-, and fifth-grade students at a central Georgia elementary school. The program was implemented beginning the fall term of the 2019-2020 school year. Through this investigation, the researcher determined whether the creativity development intervention was effective at fostering creativity in gifted-identified and non-gifted-identified students to prepare them for a world beyond graduation that values creative thinking, problem-solving skills, and innovation.

Purpose of the Study

The purpose of this study was to determine if the creativity development intervention implemented into the elementary curriculum at one elementary school improved fluency, flexibility, originality, and elaboration skills, which are components of divergent thinking. Divergent thinking skills were assessed using existing assessment scores from the DSGE from the 2019-2020 school year. These scores were examined

using a quantitative approach comparing pretest scores of third-, fourth-, and fifth-grade students with posttest scores at a school where the creativity development intervention had been implemented. The composite scores were analyzed to examine the impact on fluency, flexibility, originality, and elaboration skills. The researcher also explored how the creativity development intervention impacted the composite scores of the gifted-identified and non-gifted-identified populations within the school building. This study should be used to inform educational leaders and future researchers of the effects of creativity development intervention on the creativity of all third-, fourth-, and fifth-grade students in elementary school. More broadly, this study should inform educational policymakers of the impact a creativity intervention can have on the development of creative skills of adolescents.

Research Questions

The overarching question for this study was Research Question 1: How does the creativity development intervention impact elementary students' creativity performance, specifically in fluency, flexibility, originality, and elaboration skills? The researcher analyzed preexisting DSGE data to determine whether participation in the intervention increased student raw scores on the posttest, as compared to the pretest and as compared to a control group.

Research Question 2 was the following: To what extent are students able to retain the skills from the creativity development intervention to build fluency, flexibility, originality, and elaboration after not participating in the intervention for 9 weeks? Pretest and immediate posttest (Week 9) scores on the DSGE in fall of 2019 were compared to a

later administration of the rubric (Week 18) after students went 9 weeks without receiving the intervention.

A third question focusing on giftedness is included in this study. Research Question 3 was the following: To what extent is the effect of the creativity development intervention on fluency, flexibility, originality, and elaboration moderated by gifted-identified and non-gifted-identified status of elementary students? The researcher investigated if there is a statistically significant difference in fluency, flexibility, originality, and elaboration in DSGE raw scores between the two subgroups of students.

Conceptual Framework

Creativity can be defined in various ways, depending on the lens the researcher uses to study it. Cognitive, psychological, and educational researchers all have diverse views of what creativity is. Cognitive researchers study brain physiology, examining circuits in the brain and how they connect. Dr. Arne Dietrich (2004), a cognitive neuroscience professor at the American University of Beirut, noted in his study that cognitive neuroscientists have identified distinct brain circuits involved in specific higher brain functions. The cognitive perspective was beyond the scope of this research. Psychological researchers have defined creativity as a type of condition a person may have, with characteristics that support the condition (Runco & Jaeger, 2012). Other researchers like Sternberg (2006, 2010, 2018) defined creativity as a set of thinking skills and processes a person has or uses. Different definitions require different approaches to research. For the purposes of this study, the researcher focused on creativity in education.

Craft (2005) found devoting time and attention to the relationship between creativity and knowledge nurtured creativity in the classroom. Lin (2011) of the National

Academy for Educational Research in China proposed a three-element framework for creative pedagogy to enhance creativity through teaching, to address creative learning, and to teach creatively (see Figure 1). Teaching for creativity is about letting students explore new possibilities while arousing student curiosity and learning (Lin, 2011). Creative learning is student focused, allowing children to learn by searching, manipulating, experimenting, and playing. Lin (2011) also stated that the creative learning model flexes student thinking and builds capacity for learning. Lastly, creative teaching is teacher focused. The teachers are motivated to teach through innovative ways and create their own units without the use of textbooks. Lin (2011) stated these approaches are "more relevant to education values and settings" (p. 150). Based on the research, creativity can be developed (Torrance, 1963), and all individuals have the potential to be creative (Craft, 2001; Fryer, 1996; Lin, 2011).

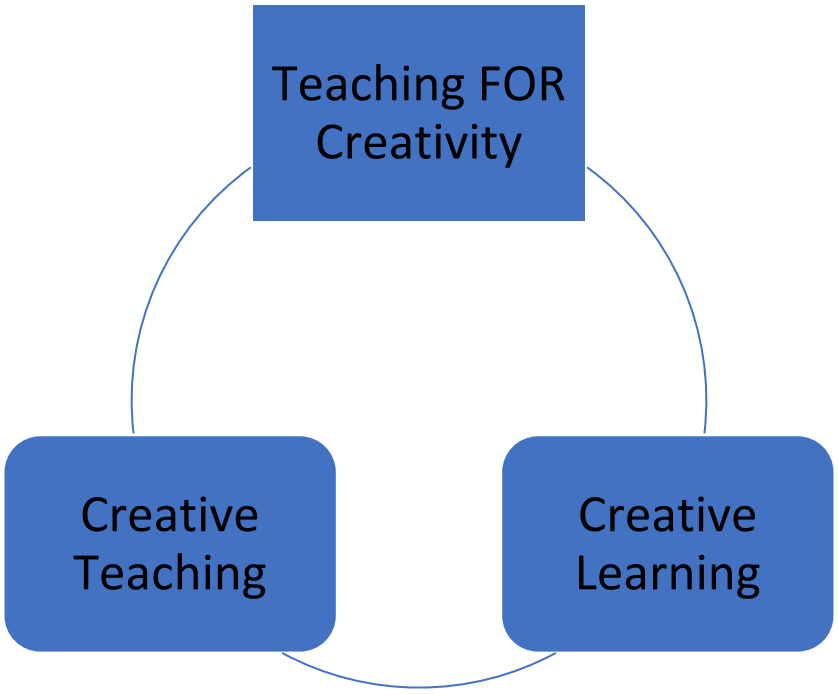

Figure 1. Framework of creative pedagogy. Adapted from "Fostering Creativity Through Education: A Conceptual Framework of Creative Pedagogy" by Y.-S. Lin, 2011, *Creative Education, 2*(3), p. 152.

Methodology Overview

This quantitative study using quasi-experimental methods and preexisting data was designed to identify the effect, whether positive or negative, of the creativity development intervention on students at one elementary school in central Georgia. Research methods involved processes of collecting, analyzing, interpreting, and writing results of the study (Creswell & Plano Clark, 2018). The quantitative research methodology was appropriate for this study because numerical data were analyzed for statistical significance (Creswell & Plano Clark, 2018). Quantitative research is concerned with discovering facts about a phenomenon within a controlled setting, where data are collected and measured through numerical comparisons or statistical analysis

(McLeod, 2019). The analysis of the data established relationships, connections, and patterns to identify the effect of the intervention on student creativity scores.

Quasi-experimental designs are commonly employed in the evaluation of educational programs (Gribbons & Herman, 1996). Random assignment was neither possible nor practical in the elementary school setting; therefore, a repeated measures design was employed. Previously established groups, or classes, were compared. All classes were divided into two teams that participated: a treatment group (Team A) and control group (Team B). A pretest–posttest design was used. Differences in the two groups were analyzed. All students participated in this intervention, for it would be unethical to withhold a program from a given set of students. The two groups participated in the program at different intervals of the 2019-2020 school year to determine a control and treatment group. The experimental or treatment group participated in the intervention the first 9 weeks, and the control group participated in the intervention during the second 9 weeks.

Data sources included the raw scores on the DSGE from third-, fourth-, and fifth-grade students who participated in the 9-week intervention. The goal was to discover through statistical analysis whether creativity can be taught through student participation in the creativity development intervention. The DSGE data were scored using the related, district-created Creativity Screener Rubric (CSR) to derive a student creativity score (see Appendix A). Scores from the DSGE were analyzed in SPSS 27.0 using a 2x3 mixed analysis of variance (ANOVA) to determine if there was a significant difference between the treatment and control groups as well as if students are able to retain the information over a period of time. A paired sample *t* test was also used to compare differences in

mean scores for further analysis of retention.Also using a simple comparison of an independent *t* test, the researcher compared scores for gifted-identified and non-gifted-identified students, to see if the intervention was more effective with a particular subgroup within the school.

Limitations

The researcher is an administrator at the school where the research was conducted. As an administrator and researcher, some bias could exist even as the researcher tried hard to employ strategies to control for bias. The researcher only used knowledge of students and their individual needs (special education services, language service) to distribute evenly among the teams. Results would not give a true picture if one team had all students who received specialized instruction on the same team. Bias was also controlled when individual student names were removed from the data spreadsheet once scores were entered and teams were coded.

During this study, the researcher made various assumptions regarding elements of the research process. First, the researcher assumed that each student responded to the best of their ability on the DSGE. Additionally, the researcher assumed that the teachers of gifted and talented education students received proper training and professional development and taught the gifted and talented curriculum with fidelity. The researcher also assumed that all teachers participating in this study were highly qualified and certified to teach in the state of Georgia. Teachers who are unqualified could affect the outcome of the student performance.

Definition of Terms

Since the literature contains conflicting vocabulary and terminology, the following definitions help to improve the reader's understanding of terms used throughout this study.

College and Career Readiness Performance Index: a comprehensive school improvement, accountability, and communication platform for all educational stakeholders promoting college and career readiness for public school students in Georgia (Georgia Department of Education, 2018).

Creativity: involves "a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate the innovation" (Csikszentmihalyi, 2013, p. 6). Relevant to elementary-age students, creativity results from processes of moving between divergent and convergent thinking (Gajda et al., 2017; Guilford, 1956).

Convergent thinking: memory and perceptual skills that point to single correct answers; measured by intelligence and proficiency tests (Millar & Dahl, 2011).

CSR: The Creativity Screener Rubric used to score results on the DSGE measure, created in the school district based on the TTCT.

Divergent thinking: refers to the propensity for the mind to generate ideas and solutions to problems outside of normally prescribed expectations (Leclerc, 2017). Divergent thinking is the "ability to produce many and diverse ideas when presented with an open-ended problem" (Runco, 1990, p. 37).

DSGE: The District Screener for Gifted Education used in this study to measure creativity, created in the school district based on the TTCT.

Georgia Department of Education: the agency charged with the fiscal and administrative management of certain aspects of K-12 public education, including the implementation of federal and state mandates.

Gifted learner: a student who is highly motivated, creative, and of high intellectual ability with high achievement (Georgia Department of Education, 2018).

21st century skills: skills required by a learner to cope with the realities and conditions of the 21st century, which include a profound focus on technology, digitized work, and the effects on the meaning and application of knowledge (Anagün, 2018).

TTCT: Torrance Tests of Creative Thinking, which measure the skills of creative production and behavior.

Significance of the Study

The significance of this research lies in its contribution to the literature of creativity not only in psychology but also in education. This study informs researchers and education professionals of the importance of creativity for all children and to reposition teaching and learning efforts to promote creative education for all students. Researchers and educators should reexamine the values and practices of education relevant to creativity and divergent thinking. This study exhibits the potential of school programs and policy to improve all students' creativity and divergent thinking. There is a need for richer literature, more research, and a new model for teaching and learning that includes development of creativity skills in all students.

Summary

The researcher has provided the academic community with data to guide instructional decisions and to support creativity development in elementary students. By

comparing the impact of the creativity development intervention on students' creativity raw scores, the researcher has provided insight into whether creativity development can be nurtured in an educational setting. Ultimately, the researcher sought to identify the best method for fostering the development of creativity and divergent thinking skills in all students to prepare them for the demands of a 21st century workplace. It is not enough to teach the skills necessary to pass a test for accountability measures. Teachers and school administrators need to provide time to stimulate creativity skills in students so that they can not only survive but thrive in the future.

CHAPTER II

REVIEW OF LITERATURE

Twentieth century author and educational reformer John Dewey (1916) stated that a democratic society is continuously changing—sometimes for the better, and sometimes not. Throughout his career, Dewey recognized that a democratic society requires citizens who are willing to participate and competent enough to distinguish between the better and the worse. Over 100 years ago, Dewey (1916) wrote that creativity connects all domains of human knowledge. At the time, America was changing from an agrarian (farming or rural) society to an industrialized nation. Dewey (1916) recognized that Americans had to change how they lived, worked, and played. America is still changing—now from a prominent industrialized nation to a global competitor in the world. America's current economy in comparison to other nations around the world has fallen (Childress, 2016). Middle-class jobs are slipping away.

Global changes have forced educators to rethink education. Immediate access to unlimited information through the internet has made it imperative that educators rethink how to prepare students for life beyond graduation. Gerstein and Friedman (2017) stressed that creativity is an essential skill in the 21st century Conceptual Age. Creativity and education are linked in producing a 21st century workforce ready to solve problems facing society. The need for creativity in education is recognized globally, as evidenced from policy documents taken from various countries (Gerstein & Friedman, 2017). These

documents indicated that practical steps are being taken to make creativity part of the educational agenda of many countries.

The following literature review investigates relevant topics to this study. The purpose of this study was to determine the impact of a creativity development intervention on student performance on a standardized measure of creativity. The research was designed to determine whether and under what conditions creativity can be cultivated in an educational setting to prepare students for the 21st century work force. Therefore, relevant topics for the literature review were 21st century skills, creativity, divergent thinking, convergent thinking, fostering and assessing creativity, the Torrance Tests of Creative Thinking (TTCT), global perception of creativity, creativity and education, creative pedagogy, and gifted education.

Twenty-First Century Skills

Researchers and educators have various definitions for 21st century skills. For the purposes of this research, 21st century skills are those abilities required by learners to cope with the realities and conditions of the 21st century. Such 21st century skills have a profound focus on technology, digitized work, and the effects on the meaning and application of knowledge (Anagün, 2018). Current learning and innovation skills include outcomes from knowledge and transferability through creativity and innovation skills, critical thinking and problem-solving skills, and communication and collaboration skills (National Education Association, 2019).

Daniel Pink is a bestselling author of several books on business, behavior, and creativity. He abandoned his career as a speechwriter for Al Gore to start a freelance career sparking a right-brain revolution in the career marketplace. Pink (2005) argued

that the future belongs to a different kind of thinker, or more specifically, a different kind of person with a different kind of mind. Right-brain thinkers will be the people who move ahead in the coming decades (Pink 2005). Pink proposed that humankind is headed to a new age, the Conceptual Age. This new time period is the age of highly creative ideas and inventions, or concepts, that come from unfamiliar ideas or things to inspire high desire or high demand from people in society.

Huitt (2007) described the Conceptual Age as an elaborate Information Age. Huitt (2007) summarized major trends of the Information Age from the first telegram sent in 1844, with a series of dots and dashes, from Washington, DC, to Baltimore, through the use of internet and information sources such as the *Wall Street Journal* available to millions of homes all over the world. Pink stated that because of the extensive access to information, the world is progressing "to a society of creators and empathizers, pattern recognizers, and meaning makers" (p. 1). Simply put, Huitt described the Conceptual Age as taking something we already know and can do and elevating the concept or elaborating on the concept to make it better. Society went from basic communications systems such as telegrams from city to city to an elaborate worldwide internet that literally connects worldwide communication to society's fingertips. The entire world was greatly impacted with this invention; whether the impact on the world was for better or worse is left up to individual opinions.

Pink (2005) stated that three forces drove the conceptual age. The abundance of wealth means that people are looking for more than their basic needs to be satisfied. Most people in the United States as well as those living in other postindustrial economies have enough material wealth to meet their basic needs (Pink 2005). Another force to drive the

Conceptual Age is the rising economy and political importance of Asia (Pink 2005). China and India account for half of the world's population (Pink 2005). The number of university graduates is rising substantially, and these countries will be able to academically challenge nations of North America, Europe, and Japan (Huitt, 2007). The third force driving the Conceptual Age is the use of automation. Fewer workers are needed, and more people are available to do other activities (Pink, 2005).

Dr. Daniel Araya is a researcher, consultant, author, and advisor. He is also a senior partner with the World Legal Summit and Senior Fellow with the Centre for International Governance Innovation. Araya (2016) stated that automation has taken over 77% of the jobs in China and 69% in India. Robotics, artificial intelligence, and digital manufacturing are changing the landscape of the economy (Araya, 2016). Araya (2016) explained that the needs of the workforce have shifted from jobs that focused more on specific skills during the Industrial Age to a workforce that requires more entrepreneurial, invention, and design expertise to succeed in the Conceptual Age. Araya (2016) stated that the future workforce will not need technical proficiency alone, but also will need to bridge skills with new thoughts, ideas, products and inventions to be successful in the Conceptual Age.

Pink (2005) described considerations for those charged with the education of children, such as parents and teachers. Pink (2005) stated that empathy must accompany the development of logic and critical thinking. Pink (2005) stated that logical thought is a defining human characteristic, but for humankind to thrive in the future, those who will stand out will have the ability to understand others, to forge relationships, and to care for others.

Another attribute necessary for future education, as described by Pink (2005), is the ability to tell a story, not just present an argument. Because of the abundance of knowledge and access to technology, a person is bound to present another argument with just as much evidence that will support a counter argument. Pink (2005) stated, “The essence of persuasion, communication, and self-understanding has become the ability to also fashion a compelling narrative” (p. 66). Huitt (2007) argued that this quote suggests creative thinking will become at least as important as critical thinking.

A third notable attribute for parents and educators that is related to creativity is the importance of design over usefulness and function, or practical purpose (Huitt, 2007). Pink (2005) stated, “It’s no longer sufficient to create a product, service, an experience, or a lifestyle that’s merely functional. Today, it’s economically crucial and personally rewarding to create something that is also beautiful, whimsical, and emotionally engaging" (p. 68). Basic needs are met by most of the postindustrial world, so products, services, and experiences must stand out above the rest to satisfy the consumer (Pink, 2005)

Additionally, Pink (2005) cited evidence that play is a benefit to not only health, but professional performance as well. Laughter and lightheartedness contribute to the “flow” process described by Csikszentimihalyi (1975). Optimal performance is occurring that is fulfilling and engaging and most often occurs when “a person’s body and mind is stretched to its limits in a voluntary effort to accomplish something difficult and worthwhile” (Csikszentimihalyi, as quoted in Pink, 2005, p. 3).

Finally, Pink (2005) noted that people must learn not only to focus on specifics but also to put multiple pieces together. People need the ability to analyze parts, see

patterns, focus on individual tasks, and yet simultaneously engage in multiple activities to resolve conflicts or tensions.

Pink (2005), Araya (2016), and Huitt (2007) have described what skills are needed in the 21st century. The components of divergent thinking—fluency, flexibility, originality, and elaboration—are skills that can support what these researchers described. The education system that will produce the future workforce needs to evaluate its practices in order to produce successful citizens in the Conceptual Age.

William Huitt is a professor at Valdosta State University and founder and codirector of Community Development Through Academic Service Learning. He has conducted research on educational reform and restructuring. He presented at the Georgia Educational Research Association, stating that preparing youth for the 21st century is a daunting task (Huitt, 2007). Huitt (2007) stated that schools provide the best opportunity for students to get what they need; however, a societal commitment is needed to make significant changes. Huitt (2007) observed that U.S. schools are not equipped to make the social change needed. Due to governing structures and accountability issues, change will not happen fast enough. Also, to compound the problem, student desired outcomes are too narrow because they focus on basic skill achievement (Huitt, 2007). Huitt (2007) stated that while basic skills are important, exclusive concentration on basics will inadequately prepare students for the Information Age, much less for the Conceptual Age. Huitt (2007) noted that even the framework proposed by the Partnership for 21st Century Skills, or Partnership for 21st Century Learning (P21), would need to be modified to address the demands and opportunities of the next decade.

The P21, which was founded by the National Education Association, has developed a vision for students to succeed in a new global economy. The mission of P21 is to position 21st century skills at the center of K-12 education in the United States by building partnerships with the business community. These partnerships should provide resources to facilitate and drive change such as the Framework for 21st Century Learning (P21, 2019). The Framework for 21st Century Learning described skills, knowledge, and expertise students must master to succeed in work and life. P21 (2019) also stated that students must learn essential skills for today's world such as critical thinking, communication, collaboration, and creativity within the context of core content knowledge instruction. The National Education Association, through P21 (2019), clearly valued creativity as one attribute that should be introduced and allowed to develop in students throughout their academic careers. The framework includes other factors, such as technology and media skills, but for purposes of this research, the creativity segment with the 21st century requirements were specifically studied. Creativity has been described as one of the most important economic resources of the 21st century (P21, 2019).

Ken Kay is the chief executive officer of EdLeader21, a professional learning community for education leaders (Kay & Greenhill, 2011). He has been a leading voice for 21st century education since 2001 (Kay & Greenhill, 2011). Valerie Greenhill is the chief learning officer for EdLeader 21(Kay & Greenhill, 2011). Both leaders in education are focused on supporting districts to integrate the Four Cs—critical thinking, communication, collaboration, and creativity—into assessment and curriculum (Kay & Greenhill, 2011). These leaders were successful in gaining corporate support to add the

Four Cs to the traditional core subjects of reading, writing, and mathematics (Kay & Greenhill, 2011). However, school districts were slow to support due to testing programs throughout the states. However, programs for social-emotional learning are increasing, college and career definitions are becoming more broadly defined, deeper learning initiatives are being adopted, and the Common Core State Standards partially include some of the Four Cs (Kay & Greenhill, 2011). Kay and Greenhill (2011) have aligned a guide to help school districts and leaders to use the Four Cs to align district vision, align professional capacity, and community support. Kay and Greenhill argued, "Our education system was built for an economy that no longer exists" (p. 42). The 19th century was based on agriculture (Dewey, 1916), the 20th century was based on industry, and the 21st century economy is based on globalization (Chen & Kauffman, 2008; Childress, 2016; Zhao, 2015).

Simone Ritter from the Department of Social and Cultural Psychology and Behavior Science Institute at Radboud University in the Netherlands did a study along with the Mostert Consultancy for Creativity and Innovation Management, also in the Netherlands. Ritter and Mostert (2017) stated that due to the increased focus on innovation for the 21st century, and recent reports of the decline of creative thinking skills, there is a need to develop creative thinking skills in schools and in business. Ritter and Mostert (2017) tested a creativity training program on undergraduate students who volunteered to participate. Thirty-two students participated in one session that lasted an hour and a half (Ritter & Mostert, 2017). The participants were shown a systematic method on applying creative thinking strategies (Ritter & Mostert, 2017). A pretest–posttest comparison was utilized with measures on divergent and convergent thinking and

creative problem-solving skills (Ritter & Mostert, 2017). The results showed an increase in ideas generated on the posttest. Most importantly, the researchers discovered cognitive flexibility was a possible underlying mechanism in improving idea generation (Ritter & Mostert, 2017). Their study is important to education and other organizations because findings indicated creative thinking skills can be improved (Ritter & Mostert, 2017). Ritter and Mostert (2017) concluded that if the goal is to train for creative thinking skills, then creative training programs need to be developed and successfully implemented.

Creativity

Historical Context

The middle of the 20th century sparked a rise of pioneering research in creativity by individuals such as Dr. Guilford and Dr. Torrance. Guilford and Torrance were psychologists and pioneers of research on intelligence and creativity. Both researchers put years of effort into extending and measuring individuals' creativity. Guilford was a psychologist known for his study of intelligence; he was part of the development of the structure of intellect theory (Guilford, 1955). This theory states that an individual's performance on intelligence tests can be traced back to the underlying mental abilities or factors of intelligence (Guilford, 1955). Most of these factors have to do with thinking; the remainder involve memory (Plucker & Esping, 2014). The purpose of identification of these factors was mainly for the concept of intelligence and for practices of intelligence testing. Guilford had a key leadership role in World War II helping the U.S. Military carry out the largest testing program in history (Guilford, 1967). He was also given the top honor of his field as being named president of the American Psychological Association in 1950 (Guilford, 1967). During his presidential address, he chose to speak

about creativity and shocked his peers. Guilford (1950) was concerned about the discouragement of creative thinking and the development of creativity within the classroom.

Dr. E. Paul Torrance began researching the impact of creativity when he was a high school teacher dealing with difficult students (Hébert et al., 2002). His interest deepened as he took a position as a research psychologist for the Air Force and completed research on the psychology of survival (Hébert et al. 2002). Here he began his lifelong pursuit of how to identify and develop creative potential (Hébert et al., 2002). Torrance established an international reputation as a scholar of creativity before he retired (Hébert et al., 2002). He published thousands of books, articles, chapters, and tests as well as delivered countless speeches and workshops at national and international sites (Hébert et al., 2002). Torrance posited that creativity is almost infinite and involves every sense—seeing, hearing, feeling, tasting—and much of it is unseen, nonverbal, and unconscious (Millar & Dahl, 2011).

Before the mid-20th century when these two men began their research, creativity was not studied. American psychology had been dominated by behaviorists, who studied only behaviors they could observe (Sawyer, 2012). During this same time, psychology was dominated by the Freudians, who considered creativity a subliminal activity (Sawyer, 2012). Yet another reason that psychologists did not study creativity was they believed creativity was a byproduct of high human intelligence (Sawyer, 2012).

Two factors led to the study of creativity education (Millar & Dahl, 2011). First, in 1950, Guilford addressed the American Psychological Association with a need for further research in creativity (Millar & Dahl, 2011). At the same time, Torrance became

the director of the Bureau of Educational Research at the University of Minnesota (Millar & Dahl, 2011). As these researchers ascended to positions of educational prowess, the Soviet Union launched Sputnik into space and set the space race into motion (Millar & Dahl, 2011). The United States responded to this event by mobilizing educational professionals to identify and develop a new generation of talented youth (Millar & Dahl, 2011). These two events in history, coupled with two reputable researchers, ignited educational research on creativity in the United States. However, societal change and the acceptance of such change take time (Millar & Dahl, 2011). In the late 1950s, Torrance asserted that it takes 75 years for an idea to be entirely accepted by society (Millar & Dahl, 2011). Before the idea of creativity can be accepted, it is necessary to understand what creativity is.

Defining Creativity

Creativity has many definitions, depending on the field. Psychology, education, business, history, and even areas like political science have varying definitions of creativity, according to Wehner et al. (1991). These researchers found that although the fields are different in context and different terms are used, the terms' meanings overlapped and described the same phenomenon. For example, in business studies, the word *innovation* was used, but the whole organization was viewed. However, in psychology, *creativity* was used, and the level of the individual was viewed. Wehner et al. (1991) described comparing definitions of creativity to the fable of the blind men and the elephant: "We touch different parts of the same beast and derive distorted pictures of the whole from what we know" (p. 270).

To explain and define creativity, four important models of creativity emerged in the 20th century: stage-based models (Wallas, 1926); convergent and divergent thinking (Guilford, 1956); blind variation, selective retention (Campbell, 1960); and the systems model by Csikszentimihalyi (1996). Table 1 summarizes these four models.

Table 1

Explanatory Models of Creativity

Researcher	Model	Description
Wallas, 1926	Stage-based models	The creative process is divided into separate stages: preparation, incubation, illumination, verification
Guilford, 1956	Convergent and divergent thinking	Creativity is intellectual theory where creativity results between processes of moving between divergent and convergent thinking.
Campbell, 1960	Blind variation, selective retention	Trial and error framework that can be modifiable across cognitive and social interpretations
Csikszentmihalyi, 1996	Systems model	Creativity results from interaction between environment, person, and field of context

Researchers continued to develop deeper explanations by developing frameworks or taxonomies to clarify meanings from the models. The four Ps framework was developed by Rhodes (1961) to refer to person, process, product, and press (environment). See Figure 2 for illustration. Rhodes's research was a collection of 40 definitions of creativity and 16 definitions of imagination. He grouped all the definitions into four categories. Person covered information about personality, intellect, physique, traits, attitudes, self-concept, values, and behavior (Rhodes, 1961). Process applied to the motivation, learning, thinking, and communicating. Product is what is created when an idea becomes something tangible (Rhodes, 1961). Finally, press was the environment,

which is related to the person or the influence that environment has had on the person (Rhodes, 1961).

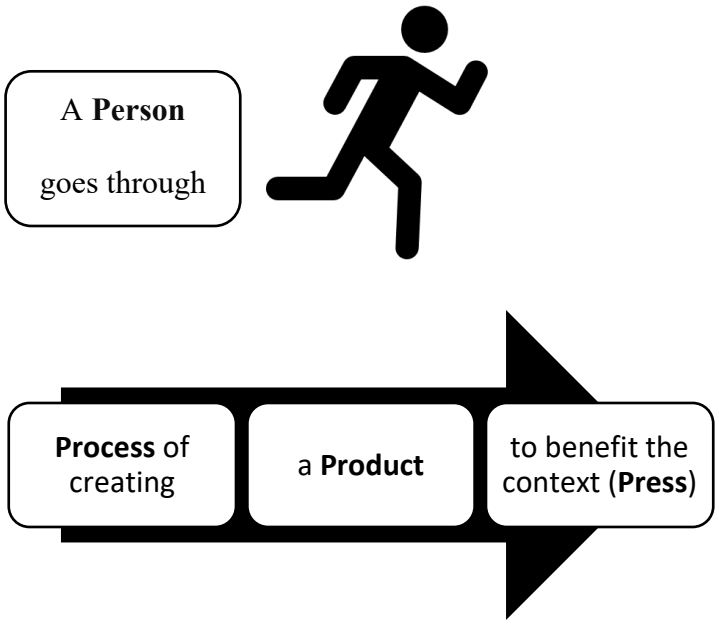

Figure 2. Four P framework for creativity. Adapted from "An Analysis of Creativity," by M. Rhodes, 1961, *Phi Delta Kappan, 42,* 305–310.

Theorists also developed combinations of multiple strategies and ideas to define creativity. Two theories of creativity came from modern psychologists Mihaly Csikszentmihalyi and Robert Sternberg. Csikszentmihalyi's (1999) systems model of creativity represented the interaction between a culture or a specific domain, an individual, and a field of experts. These interactions are shown in Figure 3. Csikszentmihalyi (1999) described creativity as a process of any act, idea, or product that changes or transforms an existing domain and is relevant to that domain.

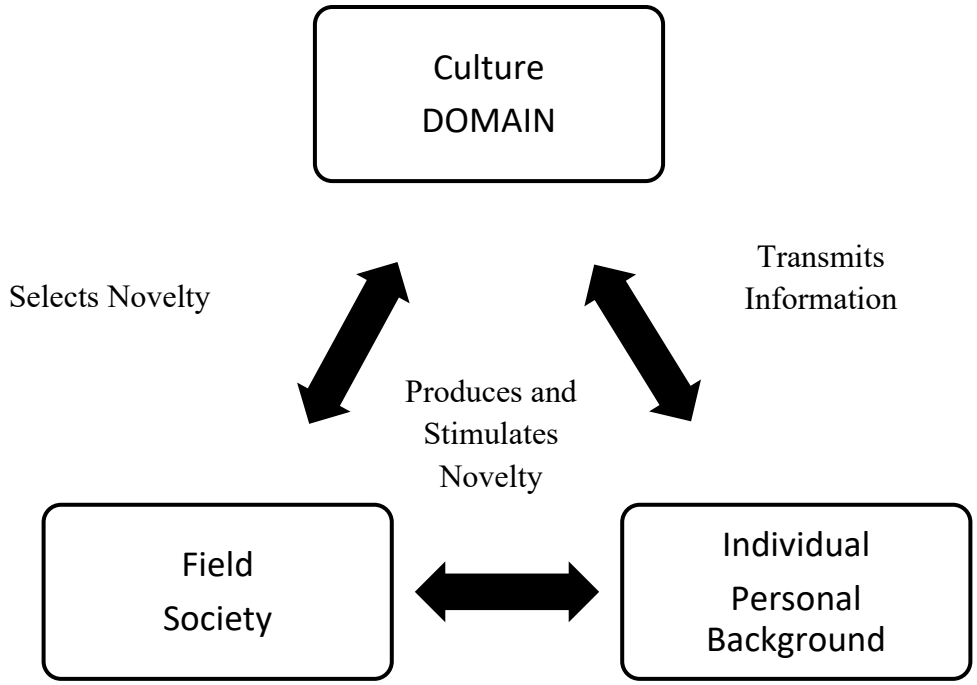

Figure 3. Systems model of creativity. Adapted from "Implications of a Systems Perspective for the Study of Creativity," by M. Csikszentimihalyi, 1999, in R. J. Sternberg (Ed.), *Handbook of Creativity* (pp. 313–335), Cambridge University Press.

Later, Kaufman and Beghetto (2009) distinguished types of creativity into the Four Cs. The Cs can be "mini Cs," which deal with creativity in learning and development; "little Cs"; or the "Big C," which is creativity to change the world known as eminent creativity. Further, Pro C is professional expertise that does not change the entire domain of that profession. Kaufman and Beghetto (2015) described the relationship among the Cs like a continuum starting at mini C and moving further to the more objective recognition at the later forms of Big C. The purpose of the categories is to understand various levels of magnitude and not distinguish one rigid category over another (Kaufman & Beghetto, 2015).

The distinctions are useful in education for teaching training purposes. The four C model helps teachers see a concrete example and better recognize how they can help students develop creativity (Kaufman & Beghetto, 2015). The four C model illustrates trajectories for developing creativity (Kaufman & Beghetto, 2015). See Table 2 for more details.

Table 2

Four Cs Model

Creativity (C) type	Definition	Example	Types of measures
Mini c	Meaningful interpretation of experiences, actions, events	Showing new learning or applying learning in a new way	Self-assessment; microgenetic methods
Little c	Everyday expressions of new ideas	Turning leftovers into a new dish for family to enjoy	Ratings, psychometric tests; assessments; peer reviews
Pro C	Expert expressions of new ideas (exceeds everyday ideas but not legendary)	Receiving an award or accomplishment in profession	
Big C	Legendary, changes entire field of study or domain	Winston Churchill, Franklin Roosevelt	Major prizes or honors of historical measure

Note. Adapted from "Beyond Big and Little: The Four C Model of Creativity," by J. C. Kaufman & R. A. Beghetto, 2009, *Review of General Psychology, 13*(1), 1–12.

Robert Sternberg was a prominent American psychologist, professor, and researcher who worked with Dr. Todd Lubart, world-renowned French psychologist, at Yale University. Sternberg and Lubart (1993) distinguished that creativity required six resources to work together to establish the investment theory of creativity. Sternberg and Lubart (1993) stated that creative thinkers are like good investors—they buy low and sell

high. Creative people generate new ideas, which are like undervalued stock in the business world, plentiful and thus cheap (Sternberg & Lubart, 1993). Once ideas begin to gain acceptance, the creator reaps the benefits or profits (selling high). Sternberg and Lubart (1993) stated that creative individuals defy the crowd and resist thinking or doing the same as others. According to Sternberg and Lubart's (1993) theory, creative individuals make decisions based on a willingness to redefine a problem, take risks, sell ideas, persevere through obstacles, and examine their own creative process. For creative individuals to do these tasks, six resources must work together to achieve these goals, as shown in Figure 4 (Sternberg & Lubart, 1993). The resources are intellectual ability, knowledge, styles of thinking, personality, motivation, and environment (Sternberg & Lubart, 1993). In simplest terms, any theory of creativity needs to consider that the creativity of a person depends very much on the environment in which the person works, where, and when the work is being done (Sternberg, 2018).

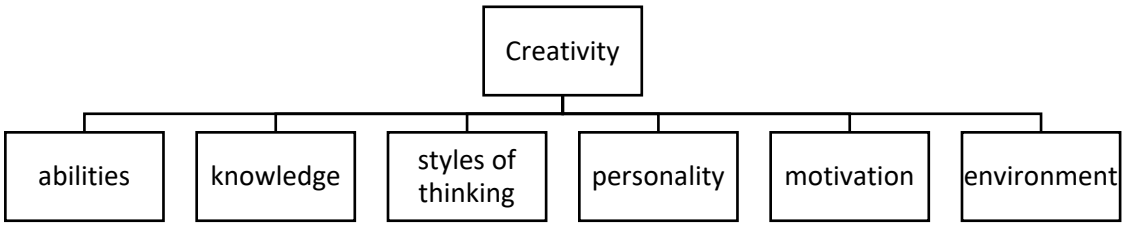

Figure 4. Investment theory of creativity. Adapted from "Investing in Creativity," by R. Sternberg & T. Lubart, 1993, *Psychological Inquiry, 4*(3), 229–232.

Mark Runco (2004) from the Torrance Creativity Century at the University of Georgia stated that creativity must be both original and effective. To gain a better understanding of the term *original*, other words synonymous with original are *novel* and *unique* (Runco & Jaeger, 2012). Original works, ideas, or products are different from

anything else or could be known as one of a kind. Originality is vital for creativity but cannot stand alone. Originality must be effective to be creative (Runco & Jaeger, 2012). *Effectiveness* also has synonyms to help better understand the word: *useful, fit, appropriateness,* and even *value*. Effectiveness means to be worth something to the user or audience and not just for monetary reasons. Value or effectiveness can be both intrinsic and extrinsic in nature. People can feel valued or effective based on job performance, as well as products can have great value based on monetary systems. Value is a label that becomes clear in economic research on creativity (Runco & Jaeger, 2012).

Findings from a longitudinal study conducted by Kim et al. (2009) in Hong Kong found employee creativity was positively associated with career satisfaction. Their study also found that employee creativity fully mediated the relationships between proactive personality and career satisfaction as well as perceived insider status (Kim et al., 2009). These findings imply that creativity can improve employees' attitudes towards their career and help employees perceive themselves as valued by the employer.

The word *creativity* comes from the Latin term *creò,* which means "to create, to make" and refers to the ability to generate ideas that are original and useful (Ritter & Mostert, 2017). In addition to the function of problem-solving, creativity allows flexibility to deal with opportunities and changes in a fast-changing world (Ritter & Mostert, 2017). Runco (2004) explained that in this complex world, creativity is more important than ever, because creativity is a useful and effective response to evolutionary change. The world has become more complex as societal issues have become more interdependent, technology has expanded, and education and industry have become globalized.

It is important for researchers to have a common understanding or at least a way to categorize what it means to be creative. Having a pathway or framework of understanding will help guide future researchers, whether by defining where understandings currently are or by identifying misconceptions that can be later studied (Kaufman & Beghetto, 2009). An important part of the creativity framework is divergent thinking.

Divergent Thinking

Guilford (1956) introduced divergent and convergent thinking as he developed his theory of intelligence. The theory was organized into three functions of human intellect, known as operations, products, and content (Sternberg & Grigorenko, 2001). Guilford's description of divergent thinking is inventive thinking, done inductively and innovatively (as cited in Sternberg & Grigorenko, 2001). For instance, divergent thinking can have multiple paths or ideas that stem from just one point. Divergent thinkers should be able to generate multiple ideas to solve problems and be able to elaborate on ideas. Guilford (as cited in Sternberg & Grigorenko, 2001) recognized that divergent thinkers do not fixate on just one idea.

Torrance published his TTCT years after Guilford's 1950 address to the American Psychological Association on creativity (Scholastic Testing Service, 2017). His tests yielded scores based on four elements of divergent thinking: fluency, flexibility, originality, and elaboration (Scholastic Testing Service, 2017). Fluency is the quantity of responses. Flexibility is the number of or quantity of categories created from the responses. Originality is the number of rare or unique ideas within responses. Elaboration is the number of details within the response or the amount of detail in the response

(Scholastic Testing Service, 2017). These elements have been described by Gautam and Shively. Sandeep Gautam manages a software development team for a network communications giant and publishes a blog on psychology, neuroscience, and creativity (Gautam, 2012). Candice Shively (2011) was a teacher in Ohio and Pennsylvania and is the director of K-12 initiatives at a nonprofit organization called TeachersFirst. She blogs, writes articles for technology, and presents to educators all over the United States.

Fluency

According to Gautum (2012) and Shively (2011), fluency is the ability to rapidly generate various ideas. It is an element of divergent thinking that is the first step to any creative process. The goal is to create as many ideas as possible to solve a problem. Torrance's 1998 definition of creativity is showing sensitivity to problems, shortcomings, knowledge gap, and inconsistencies; looking for solutions; forming hypotheses on shortcomings; testing and retesting such hypotheses; and reaching a conclusion (Aiamy & Haghani, 2012). Fluency is usually one of the first stages in the creation of ideas or solutions to problems (Shively, 2011). Brainstorming is one process that is an example of developing fluency (Shively, 2011).

A study was done on the effects of brainstorming, synectics, and traditional teaching methods on 196 third-grade students in Sanandaj in 2010 (Aiamy & Haghani, 2012). Synectics is a problem-solving method in which, as ideas are generated, the ideas lead to new ways of thinking. Synetctics is a way of bringing together subjects that are not traditionally connected in order to come up with something new (Aiamy & Haghani, 2012). Science content was taught using these three teaching methods. The experimental design included a pretest and posttest, and the TTCT was used prior to and after teaching

(Aiamy & Haghani, 2012). Both descriptive and inferential statistics and analysis of covariance (ANCOVA) were used to assess the effect of teaching methodology on creativity (Aiamy & Haghani, 2012). Aiamy and Haghani (2012) concluded, using Fisher's least significant difference test, that the synectics method is the best teaching method, based on a mean difference of 15.54 points between traditional teaching and synectics methods ($p < .01$; Aiamy & Haghani, 2012). Brainstorming was more efficient than traditional teaching, with a mean difference of 10.36 ($p < .01$) as far as development of creative thinking (Aiamy & Haghani, 2012). Aiamy and Haghani's (2012) study supported the idea that teaching methods should be transformed to develop students' creative thinking.

Another study was completed in Amman during the second semester of the 2017-2018 school year to identify the effect of using brainstorming in the development of creative thinking and achievement (Al Masri, 2019). The concept of brainstorming is simply to generate ideas to open the mind to recognize the problem and view it from different angles. The definition of brainstorming, according to Al Masri (2019), is to use the mind to actively address the idea or problem. Brainstorming is a method of learning that is based on the freedom of thought and is used to generate the greatest number of ideas to address the topic or problem. Al Masri (2019) emphasized that giving as many ideas as possible leads to the generation of creative ideas. Al Masri (2019) noted the right atmosphere is crucial for creating an open mind and freedom of thought, without pressure of opinions of others; such an environment is crucial to the development of fluency, flexibility, and originality. Most conventional teaching methods hinder this type of

thinking because the teaching methods focus on conservation and memorization of knowledge and information (Al Masri, 2019)

The results of Al Masri's (2009) study showed statistically significant differences ($p < .05$) between the pre- and posttest mean scores of the group taught using the brainstorming strategy. Pre- and posttests measured creative thinking (Al Masri, 2019). Results also showed statistically significant differences between the mean scores in fluency, flexibility, and originality of the group taught with brainstorming strategy (experimental group), and the group taught in the usual way (control group; Al Masri, 2019).

Flexibility

Fluency deals with the generation of many ideas, but flexible thinking allows thoughts and ideas to be categorized into groups by similarities or associations (Gautam, 2012). One example of building flexible thinking skills is to practice taking different perspectives to solve the problem. Flexibility also promoted interpersonal and cross-cultural understandings as categories are studied (Gautam, 2012).

Dr. Maura Sellars, the assistant director of professional experience at the School of Education at Newcastle University in Australia, investigated the capacity to develop cognitive competencies in executive function, known as flexible thinking, on 40 students aged 10–12 at a school in Australia (Sellars, 2011). Improvements were made based on baseline data that showed none of these students were able to demonstrate the cognitive capacity of flexible thinking (Sellars, 2011). Findings showed a considerable increase in students' flexible thinking skills over 6 months (Sellars, 2011). First, student choice and ownership of their learning appeared to be a factor (Sellars, 2011). Students in the

intervention program were allowed a choice of learning tasks as well as how their tasks were to be completed (Sellars, 2011). Students also could choose they type of product that best demonstrated mastery of the skill (Sellars, 2011). Teacher interaction was a second factor that determined the improvement in flexible thinking (Sellars, 2011). The teachers became mentors and guides to help students make their own decisions. The teachers were no longer the decision makers in the students' learning process. At the commencement of the intervention, the teachers could not find any evidence of flexible thinking in any of their students, either by observation or by conferencing with them (Sellars, 2011). At the conclusion, 34 students demonstrated the cognitive capacity to think flexibly. Six were at the beginning stages to develop these skills (Sellars, 2011). These skills were demonstrated by the reflective responses completed at the end of each task (Sellars, 2011). Another observation was that the class with the most participants in the study showed the strongest flexible thinking skills (Sellars, 2011). Sellars (2011) noted that the impact could be from strong interaction and strong support among students, but also that this teacher was enthusiastic about the potential of the intervention and spent increased time developing strategies for implementation and success of the intervention program.

Developing flexible thinking in students can be done through service learning (Thomson et al., 2016). Professors at a college in North Carolina designed a course for graduate students to participate in a service-learning project of teaching students and their families about healthy eating, childhood obesity, and diabetes through puppet shows (Thomson et al., 2016). The health puppetry project led the graduate students to develop and engage their flexible thinking by taking on different perspectives from puppet to

perspective of teacher, the perspective of community leader, and the perspective of a citizen that is making a difference in the community (Thomson et al., 2016). The graduate students learned new roles to play that Minnick (as cited in Thomson et al., 2016) listed as a characteristic of the kind of thinking that should be taught in classrooms.

A thematic analysis was compiled through reflection journals kept by the graduate students (Thomson et al., 2016). The results from the qualitative study demonstrated that a single semester's coursework has real possibilities to change students, faculty, universities, and communities as societal problems are addressed (Thomson et al., 2016). This project required students to see the big picture of a complex social problem and to look at the problem from different perspectives and respond with a creative solution to make a difference in the community (Thomson et al., 2016).

Flexibility in learning is important as the learner advances knowledge beyond the introductory phase for a subject or content area (Spiro et al., 1988). Showing flexibility, the learner must attain a deeper understanding of content material, reason with it, and apply it flexibly in diverse contexts. The typical methods in education are exposure to content, followed by assessment of general recall or recognition of facts. Approaches to learning to enhance cognitive flexibility should allow for multiple representations, be multidirectional or have multiple perspectives, and foster the ability to assemble diverse sources of information to fit the situation (Spiro et al., 1988).

Originality

To better understand originality, synonyms can be used. Synonyms for *original* are *unique, novel, unusual*, and *unexpected*. One way to measure if the idea is original is to compare it with a group. If the idea stands out as a one-of-kind idea among the

comparison, then it shows originality (Gautam, 2012; Shively, 2011). One way to build original thinking skills is to offer "what-if" scenarios. A negative aspect of developing original thinking is that it may disrupt the school setting, although the processes prove beneficial to the world setting (Shively, 2011). Being original goes against other ways of thinking. Being original means not conforming to the way others are thinking or doing.

A *New York Times* bestselling author Adam Grant (2006) recommended three strategies for teaching creativity in his book, *Originals: How Non-Conformists Move the World*. He suggested teaching in conditional terms instead of in absolutes, using jigsaw classrooms, and teaching values instead of rules (Grant, 2016). Grant (2016) highlighted evidence that children are more likely to think in original ways if conditionals are taught versus using absolutes. For example, instead of saying, "This is a wedge," the teacher can say, "This could be a wedge, but this could also be an X or a Y" (Grant, 2016). Jigsaw classroom use is prevalent in project-based learning (PBL) classrooms (Grant, 2016). Students are assigned roles and responsibilities while working on a project (Grant, 2016). This group collaboration method allows students to see alternative ways to create the project together instead of doing the project just one way using one idea (Grant 2016). For example, if students are working on building a model community, the teacher may assign student roles such as a researcher, a writer, an artist, a publicist, or any other jobs that fit the task to develop a coordinated effort to complete the project (Grant, 2016). Rules set limits that are fixed (Grant 2016). Teaching values supports and encourages various interpretations of the values or principles (Grant 2016). For example, respect others is a value that is expected in school yet is open for interpretation (Grant 2016).

Instead of rules stating to follow teacher directions, respect others means to list to others such as the teacher, other adults, and peers (Grant 2016).

Elaboration

Elaboration focused on the solutions or ideas generated and then develops those solutions and ideas further. Words such as *embellish* and *detail* are synonyms with elaborate (Shively, 2011). Embellishments or details are added to the context of the problem or situation to develop it further (Shively, 2011). Shively (2011) offered suggestions to develop elaboration skills with students. Without elaboration, "others would not see the full potential of creative inspiration" (Shively, 2011, p. 13). Elaboration involved adding detail to make things real, embellishing to make things aesthetically pleasing, and carrying ideas to fruition or making ideas understandable (Shively, 2011). One method Shively (2011) used to build elaboration skills is writing a "starter" and having students take turns adding details. She offered content-specific strategies. In math, students can explain the steps on a poster; in science, students can annotate a diagram or image of what is being studied; and in social studies; students make campaign posters of slogans for a war (Shively, 2011). Elaboration consisted of deep levels of cognitive processing for learners (Shively, 2011). Elaboration skills help learners use images, associations, and more meaning analysis of information, leading to better recall of information (Shively, 2011).

Donn Ritchie is an associate professor at San Diego University, and Belinda Karge is a professor in the Department of Special Education at California State University. Ritchie and Karge (1996) stated teachers cannot change how students learn or what background knowledge each student already has, but teachers can change

instructional techniques that will help students retain and recall information. Ritchie and Karge (1996) claimed that an elaboration process is a key instructional technique to help students retain and recall information. Elaboration occurs when students think of a piece of information and construct a memory link between that information and some piece of knowledge already in long-term memory (Ritchie & Karge, 1996).

Ritchie and Karge (1996) categorized elaboration teaching strategies into groups. Micro elaboration techniques help students retain individual facts. Some strategies discussed are making associations with similar words or facts, using mental imagery, and mnemonic devices to name a few. Macro elaboration techniques facilitate retention of entire lessons (Ritchie & Karge, 1996). Examples include making analogies, starting with abstract ideas, and then given more details as the meaning can be conceptualized. Ritchie and Karge (1996) stated that exposure to different types of strategies may help students establish a general tendency to elaborate more. Elaboration was a technique to make information more memorable (Ritchie & Karge, 1996). Therefore, one implication for educators is that improving elaboration skills will improve retention and recall skills (Ritchie & Karge, 1996).

Convergent Thinking

In addition to divergent thinkers, Guilford (1956) also presented the idea of convergent thinkers. Convergent thinking, as described by Guilford (1956), is logical, analytical, and deductive. Convergent thinkers look at the facts and information presented to get to a solution or correct answer to a problem (Sternberg & Grigorenko, 2001). Gajda et al. (2017) noted the importance of convergent processes in creative thought.

Gajda et al. stated creative thought is the utilization of both divergent and convergent processes working together.

Educational psychologists van de Kamp et al. (2015) concluded creativity can be taught and assessed. Teaching and assessing in ways that encourage divergent thinking as well as convergent thinking helped students transfer their learning across disciplines to think critically and solve macro and micro problems within the classroom and the world (van de Kamp et al., 2015). Shrestha (2017) identified characteristics of divergent and convergent thinking, as shown in Table 3.

Table 3

Descriptive Characteristics of Divergent and Convergent Thinking and Thinkers

Divergent thinking/thinkers	Convergent thinking/thinkers
Considers several solutions	Direct answers
Instinctual and free-flowing ideas	Right or wrong/ precise
Complex	Logical
Explores in an outward direction	Centers on strongest solution
Unique ideas/novelty	Linear thinking
Possibilities are limitless	Seeks to find definitive answer
Less rigid: considers the “gray areas”	Fixed mindset: black or white
Figures out probable options	Decision-making tasks
Personalities are extroverted	Introverted personality
Open to new experiences	Goes with what is familiar
More positive in nature	Negative and closed minded
Multiple answers	One correct answer
Risk taker: goes against the norm	Plays it safe
Curious thinker	Rule follower
Inductive reasoning	Deductive reasoning
Quantity over quality	Quality over quantity
Time: works through the process	Speed is of importance

Note. Adapted from “Convergent Vs. Divergent Thinking,” by P. Shrestha, 2017, https://www.psychestudy.com

Fostering and Assessing Creativity

Torrance (1979) stated creativity is essentially two basic approaches, cognitive and personality approaches. However, creativity assessments have grown beyond these two approaches. Assessment methods of creativity fall broadly into four types of investigations: creative processes, creative behavior, creative products, and creative environments (Rhodes, 1961). Kaufman et al. (2012) classified creativity instruments into four other types: divergent-thinking tests, consensual assessment technique, rating scales by others, and self-assessments.

Divergent thinking is the "ability to produce many and diverse ideas when presented with an open-ended problem" (Runco, 1990, p. 37). Guilford (1967) stated that the focus of divergent thinking is on the quantity and quality of ideas or responses produced by the problem solver. Therefore, assessments of divergent thinking are designed to assess the ability to solve open-ended problems with a novel and useful response. The quantity and quality of the responses are assessed based on the components of fluency (how many ideas), flexibility (diverse classifications of ideas), originality (uniqueness of ideas), and elaboration (details), according to Sak and Maker (2005). Divergent thinking has the main form of creativity assessment for many years (Kaufman et al., 2012). The TTCT is the most widely used assessment of creativity (Kim, 2017; Sternberg, 2006).

The consensual assessment technique is an approach to evaluate a creative product by a group of experts in a field making a collective judgement of the product (Baer & Kaufman, 2019). According to Baer and Kaufman, (2019), the consensual assessment technique is effective for making decisions about creativity of applicants for

education programs. The Gifted Rating Scale used in Georgia is one example of this type of assessment.

Assessments of creativity by others and self-assessments are two more types of tools that can be used. Assessments of creativity by others focus on the creative person, who is judged or rated by others, such as teachers. This method is similar to the consensual assessment technique; the major difference is that the consensual assessment technique evaluates a product rather than a person. Self-assessments are measures in which people judge or rate themselves based on their creative performance in everyday life and creative achievement, as well as their creative self-concept (Kaufman et al., 2012).

In a quasi-experimental study with a pretest–posttest design in the Netherlands, van de Kamp et al. (2015) examined whether explicit instruction of meta-cognition leads to enhanced divergent-thinking skills. The participants were Grade 11 students aged 16–17 years old from the same secondary school (van de Kamp et al., 2015). Five classes with 80 female students and 67 male students participated in the investigation (van de Kamp et al., 2015). Three classes were randomly assigned to Group A and two classes were assigned to Group B (van de Kamp et al., 2015). All classes worked on the same project concerning art reception, production, and reflection. Group A followed one intervention lesson with explicit instruction of metacognition, while Group B followed a regular art reception lesson (van de Kamp et al., 2015).

Students participated in one 50-minute lesson per week with an equal number of lessons focusing on art reception, art production, and reflection assignments (van de Kamp et al., 2015). This instruction continued for 19 weeks (van de Kamp et al., 2015).

All participants worked with the same materials, and all classes participated in the intervention during one specific lesson within this project, either in Week 5 for Group A or Week 9 for Group B (van de Kamp et al., 2015). The teachers included explicit instruction about divergent thinking, meta-cognition, and strategy in the lesson. After the intervention lesson, students started working on assignments and received guidance from art teachers as usual (van de Kamp et al. 2015).

Results of a multivariate ANCOVA showed a significant effect of the intervention (van de Kamp et al. 2015). Students in Group A generated more ideas, indicating fluency, $F(1, 103) = 5.54$; $p = .02$; Cohen's $d = .40$ (van de Kamp et al., 2015). Group A also had higher flexibility of ideas than students in Group B, $F(1, 103) = 6.69$; $p = .01$; Cohen's $d = .45$ (van de Kamp et al., 2015). However, originality did not show a significant effect, $F(1, 103) = 1.26$, $p = .26$; Cohen's $d = .30$ (van de Kamp et al., 2015). The effects found for fluency and flexibility demonstrated students developed more effective divergent-thinking skills through explicit instruction (van de Kamp et al., 2015).

Torrance's (1974) definition of creativity that guided his research was a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possible modifying and retesting them; and finally communicating the results. To measure creativity attainment, Torrance (1974, 2001) determined the five criteria he would use for each task created to measure creative abilities on the TTCT: (a) a natural, everyday process; (b) suitable for all ages, kindergarten through graduate school; (c) easy enough for young or disabled individuals to respond yet still challenging

for all; (d) unbiased by gender or race and inclusive of diverse experiences and backgrounds; and (e) fun.

Torrance sought both verbal and figural activities. The verbal component consisted of five different types of activities: Ask and Guess, Product Improvement, Unusual Uses, Unusual Questions, and Just Suppose (Torrance, 1974, 2001). The stimulus for each task consisted of a picture to which individuals responded in writing (Torrance, 1974, 2001). The figural component consisted of three different activities (Torrance, 1974, 2001). These activities asked respondents to draw additions to shapes and incomplete figures to give meaning to the shapes. Torrance personally oversaw the administration to various groups so he could monitor both individual and group responses (Torrance, 1974, 2001).

The TTCT

This study utilized an assessment created by the study school district. The assessment was modeled and adapted from the TTCT. It is important to describe this assessment for creative potential.

The TTCT is the most researched and analyzed creativity instrument, according to Kim (2006, 2017). The TTCT has two forms, verbal and figural. Kim (2017) stated that the two forms are related; however, the TTCT–Figural is a more comprehensive, reliable, and valid measure of creative potential than the TTCT–Verbal. Culturally, the TTCT–Figural is fairer and predicts creative achievement better than IQ tests and other creativity tests, including divergent-thinking tests (Kim, 2017). Kim (2017) stated the TTCT–Figural should be used to identify and develop all children's creativity.

The figural form has one of largest norming samples with longitudinal and predictive validity over a wide age range (Kim, 2006). The TTCT has become useful in identifying gifted and talented students due to the benefits of standardized administration and procedures for scoring. Kim (2006) stated that the TTCT–Figural is fair and unbiased for use regardless of race, gender, community status, culture, socioeconomic status, or language background. The responses to the figure do not require a mastery of the English language (Garaigordobil, 2006; Sternberg, 2006; Torrance, 1974). According to the Scholastic Testing Service (2017) *Norms and Technical Manual*, the figural TTCT is appropriate at all ages and grade levels, from kindergarten through adult.

The TTCT–Figural uses three tasks designed to tap into different aspects of creative functioning (Torrance, 1998). These tasks are exercises to score fluency, flexibility, originality, and elaboration by having students finish pictures, create multiple ideas from repetitive stimuli, and complete drawings from parts (Torrance, 1998). For example, a stimulus such as a black dot will be on a page, and students are asked to create a drawing using that dot in some way Scholastic, 2017). This stimulus is used to evaluate originality, elaboration, and abstractness of title (Scholastic, 2017) . In the next task, creating multiple ideas, the student is given a page full of parallel lines and asked to create as many different drawings as they can using the same parallel lines. Task 2, creating multiple ideas, is used to evaluate fluency, originality, elaboration, abstractness of title, and resistance to premature closure (Scholastic, 2017). The final task allows students to create drawing out of various lines or shapes. Task 3 evaluates fluency, originality, and elaboration (Scholastic, 2017). The students are given only 10 minutes per task to complete.

The TTCT uses a streamlined scoring procedure that is elaborate and detailed (Hébert et al., 2002). Scoring can take up to 30 minutes for each student. The TTCT has norm-referenced measures as well as criterion-referenced measures. The rationale for criteria on the TTCT checklist is that each of the 13 indicators show a role in real life creativity and how each of these indicators can be improved with practice (Scholastic Testing Service, 2017). The 13 items on the checklist are emotional expressiveness, storytelling articulateness, movement or action, expressiveness of titles, synthesis of incomplete figures, synthesis of lines or circles, unusual visualization, internal visualization, extending or breaking boundaries, humor, richness of imagery, colorfulness of imagery, and fantasy (Hébert et al., 2002).

The TTCT scoring guide contains three parts. The first part is the Profile of Creative Thinking. The TTCT scoring guide includes normative scores based on both age and grade (Scholastic, 2017). The creativity measures in this component are fluency, originality, elaboration, abstractness of titles, and resistance to premature closure (Scholastic, 2017). Each individual component is scored by specific procedures within the manual (Scholastic, 2017). One point is awarded for fluency each time the given stimulus is identifiable and used appropriately according to the scoring guide (Scholastic, 2017). Raw scores are then transferred to the appropriate grade or age range table given in the TTCT scoring manual (Torrance, 2019) to derive national percentile and standard score for fluency (Scholastic, 2017). The same process is completed for originality, elaboration, abstractness of titles, and resistance to premature closure (Scholastic, 2017). Next, a checklist of creative strengths is completed on 13 factors using symbols

(Scholastic, 2017). The Creativity Index is then calculated using formulas given in the manual (Scholastic, 2017).

A review of the TTCT, written by Kim (2006), presented basic information about the purpose, content areas, norms, reliability, and validity of the TTCT. Kim (2006) examinedstrengths and weaknesses of the assessment and described the use of the TTCT for identifying gifted learners. Kim (2006) found that the purpose of the TTCT was a part of a research project where Torrance's main focus was in understanding and nurturing qualities that helped people express their creativity. Kim (2006) discussed the content of the original TTCT in 1966 was taken from Guilford's Structure of Intellect Model (1959), composed of fluency, flexibility, originality, and elaboration. The main aspect that has changed through the years is the scoring procedures, but the same core content has remained the same since the first edition.

Norms were established in 1997 and included both grade-related and age-related norms (Kim 2006). Samples from all over the United States and Canada were used to establish these norms. The same groupings are used by the National Assessment for Education Progress, the U.S. Department of Commerce, and the National Education Association, according to Kim (2006).

Kim (2006) reported results to several preliminary studies to support the reliability and validity of the TTCT. Results were reported from various TCTT-Figural Manuals from 1998, 1990, 1966, and 1974. Kim (2006) reported the TTCT had reasonable reliability for group and research applications. Kim (2006) cited multiple studies to support and explain the validity of the TTCT. For example, Kim (2006) cited how Torrance in 2002 found in a follow-up study of 99 elementary school students 40

years after the original testing, originality remained a significant predictor of quality creative achievement for both male test takers, $r = .32$, $p < .05$, and female test takers, $r = .40$, $p < .01$. The study also correlated creative strengths as a significant predictor of quality for male participants, $r = .45$, $p < .01$, and both quality, $r = .41$, $p < .01$, and quantity, $r = .29$, $p < .05$, for female participants (Torrance, 2002, as cited in Kim, 2006).

Benefits from the studies cited by Kim (2006) of the TTCT figural is that it is easy to administer and has fewer limitations and cautions to apply than other creativity assessments. The test has one of the largest norming samples with valuable longitudinal evaluations with high predictive validity over wide ranges of time and over wide age ranges (Kim, 2006). There were no statistically significant differences in performance on the TTCT because of race or socioeconomic status, and the assessment is fair in terms of gender, race, and language background (Kim, 2006).

The TTCT figural is a valuable instrument in the testing of gifted education programs because it gives another perspective on student ability that is different from aptitude and achievement tests (Kim, 2006). The TTCT is only part of the process for admission to gifted programs for the state of Georgia. According to the Georgia Department of Education (2018), to be eligible for the gifted program, students must score either at the 99th percentile (kindergarten through Grade 12) or 96th percentile (Grades 3–12) on the composite or full scale score of a standardized intelligent test. However, students also can qualify through a multiple criteria assessment process by meeting three of the four criteria in intelligence, achievement, creativity, and motivation (Georgia Department of Education, 2018).

Kim (2006) concluded that the TTCT is a good measure not only for identifying gifted students, but also for learning about student strengths and encouraging their creative development. Kim (2006) stated that when used appropriately, the TTCT is an important part of Torrance's legacy, which was to nurture and enhance creativity among students.

A longitudinal study by Torrance (1981) followed 211 elementary school students 22 years after the TTCT administration. High school creative achievements, number of creative achievements after high school, number of creative style of life achievements, and quality of highest creative achievements were criteria assessed in the study (Torrance, 1981). Interrater reliabilities using Cronbach's alpha were .81 (Torrance, 1981). Creative Index scores from the elementary school TTCT scores on each of the criteria were significant using Pearson product-moment correlation. A multiple correlation coefficient of .63 was obtained for the criteria entered a stepwise multiple regression equation (Torrance, 1981). Kim (2006) reported criticisms of the TTCT include that subscores of fluency and originality overlap and thus the TTCT may not measure independent constructs.

Intelligence and Creativity

Intelligence is a cognitive process for convergent thinking that narrows thought down to one right answer. Intelligence can be measured in various forms. Getzels and Jackson (1962) argued that creativity and intelligence are distinct. Getzels and Jackson took a sample of Chicago area middle and high school students and measured for both intelligence and creativity. The students had a mean IQ of 132 with a standard deviation of 15. Students were divided into two groups, a high-IQ/low-creativity group and a low-

IQ/high-creativity group. Two outcomes were observed of the two groups (Hasan & Butcher, 1966). When given tests on skill attainment, both groups scored equally (Hasan & Butcher, 1966). The other finding was that teachers rated the high-creativity group lower on their desirability as pupils (Hasan & Butcher, 1966). In other words, teachers preferred the high-IQ group over the highly creative group (Hasan & Butcher, 1966). The study was limited by poor validity on the creative tasks that were used for the assessment (Getzels & Jackson, 1962). The creativity tasks tended to correlate just as highly with intelligence tasks as they did with each other.

Wallach and Kogan (1965) assessed intelligence and creativity with a sample of 151 fifth graders, 70 boys, and 81 girls. Five creativity tests were administered. Each of the five tests gave scores for originality and fluency. Wallach and Kogan (1965) argued that creative responses were unique to each person in the group. Students in the sample completed divergent tasks and were given scores for fluency (total number of responses) and for uniqueness (the number of unique responses). One point was given for each answer that was different from any other answer, and 10 indicators of intelligence were assessed (Wallach & Kogan, 1965). Wallach and Kogan (1965) simplified their assessment, based on as assessment Guilford had used to assess divergent tasks. Wallack and Kogan (1965) found validity on their tasks by showing creativity tests correlated (r = .41), and intelligence and academic achievement tests correlated (r = .51). However, the measures of creativity did not correlate with the measures of intelligence and academic achievement, average r = .09, 95% confidence interval [-0.07, 0.25] (Wallach & Kogan, 1965). This scientifically supported that one can be creative and intelligent and have high

academic achievement, yet high intelligence and high academic achievement does not mean an individual is creative.

In 2017, a meta-analysis was conducted by Aleksandra Gajda, Maciej Karwowski from the Maria Grzegorzewska University in Poland, and Ronald Beghetto from the University of Connecticut to discover any relationship between creativity and academic achievement. Gajda et al. (2017) analyzed 120 studies, and the correlation between creativity and academic achievement was $r = .22$, 95% confidence interval [.19, .24]. Gajda et al. (2017) concluded that this relationship was constant across time but stronger when creativity was measured with creativity tests compared to self-report measures, and when academic achievement was measured using standardized tests rather than grade point averages. Findings also indicated that verbal tests of creativity yielded significantly stronger relationships with academic achievement than figural tests (Gajda et al., 2017). Gajda et al. (2017) concluded with confidence that prior research demonstrated a positive relationship between creativity and academic achievement but is significantly moderated by the types of measures used. Gajda et al. (2017) noted that their research could be used as a baseline correlation for future research.

Nami et al. (2014) investigated the relationship between students' creativity and academic achievement. Nami et al. (2014) concluded with a 99% confidence level that a positive and significant correlation between creativity and academic achievement exists, and higher levels of creativity for students correspond to higher academic achievement. Students were randomly selected from 68 schools (population 2,264 students, 38% boys, 62% girls). Nami et al. (2014) used Krejcie and Morgan's (1970) table to determine the appropriate sample size for their study of 242 students. Then Nami et al. (2014)

administered three creative batteries to the students: the TTCT, the Abedi-Schumacher Creativity Test, and the Villa and Auzmendi Creativity Test. Participants self-reported their achievement scores for English, math, natural science, and social science. An authorized correlation was found that when operationalized by student grades, creativity was related to academic achievement (Nami et al, 2014). Further investigation broke creativity components down into four sections: fluid, flexibility, innovation, and extended components (Nami et al., 2014). Nami et al. (2014) used Cronbach's alpha test to determine reliability. The researchers used a correlation coefficient to determine relationships between the variables (Nami et al., 2014). Nami et al. (2014) found a significant positive relationship between academic achievement and extended components, flexibility components, and innovation components of creativity. These two studies, Gajda et al. (2017) and Nami et al. (2014), supported a strong positive correlation between creativity, intelligence, and academic achievement.

Gender

Anna Abraham is a psychologist and neuroscientist whose research centers on neurocognitive study of imagination. Abraham (2016) explored literature relevant to gender and creativity. Abraham defined creativity based on Runco and Jaeger's (2012) statement that a creative response or product is original and relevant. Abraham (2016) stated empirical studies on creative abilities among children and adults are inconclusive with reference to gender differences. According to Abraham's research, approximately half of the investigations reported no significant differences between males and females, and the other half were mixed findings but most suggested that females were superior

with their creative abilities (Abraham, 2016). Abraham (2016) found no firm grounds to presume systematic differences based on gender in terms of creative ability or potential.

Ethnicity

Kaufman (2006) stated there are few significant differences in creative abilities across ethnicities. Kaufman also reported few differences have been found between African Americans and European Americans. The TTCT and other divergent-thinking measures with both verbal and figural forms have been used in these studies. In 1971 and 1973, Torrance (as cited in Kaufman, 2006) found that African American children scored higher on the TTCT than European Americans on the figural tests in fluency, flexibility, and originality. The initial sample compared African American students in Georgia with higher socioeconomic students in Minnesota. In a second study, students from Minnesota were replaced with European American students from Georgia, and all the differences were significantly reduced. Kaltsounis (1973, as cited in Kaufman, 2006) also found that African American received higher scores in fluency and originality on the TTCT. Troiano and Bracken (1983, as cited in Kaufman, 2006) gave measures of creative thinking and found that African American and Native American scores were approximately one standard deviation higher on creative thinking in fluency than those of Dutch Americans.

Kaufman (2006) reported that differences in TTCT scores for Hispanic Americans and European Americans depended on whether the measure was verbal or nonverbal. European Americans were found to score higher on three of four of the TTCT verbal forms, but the nonverbal, figural scores showed no significant differences (Kaufman 2006). Other nonverbal assessments found no differences or just a modest advantage for bilingual Hispanic Americans (Kaufman 2006).

Kaufman (2006) stated that Asian culture is less clear with creative production. Kaufman reported of a study where American and Chinese raters scored American college student artwork as "more creative than art produced by Chinese students" (p. 1067). In another study, American and Chinese raters scored similar results for both American and Chinese students with drawings that included geometric figures (Kaufman, 2006). Japanese children were found to have higher ratings on a drawing than British children. Studies repeatedly have shown that the TTCT results show that individuals in Western cultures scoring higher than those in Eastern cultures (Kaufman, 2006).

Literature has supported few differences by ethnicity that are statistically significant with creativity as measured by the TTCT results. However, differences seem to emerge as different cultures are compared. The following section includes a comparison based on culture.

Culture

In the 21st century, global issues such as global warming and terrorism are pressing for problem-solving and creative thinking skills, and innovation-oriented development strategies are being implemented at national levels. Because creativity has an intimate relationship with culture, it is important to understand the perceptions of creativity from cultures around the world (Shao et al., 2019). Countries such as China, Japan, and Korea, known as "the East" (Shao et al., 2019, para. 3), characterize a collectivist point of view where the collective interest should override the individual interest, and therefore collective is more important than being unique. The United States, Western Europe, Canada, Australia, New Zealand, known as "the West" (Shao et al., 2019, para. 3), are closely linked to ideas from ancient Greece and value an

individualistic approach. Shao et al. (2019) provided research on the profound effects that culture plays in defining and assessing creativity.

Ultimately, the findings from analyses of recent studies are themes of creativity from the East that creativity spirals in a circular movement of reconfiguration, whereas those in the West view creativity as a linear movement to a new point (Shao et al., 2019). Another key difference across the two cultures is that the four-stage approach from Wallas (1926)—preparation, incubation, illumination, and verification—provides the underlying categories of Western thought on creative processes. Conversely, Eastern studies on creative thinking have shown some variation (Shao et al., 2019). For example, Western philosophy follows the cognitive process model in which a problem creates a product, whereas the Eastern philosophy highlights emotion and intrapsychic aspects of the mind. Table 4 presents a summary of the cultures and how they view creativity.

Table 4

Cultural Perceptions Related to Creativity

Variable	West	East
Countries	Canada, United States, Western Europe, Australia, New Zealand	China, Japan, Korea
Religion/culture	Greece, Christianity, Judaism	Taoism, Buddhism, Confucianism
Point of view	Individualism	Collectivism
Theme	Linear movement to a new point	Circular movement of constant reconfiguration
Philosophy	Cognitive process	Emotion, intrapsychic aspects of the mind
Approach	Wallas, 1926 • Preparation • Incubation • Illumination • Verification	Yoga Sutras • Self-will • Ceaseless effort • Internal identification • Personal insights • Social communication

Note. Data from "How Does Culture Shape Creativity? A Mini-Review," by Y. Shao, C. Zhang, J. Zhou, T. Gu, and Y. Yuan, 2019, *Frontiers in Psychology, 10*, Article 1219.

In conclusion, culture plays a key role into how creativity is conceptualized and developed. Understanding cultural belief systems can help global societies to accept traditional values yet create an opportunity for creative development (Rudowicz, 2003). The research from Shao et al. (2019) provided substantial evidence which supports the profound role that culture plays in defining and assessing creativity when comparing the Eastern and Western cultures.

Global Perception

There is evidence of developed nations all over the world identifying creativity within the curriculum at various educational levels. The perceptions of creativity from

around the globe reflect cultural differences (Drapeau, 2014). Western countries think of creativity as novelty and emphasize humor, freedom, and imagination (Murdock & Ganim, 1993). Eastern countries consider creativity as connections between old and new knowledge, rediscovery, societal contributions, and moral goodness (Drapeau, 2014). Shaheen (2010) reported the findings of O'Donnell and Micklethwaite's research study. O'Donnell and Micklethwaite, as cited in Shaheen (2010), reviewed various curriculum documents of over 16 countries within America, Europe, and East Asia and found that creativity was included at various levels from early years through primary education and higher (Shaheen 2010). In Canada, creative thinking is one of the Common Essential Learnings (Shaheen, 2010). In Korea, the National Curriculum defined an educated person as "healthy, independent, creative, and moral" (Shaheen, 2010, p. 167). In Sweden, the 1997 national development plan for education, preschool through adult education, stated that education should provide "the conditions for developing creative skills" (Shaheen, 2010, p. 167). The Australian Curriculum, Assessment, and Reporting Authority had an educational goal for students to "become successful learners, confident and creative individuals, and active informed citizens" (Shaheen, 2010, p. 167).

In Singapore, the Ministry of Education launched the Thinking Schools, Learning Nation program (Shaheen, 2010). This program was designed to develop thinking skills and creativity in students (Shaheen, 2010). This action was in response to business leaders and industrial leaders indicating that workers were conforming and not curious (Shaheen, 2010). The Ministry of Education in Singapore named creativity as one of eight core skills and values of the nation (Shaheen, 2010). Shaheen (2010) discussed developments for creativity within the education system in Ireland, Scotland, and the

United Kingdom. Florida and Kentucky are two states Shaheen (2010) mentioned as highlighting creativity as learning goals to provide students with opportunities to learn and apply strategies for creative thinking.

Creativity is of interest in the education system of many developed countries (Cropley & Patston, 2019). The resurgence of interest in creativity is related to divergent thinking, problem-solving skills, and other abilities being at the core of the 21st century skillset. Emphasizing creativity is necessary in the modern innovation economy (Beghetto & Kaufman, 2014). The role of creativity in the economy is crucial to assist nations for attaining higher employment, economic achievement, and cope with increased competition. Creativity cannot be suppressed or ignored (Shaheen, 2010) for this reason. However, "before creativity can be embedded in the 21st century curriculum, it must be allowed to fall on fertile ground" (Cropley & Patston, 2019, p. 268). Shaheen (2010) pointed out that developing children's creativity during their years in education is the start of building human capital.

Creativity and Education

Based on economical concepts, the role of education is changing. Formal education "has been criticized for turning out 'conformists' and 'stereotypes' rather than 'freely creative and original thinkers'" (Shaheen, 2010, p. 166). Education systems have been blamed for "spoon feeding" knowledge and "killing creativity" due to increased pressures of testing (Shaheen, 2010, p. 166). Tests given in schools require convergent thinking, only one correct answer, rather than encouraging divergent thinking, when an individual can think about original options (Runco, 2004). These barriers and

misconceptions are relatively harmless, but in education, these barriers have hindered efforts to embed creativity into the curriculum (Plucker, 2017).

Torrance (1974) stated that the traditional educational setting is a hindrance of students' learning and creativity development. This researcher's belief is that the goal of educators is to create independent lifelong learners. Students need to know how to come up with options. "All science, art, and human civilizations are products of creativity" (Aiamy & Haghani, 2012, p. 610). Aiamy and Haghani (2012) stated that scientists speak of the modern age as the "age of creativity and innovation" (p. 610). Therefore, considering determining factors behind the development of creativity is important in the 21st century (Aiamy & Haghani, 2012). Students today need options for the unknown tomorrow to keep human civilization alive and prospering.

American public schools have easily killed intrinsic motivation and creativity, according to Hennessey (2013). Hennessey (2013, 2015) stated the classroom environment determines the motivational orientation of students. Expected rewards, expected evaluation, competition, time limits, and surveillance are included in the laundry list of creativity killers in the American classroom (Hennessey, 2015). At one time American students were encouraged to be creative, which led to innovation (Hennessey, 2015). Tests and evaluations, convergent-thinking measures, have caused students to want to stay inside the proverbial box in fear of not doing well on the test (Hennessey, 2015). Torrance (1962) noted in his studies that creativity is a progression until the age of 10 (Aiamy & Haghani, 2012), yet students as young as 8 are retained in third grade if they do not meet mastery skills on a state assessment. Students are trained in the U.S. education system to consume knowledge and recall information for the test;

they are not taught to produce creative ideas and solutions (Ritter & Mostert, 2017). Knowledge as an outcome of education is said to be no longer enough (Guilford, 1975), but it is difficult to know what knowledge will be needed in the future (Shaheen, 2010).

Researchers from the University of Utah, Marissa Diener, Cheryl Wright, Beverly Brehl, and Tyler Black, conducted a study in 2016 that examined creative potential with a focus on children's social behavior in preschool-aged children. Out of 173 children in a part-time university-based preschool, 94 students returned consent to participate (Diener et al., 2016). Mothers of the participants and teachers at the school also participated (Diener et al., 2016). Children's ages ranged from 39–73 months. All teachers at the preschool were women. Most of the mothers identified themselves as White (n = 80; 87%); five mothers self-identified as Hispanic, three as Chinese, one as African American, one as American Indian, one as Japanese, and one as Korean. Further, 87% of the mothers had a college degree or higher (Diener et al., 2016). Mothers completed a questionnaire on children's shyness, and teachers reported on children's levels of shyness, prosocial behavior, and aggression (Diener et al., 2016). Children completed the Thinking Creatively in Action and Movement assessment to measure divergent thinking and imagination, as well as the Metropolitan Readiness Test to assess levels of achievement (Diener et al., 2016). Preliminary analysis of demographic characteristics showed no significant associations between family income, mothers' education levels, marital status, or mothers' age and children's creative potential, achievement, or socioemotional characteristics (Diener et al., 2016). Bivariate correlations examined associations between children's age, their creative potential (divergent thinking and imagination), achievement, and socioemotional characteristics (shyness, prosocial

behavior, and aggression). As Diener et al. (2016) predicted, child's age was significantly associated with achievement, $r(88) = .57$, $p < .001$, with greater age associated with higher scores on the Metropolitan Readiness Assessment. Older children also showed greater divergent thinking, $r(93) = .32$, $p = .002$; more imagination, $r(86) = .30$, $p = .006$; and more prosocial behavior, $r(94) = .37$, $p < .001$ (Diener et al., 2016).

Diener et al. (2016) conducted regression analyses to examine the predictive power of children's age, gender, achievement, and socioemotional characteristics on creative potential. Children's divergent thinking was significantly predicted by children's age and aggression, $F(6, 81) = 3.09$, $p = .009$ (Diener et al., 2016). Older children and children with higher aggression levels showed greater divergent thinking. Achievement did not predict either divergent thinking or imagination (Diener et al., 2016). Children whose mothers reported as less shy and whose teachers reported as more prosocial showed high levels of imagination. Results indicated that imagination was predicted by lower levels of shyness and greater prosocial behavior, whereas divergent thinking was predicted by older child age and teacher rating of aggression (Diener et al., 2016). Diener et al.'s (2016) study provided documentation of the relationship between creative potential and behavior and can guide teachers, parents, and others who interact with children to be aware of how to respond to children's conforming and nonconforming behavior to encourage children's creative potential.

Implications from the Diener et al. (2016) study support Sternberg's (2018) notions that the creativity of a person depends very much on the environment in which a person works, when, and where the work is being done. Early-childhood teachers typically emphasize self-regulation skill development and emphasize conformity to rules

(Diener et al., 2016). Another creative theorist, Runco (2013), stated that creativity requires certain levels of assertiveness and resistance to the pressures to conform. Therefore, children with creative potential may not be well liked by teachers because their actions are mistaken as disrespect (Diener et al., 2016). Based on the data from the Diener et al. study, it is important for teachers to balance instruction in self-regulation, conformity, and assertiveness to develop creative potential. Teachers also may discourage creative responses because they fail to recognize the positive sides of these behaviors (Diener et al, 2016). Teachers should recognize children's initiative and allow times for students to take chances and explore concepts (Diener et al., 2016). Another implication of the study is the importance of pretend play to foster creative potential. Diener et al. reported an association between greater pretend play and imagination and lower levels of aggression and more prosocial behavior.

As a response to the calls of the economic needs of nations, criteria to produce an educated workforce require not only a rise in educational achievement, but also restructuring and reconceptualizing educational achievement to include a value in creativity. Shifts in educational policy around the world are being made to combine creativity and knowledge; creativity is becoming the focus of curriculum and pedagogy and an official agenda for improving schools (Shaheen, 2010). Craft (1999) stated that creativity needs to be "fostered by the education systems from the early years onward" (p. 137). Walberg (as cited in Shaheen, 2010) pointed out that elementary and secondary education may be more important than university education for national prosperity.

Culture of Education

The culture of accountability in education drives daily decisions by education professionals. Accountability holds educational institutions responsible for student outcomes (Deming & Figlio, 2016). Schools are rated on student achievement and leadership, while teacher evaluations are also based on student achievement. Many states have adopted new teacher evaluation systems. The evaluations are based on data from student test scores in the form of value-added measures. Some states mandate up to 50% of the teacher evaluation must be based on student test scores (National Association of Secondary School Principals, 2019).

School achievement policies, such as the federal Every Student Succeeds Act (2015) and the state Georgia College and Career Readiness Performance Index, have influenced school districts to focus on school accountability to enhance school improvement (McBrayer et al., 2018; Wright, 2020). According to McBrayer et al. (2018),

> The reauthorization of the 50-year-old Elementary and Secondary Education Act ... charged school districts and schools with embracing a commitment to equal opportunities for all students, which resulted in identifying a clear goal of fully preparing all students for success in college and careers. However, when schools do not show progress and students do not adequately achieve, the onus is on school leaders to aid improvement initiatives to attain school reform and accountability. State policymakers are increasingly holding schools more accountable. (p. 597)

Accountability is a “tool that ensures organizational managers have appropriate conduct in line with the law and its regulations during the administration or organizational goals” (Argon, 2015, p. 926). According to McBrayer et al. (2018), “These accountability standards are based on students’ performance on state assessments, and the need to meet or exceed state standards on these assessments causes administrators to focus their attention on the performance of school leaders” (p. 597). Traditional “drill and kill” (convergent-thinking skill) approaches or standards-based teaching often have squeezed creativity out of the curriculum or areas of policy and assessment (Henshon, 2015). Standards and accountability of recent decades have driven creativity education from schools (Baer, 2016). Baer (2015) suggested that creativity requires deep knowledge in the content-area skills. Therefore, creativity should not be seen as a barrier for meeting standards but as a way to cultivate deeper understanding of concepts by using divergent- and convergent-thinking processes to cultivate deeper understanding and knowledge transfer (Baer, 2015; McTighe, 2018).

In today’s classroom, student achievement informs instructional decisions made daily at the classroom, school, system, state, and federal levels. Personnel decisions such as dismissal or retention of classroom teachers and principals are based on student test scores (Deming & Figlio, 2016). Compensation for teachers and principals also depends on student test scores in some states (Deming & Figlio, 2016). Parents even decide where they want to live by examining school performance ratings, which are based on student achievement (Deming & Figlio, 2016) .

In December 2015, President Obama signed the Every Student Succeeds Act into law. The Every Student Succeeds Act (2015) mandated that states have an accountability

system in place to measure student achievement. The need for accountability in schools stemmed from *A Nation at Risk*, a report commissioned by President Ronald Reagan in 1983 (Zhao, 2015). Regarding educational reform in the United States since *A Nation at Risk*, Zhao (2015) proposed the nation has focused on fixing the past, and these strategies are trying to do the wrong things more right. President Reagan famously stated in his 1984 State of the Union address, "If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war" (as cited by Deming & Figlio, 2016, p. 33). Policymakers established a need for educational reform based on language from *A Nation at Risk* (National Commission on Excellence in Education, 1983), and changes began to occur.

Based on interpretation and use of the *A Nation at Risk* document (National Commission on Excellence in Education, 1983), educational policymakers targeted on the language of failing schools as a national security crisis and called for reform based on a war of mediocrity (Ansary, 2007). The Secretary of Energy, Admiral James Watkins, commissioned Sandia Laboratories in New Mexico to show actual data as evidence of what was being claimed by the White House (Ansary, 2007). *A Nation at Risk* specified a decline of scores on the SAT from 1963 to 1980 as evidence of failing schools (Ansary, 2007). However, the Sandia report broke scores down by subgroups, and the data that emerged were astonishing. Nearly every subgroup—ethnicity, students with economic disadvantages, and students at all performance levels—proved to hold steady or improve based on the subgroup data (Ansary, 2007).

When examining educational culture, it is important to note the sweeping cultural changes that occurred during the 1960s, '70s and '80s across the United States. These

changes related to civil rights, foreign war, and immigration shaped the educational culture of the time. The ruling by the Supreme Court in the landmark case *Brown v. Board of Education* in 1954 declared that racial segregation of children in public schools was unconstitutional (Mulheron, 2014). Other events around the country fueled the Civil Rights Movement, such as Rosa Parks refusing to give up her seat on a Montgomery, Alabama bus, a Senator from South Carolina, Strom Thurmond, conducting the longest speaking filibuster ever in opposition to civil rights legislation, and federal troops enforcing integration in Little Rock, Arkansas (Mulheron, 2014). These events sparked improvement of civil rights but also caused turmoil throughout the nation. Meanwhile, on the other side of the world, the Soviet Union launched Sputnik; the Cold War created a culture of fear as well as innovation. Mulheron (2014) noted the 1960s brought the removal of required prayer from schools, the assassination of John F. Kennedy, the Cuban Missile Crisis, and the signing of the Civil Rights Act into law. Congress passed the Elementary and Secondary Education Act during President Lyndon Johnson's presidency, which provided federal funds to low-income students and initiated Title I and bilingual education. Asian and Latin American immigrants poured into American classrooms as President Johnson signed the Immigration Act of 1965. Dr. Martin Luther King, Nobel Prize winner and leader of the American Civil Rights Movement, was also assassinated during this decade (Mulheron, 2014). The 1970s and '80s brought Americans fighting a foreign war in Vietnam, the passing of the Education of All Handicapped Children Act, the growth of bilingual education, and Apple computers introduced in public schools (Mulheron, 2014). All these changes represented a growing

nation and a more diverse population being educated. The United States was changing, and education needed to change with it.

With diversity increasing in public schools, the proportion of top-performing students to all students was shrinking, and SAT scores dropped (Ansary, 2007). However, the overall national goal was to extend educational opportunities to a broader range of the population. The Sandia Report showed data for the broader range of the population by subgroups and fell victim to what statisticians call Simpson's paradox (Ansary, 2007). Simpson's paradox explains that the average can change in one direction while all the subgroups change in the opposite direction if proportions of the subgroups are changing (Pearl, 2014). Simpson's paradox explains why the report was never released to the public. The Sandia Report went into peer review and "died a quiet death" (Ansary, 2007, para. 26). A few specialists became privy to the report as it was published in the *Journal of Education Research* in 1993 and became more widely known by 1994 (Ansary, 2007). As a result of the constant changes, school districts across the nation developed academic programs during the 1970s and 1980s with the explicit goal of keeping White families in the public school systems (Golstein, 2018).

In early 2002, President George W. Bush signed the No Child Left Behind Act into law. This federal law required states to test K-12 students regularly in core subjects and to evaluate schools based on student outcomes. One of the stipulations of the No Child Left Behind Act (2002) was to measure adequate yearly progress with the goal of 100% of students showing proficiency by 2014. The lofty goal of 100% proficiency was never attained, which led educational decision-makers to search for a better way to promote student achievement.

The world does need excellence in education, but defining excellence is what matters, according to Zhao (2015). Zhao (2015) maintained that due to globalization and technological advances, a new educational paradigm is needed. A shift must occur from the teaching of skills and knowledge to incorporating more development of a child's potential for the 21st century (Zhao, 2012). Zhao (2012) described two paradigms: employee-oriented education and entrepreneur-oriented education. Employee-oriented education values what children should learn to fit existing jobs, and entrepreneur-oriented education comprises what children would learn in preparation for the responsibility to create new jobs (Zhao, 2012).

Helen Soulé and Tatyana Warrick also provided research calling attention to the need for an updated approach to education in the 21st century. Soulé and Warwick (2015) asserted that creativity and innovation continue to be the driving force of today's economy. Stakeholders in the U.S. education system have yet to determine solutions to ensure that creativity and innovation play an important role in students' educational experiences in and out of school.

Soulé and Warwick (2015) emphasized learning opportunities rest in the hands of educators and the many stakeholders in the academic community. The purpose of school is to prepare students for life and opportunities beyond school. Individualized learning helps students develop and improve skills capacity. New orientations for both teaching and learning in the 21st century have been guided by the Framework for 21st Century Learning, which has been updated by the P21 (2019). The framework comprises of skills, knowledge, and expertise of core content but also incorporates the 4Cs of critical thinking, creativity, communication, and collaboration. Soulé and Warwick (2015)

contended that use of the framework will result in students being more engaged in the process of learning and being better prepared for life, whether their path is college or straight to a career. Benefits for educators are more collaboration, interdisciplinary application across the curriculum, and more support for students and teacher colleagues (Soulé & Warwick, 2015).

Cho et al. (2017) explored the existence, value, and importance of creativity in education. Their study, based in Idaho, examined prekindergarten through third-grade educators' perceptions regarding the value and importance of creativity education in the early-childhood setting. Cho et al. (2017) compiled teacher perceptions from surveys and interviews. Their findings indicated that these educators claimed to value the concept of creativity; however, a discrepancy existed between this value and what was happening in the classrooms (Cho et al., 2017). More than 70% of the respondents in the study valued the importance of creativity education (Cho et al. 2017). Over 90% believed that they valued creativity and creative behaviors, and more than 80% recognized its importance in early childhood education (Cho et al., 2017). The researchers identified barriers to creativity development, including a lack of understanding of what creativity is, curricular restrictions, and high-stakes testing environments (Cho et al., 2017). To eliminate these barriers, Cho et al. (2017) called for a shared understanding of creativity, more flexibility within the curriculum, and fewer regulations on standardized tests.

Education Goals

Historically, education reformers have sought to achieve goals based on their perceptions of social and economic problems of the time (Wagner & Sokol, 2016). President Bush declared in his 2006 State of the Union address, "To keep America

competitive, we must continue to lead the world in human talent and creativity" (as quoted in Wagner & Sokol, 2016, p. 16). Multiple presidential debates and speeches have stated the need for education, knowledge, competitiveness, and skill (Wagner & Sokol, 2016). Wagner and Sokol (2016) indicated that President Bush and President Obama agreed that the role of education was to prepare the United States for jobs in the 21st century and the global marketplace.

Drapeau (2014) stated teachers and administrators are doing everything they can to meet the demands of local to federal legislation. The focus of educators is on student growth and making schools better. Educators are working hard to make adequate yearly progress. Ordering textbooks, addressing curriculum needs, and concentrating on continuous professional development are three examples of how the education community of both teachers and administrators are trying to increase student achievement based on demand of legislation.

Drapeau (2014) also discussed in her work how educators are monitoring students to improve their behavior. Drapeau (2014) had the opinion that promoting critical thinking and creative thinking, by encouraging students to use divergent thinking, may be one way to change students' attitudes and enhance achievement. Creative thinking lessons build critical thinking beyond basic recall of knowledge and basic skills to consider "what if" possibilities and focus on real-life problem-solving (Drapeau, 2014). Drapeau (2014) stated that both divergent and convergent thinking skills are required to move to the higher levels of thinking.

Wiggins et al. (1998) identified four key types of educational goals essential for success in education in the 21st century: (a) knowledge, (b) basic skills, (c) conceptual

understanding, and (d) long-term transfer goals. These categories link to elements in *Understanding by Design*, written by Wiggins and McTighe (2005). In the following sections, research is reviewed supporting these goals for the future.

Knowledge and Basic Skills

Knowledge and basic skills are taught with the intention of students using convergent thinking to recall, retell, or perform facts and skills to show mastery of learning (Wiggins et al., 1998). Like general knowledge and skills, knowledge and skills specific to creativity can be taught as well (Tomasulo, 2019). As these skills are acquired and enhanced, they become a significant part of pedagogy or teaching (Tomasulo, 2019) .

Frank Tomasulo (2019) is a teacher of graduate seminars and delivers at conferences in the field of film and media. Tomasulo (2019) offered teaching strategies to teach creativity in film that can be modified or translated across content-area learning. Some strategy examples proven to enhance creativity in film students are teaching students to notice patterns and their uses and applying the Freudian theory of making the unconscious conscious. Tomasulo (2019) stated that teaching students to look at things in a new way, such as using freezeframe or still shots to deconstruct details in color, focus, and other details that students would not normally notice, is recommended to teach creative skills while teaching basic knowledge of content.

Intentional teaching of knowledge and basic skills is necessary prior to use of divergent thinking process. Drapeau (2014) stated that convergent thinking is necessary for creative thinking in that convergent thinking is used to determine which ideas are best for the divergent-thinking process. Knowledge and basic skills, although a very low level

of cognitive functioning, are necessary for knowledge acquisition before moving into higher level thinking skills.

Conceptual Understanding

Conceptual understanding is making meaning of big ideas (Wiggins & McTighe, 2005; Wiggins et al., 1998). Rittle-Johnson et al. (2001) defined conceptual understanding as simply the transfer of learning from one problem to the next. Successful students are able to learn more than basic facts and skills and take the learning to the next level by understanding the big idea of the concept and transferring their knowledge to other situations or new contexts (Rittle-Johnson et al., 2001; Wiggins & McTighe, 2005; Wiggins et al., 1998).

Rittle-Johnson et al. (2001) completed two experiments with fifth- and sixth-grade students. The goals were to provide both correlational support as well as causal links of a iterative model of learning (Rittle-Johnson et al., 2001). The iterative model is a pictoral representation that shows as one type of knowledge increases, it leads to gains in another type of knowledge, and in turn leads to further increases in the first type of knowledge (Rittle-Johnson et al., 2001). Seventy-four students with a mean age of 11 years and 8 months participated in the study near the end of their fifth-grade year (Rittle-Johnson et al., 2001). There were 33 girls and 41 boys from two rural public schools (Rittle-Johnson et al., 2001). Both schools used traditional math textbooks for instruction (Rittle-Johnson et al., 2001). The children completed a pretest in both conceptual and procedural knowledge and participated in an individualized intervention that lasted approximately 40 minutes (Rittle-Johnson et al., 2001). Students then played a game and took the posttest in both conceptual and procedural knowledge (Rittle-Johnson et al.,

2001). An additional 25 students were excluded from the study because they solved at least two-thirds of the procedural questions correctly on the pretest (Rittle-Johnson et al., 2001). The study revealed that conceptual knowledge and procedural knowledge develop together, and it is important that both types of knowledge are taught in the classroom (Rittle-Johnson et al., 2001). To improve student learning, determining the interrelations among the conceptual understanding and the basic skill is important.

Drapeau (2014) argued that intentional creative instruction can support conceptual understanding of any content area. Drapeau (2014) cited an example that when students use a brainstorming activity of reasons why immigration laws were passed, students have to know what the immigration laws are, but they also have to know what brainstorming is and how to do it. Types of intentional creative instruction in content areas help students see that thinking creatively about concepts is as valued as the act of understanding the concept (Drapeau, 2017).

Long-Term Transfer

Long-term transfer goals refer to transferring learning to new situations (Wiggins & McTighe, 2005, Wiggins et al., 1998). McTighe and Wiggins (2005) maintained that transfer is about independent performance in contexts or new situations based on existing knowledge. The highest level of educational goals (Wiggins et al., 1998), long-term transfer goals can be described as divergent thinking, where one uses knowledge from one concept to help solve problems or create new thinking. One example where divergent thinking is used to transfer learning is through STEM education, which merges learning concepts in science, technology, engineering, and mathematics to help students solve real-world problems (McAuliffe, 2016). McAuliffe (2016) also asserted that art and

design skills can contribute to the metacognitive processing or knowledge transfer through STEAM education (STEM plus the arts). However, much of the focus of U.S. classrooms has been based on convergent thinking, which is coming to the generalized idea of the one correct answer or the one best answer for a given problem (Schmidt et al., 2012).

McAuliffe is a professor at Queensland University of Technology in Australia. McAuliffe (2016) urged the art and design community to advocate for the importance of divergent thinking and metacognitive skills in STEM education. McAuliffe (2016) stated that thoughtfully developed STEAM activities improve student learning by including interdisciplinary discussion and by students thinking both within and beyond the arts. McAuliffe (2016) argued that divergent thinking helps to broaden the understanding of the creative process. McAuliffe (2016) also stated that effective learning takes place when learners experience a problem, reflect on their actions, form concepts based on their reflection, and then apply these concepts to new situations.

McTighe (2018), education writer and consultant, defined long-term transfer goals for student learning as students transferring what they have learned into a new situation or using their learning in a different context. McTighe (2018) continued by describing transferring knowledge as process-oriented; specifically, it is teaching students what they should know and be able to do when confronted with new situations, opportunities, or challenges. Critical thinking, persistence, and self-regulation skills were deemed as based on academic standards but "often transdisciplinary in nature" (McTighe, 2018, p. 15). According to McTighe (2018), these elements required explicit instruction for the transfer of knowledge process to occur across all disciplines. In the 21st century,

transfer of knowledge and creativity have become key sources for sustainability and competitive advantage.

One example of research to support the concept that transfer of knowledge and creativity are key sources for competitive advantage in the 21st century is the Unilever study. Gassman (2001) examined a European company called Unilever, a multinational, fast-moving consumer goods company that produces and markets goods such as Dove, Lipton, Elizabeth Arden, and Ragu. In several product areas, Unilever advanced methods for developing knowledge strategies for both transferring and creating knowledge (Gassman, 2001). One strategy Unilever advanced was how research and development teams were formed (Gassman, 2001). Data analysts, product taste testers, and other key people with tactical knowledge were assigned a project manager (Gassman, 2001). The project manager assimilated all the information from the areas within the group to create new knowledge and to transfer that knowledge to make decisions for the team and corporation (Gassman, 2001). In the corporate world, key sources for sustainable competitive advantage and superior profitability within any industry are how a company transfers knowledge about successes and failures of products and how that company creates new strategies and produces innovation in any field (Gassmann, 2001). In the literature on knowledge management, two core knowledge processes are prevalent: knowledge transfer and knowledge creation. Within companies that reach strategic goals such as innovating, enhancing efficiency, and better managing risks, core processes from knowledge transfer and creation dominate the evolution of the product or goal (Gassmann, 2001).

Creative Pedagogy

Various explanations and theories of creativity exist, resulting in various approaches to research. Some psychologists have posited creativity arises from the unconscious, whereas other psychological researchers have viewed creativity as a syndrome or complex (Sternberg, 2006). Other researchers have described creativity as thinking skills or personal qualities (Sternberg, 2006). In education, unique concerns include the relationship between creativity and knowledge, curriculum, and appropriate pedagogical strategies to foster creativity in the classroom (Craft, 2005). Two premises that underpin the approach of creativity in education is that creativity can be developed (Baer & Kaufman, 2006; Torrance, 1963) and that all individuals have the potential to be creative (Craft, 2005).

Lin (2011), of the National Academy for Educational Research, proposed a three-element framework for creative pedagogy to enhance creativity for all students through teaching, to address creative learning, and to teach creatively. These elements were interdependent of each other and worked together to develop creativity skills (Beghetto, 2015; Lin, 2011). Teaching for creativity is the element described next.

Teaching for Creativity

According to Lin (2011), teaching for creativity involves inspiring students' imagination and seeking ways for students to be inventive and become problem-solvers. Fisher et al. (2016) recommended explicitly teaching thinking strategies. Specific strategies, such as thinking strategies, should be explained and modeled, and students should be guided as they practice the strategy (Fisher et al., 2016).

Stephen Vincent-Lancrin, Carlos Gonzalez-Sancho, Mathias Bouckaert, Federico de Luca, Meritxell Fernandez-Barrerra, Gwenael Jacotin, Joaquin Urgel, and Quentil Vidal worked at the Organisation for Economic Co-operation and Development (OECD) and wrote a book to support creative teaching and learning. The OECD is a forum where governments and economic agencies work together throughout the globe to promote growth, prosperity, and sustainable development. Vincent-Lancrin et al. (2019) evaluated the education systems all over the globe and noted that nurturing creative thought and critical thinking should be intentional in all content areas. Vincent-Lancrin et al. (2019) expressed a need for education to embrace creative development and promote critical thinking with intention. Vincent-Lancrin et al. (2019) offered practical strategies on how teachers can plan their teaching and student learning and still promote creativity and critical thinking in all academic subject areas, not just in fine arts. Vincent-Lancrin et al. (2019) suggested that inquiry, imagining, doing, and reflecting activities are four dimensions of developing creative learning in all content areas of education. Implementing these activities to help with thinking processes in content areas such as English, math, science, and social studies will build creative and critical-thinking skills in students.

Creative Learning

Lin (2011) defined creative learning as student-focused learning where children question, inquire, search, manipulate, and experiment. Sawyer (2015) found that creativity for learning involves both general creativity skills as well as domain-specific skills. Sawyer (2015) recommended altering the design of learning environments in content areas so students can engage creatively with the content. One example Sawyer

(2015) used was to redesign science class so that students recognized good research questions and proposed hypotheses or even designed their own experiments.

Vincent-Lancrin et al. (2019) suggested students empowered with creative learning opportunities that trigger student inquiry and imagination in content-specific ways are more engaged and challenged. Vincent-Lancrin et al. (2019) recommended giving students time and space to reflect and receive feedback on their learning. Giving and receiving feedback are both important in creative learning for students. One more very important step cited by Vincent-Lancrin et al. (2019) is development of technical knowledge or skills in a content area before the act of creative thought can take place.

Creative Teaching

Lin (2011) described creative teaching as teacher focused, with teachers motivated to teach in innovative ways. Teachers who encourage learners to plan, investigate, and elaborate on their learning will nurture deep learners (Fisher et al., 2016). Creative teaching is ultimately part of creating an environment that contributes to learning creatively. Therefore, teacher focused means the teacher creates the environment and activities that engage the learners in creative actions. Sawyer (2015) described creative teaching as an improvisational performance in collaboration with the learner that emerges as situations arise in classroom practice.

Intentional creative teaching not only involves the environment created by the teacher but also strategies embedded in lessons that lead students to use creative thought in specific content areas (Vincent-Lancrin et al., 2019). A questioning technique that involves explanations of observations or experiences is one example of how a teacher intentionally teaches for creativity in a content area. Another example of teaching for

improvement in creative thought is utilizing different perspectives to discuss posed problems. Teachers can ask students for multiple solutions to problems to enhance creative thinking in content areas.

Creative Pedagogy in Action

According to Lin (2011), creativity skills developed when the three elements of teaching for creativity, creative learning, and creative teaching worked together. Project-based learning (PBL) is an instructional method that employs all three elements in Lin's framework of creative pedagogy (Lin, 2011) . PBL includes strategies that employ teaching for creativity as learners explore new possibilities; PBL arouses curiosity for learning (Lin, 2011). PBL begins with the facilitator, or teacher, providing open-ended, driving questions aligned with the desired thinking and learning needed to meet content objectives (Lin, 2011). Using the PBL method of instruction, students move from a classroom where answers are the norm to profound thinking and creativity as one idea builds on another (Abdalla & Gaffar, 2011).

Teaching is also centered around the learner and gives the learners opportunities to investigate worthy topics of their choice (Grant, 2002). Learners have the autonomy to decide what artifact they will create to represent what they have learned (Grant, 2002). The projects in PBL challenge students to create products for real-world purposes and audiences (Abdalla & Gaffar, 2011). Authenticity and originality help to increase student interest and engagement and can empower students as they do purposeful work that transcends traditional classwork tasks (Abdalla & Gaffar, 2011).

Teachers serve as facilitators in the PBL instructional model and are there only to provide support to students based on specific needs. The teacher's primary role is to align

the thinking and learning as well as to motivate and encourage the students to make their own decisions and do their best work (Abdalla & Gaffar, 2011). This creative method is very different from using a rigid lesson plan or textbook that directs the learner with specific objectives; PBL does not follow the traditional framework (Abdalla & Gaffar, 2011).

In the late 1990s, Jo Boaler conducted a 3-year research study comparing two schools in Britain with two different teaching pedagogies. Boaler (2002) was involved with promoting mathematics education reform and equitable mathematics classrooms. The purpose of Boaler's (2002) study was to find the differences in how students encountered math and how different students understood math based on different pedagogy and a different atmosphere. Boaler (2002) followed 300 students from ages 13–16 for her mixed-methods study. Qualitative data focused on perceptions of students about the learning methods. Boaler (2002) collected quantitative data at the beginning of Year 8 from students at both schools using a standardized math assessment. She deduced that students at both schools had similar levels of math knowledge and similar demographics (Boaler, 2002).

One school in the study, known as Amber Hill, employed competent teachers who taught from textbooks and conformed to traditional methods of breaking problems down into parts and guiding students through the steps of solving the problems (Boaler, 2002). The other school in the study, Phoenix Park School, employed competent teachers who designed a curriculum with no textbooks and spent time planning 2- to 3-week units including a range of open-ended projects (Boaler, 2002). Each class had students of

varying performance levels, known as mixed-ability grouping. Phoenix Park followed the framework for creative pedagogy and PBL (Boaler, 2002).

The approaches to learning were vastly different, but the standardized test results at the conclusion of the study showed that the rigid classes at Amber Hill did not achieve better results than the PBL classes at Phoenix Park (Boaler, 2002). The students who learned in the open environment with mixed-ability groups at Phoenix Park achieved higher despite the comparability of the two cohorts of students on entry to their schools (Boaler, 2002). The achievement data also showed that the students at Phoenix Park attained higher grades than the national average on the national exam (Boaler, 2002). The mixed-ability approach at Phoenix Park was most advantageous for the highest and lowest scoring students when compared to similar students at Amber Hill (Boaler, 2002).

The study demonstrated that students developed different capabilities and understandings because of school experiences (Boaler, 2002). Also, based on the study, following the framework for creative pedagogy did not hinder standardized test scores (Boaler, 2002). Students at high and low achievement levels scored higher than students at similar levels taught with the traditional approach (Boaler, 2002).

Maite Garaigordobil, researcher and professor at Basque Country University, conducted a study in Spain to test the influence of an intervention on the creativity of students ages 10 and 11 (Garaigordobil, 2006). Specifically, a play program was introduced to 86 children to improve their verbal and graphic-figural creativity skills. The researcher conducted a weekly 2-hour intervention session throughout the school year (Garaigordobil, 2006). The tasks in the program stimulated verbal, graphic-figural, constructive, and dramatic creativity.

The TTCT was administered as pretest and posttest phases (Garaigordobil, 2006). Both verbal and figural forms were used (Garaigordobil, 2006). The verbal forms used word-based exercises assessing three indicators of fluency, flexibility, and originality. Four activities were administered. The first three were based on a drawing, and the child had 5 min to ask questions about possible causes and consequences of what was happening in the drawing (Garaigordobil, 2006). The fourth task was about improving a product (Garaigordobil, 2006). The child was given 10 min to suggest ideas on changes that could be made to make a toy more fun. One point was awarded for each idea presented to obtain a fluency score (Garaigordobil, 2006). Flexibility score was given by awarding 1 point for each category named by the child (Garaigordobil, 2006). Originality scores were determined by statistical frequency of the idea using a measure based on the 139 participants from the same age group (Garaigordobil, 2006). Zero points were awarded if the idea was mentioned by more than three participants, 1 point was awarded if it was mentioned by three participants, 2 points if it was mentioned by two participants, and 3 points if it was mentioned by just 1 participant (Garaigordobil, 2009).

The figural form of the TTCT is made up of three activities (Garaigordobil, 2006). The first task was giving a black inkblot drawing a title (Garaigordobil, 2006). The second task was a drawing to complete (Garaigordobil, 2006). The third was a lines and circles activity, where the child was presented with parallel lines or circle with which to make drawings (Garaigordobil, 2006). The time limit for each activity was 10 minutes. Fluency, flexibility, originality, abstractness of the title, and resistance to premature closure were all aspects of creative thinking assessed with these three activities (Garaigordobil, 2006).

The intervention was based on cooperative and creative games involving two or three recreational activities conducted weekly (Garaigordobil, 2006). The two main objectives of the intervention were (a) to develop creativity in different domains such as verbal, graphic-figural, constructive, and dramatic creativity and (b) to promote socioemotional development stimulating communication, cooperation, and expression of emotions (Garaigordobil, 2006). The activities of the program were distributed in four modules: verbal creativity, dramatic creativity, graphic-figurative creativity, and plastic-constructive creativity (Garaigordobil, 2006). The results suggested, through ANOVA, a positive effect, as the experimental group significantly increased their verbal and graphic-figural creativity skills (Garaigordobil, 2006). The analysis also confirmed a significant improvement for the participants who showed a low creativity on the pretest. The effects were similar in both boys and girls (Garaigordobil, 2006).

Joseph Renzulli, an educational psychologist and director of the National Research Center on the Gifted and Talented, has focused research on the identification and development of creativity and giftedness in young people (Renzulli & Renzulli, 2010). His wife, Sally Reis Renzulli, is also an educational psychologist, and they work together at the University of Connecticut. Their focus has been on applying the strategies of gifted education to the improvement of learning for all students (Renzulli & Renzulli, 2010). To help children develop creative thinking and value opportunities for creative self-selected work, Renzulli and colleagues created a schoolwide enrichment model for learning with the overarching goal to replace dependent and passive learning with independent and engaged learning (Olenchak & Renzulli, 1989; Renzulli & Purcell, 1995; Renzulli & Reis, 2000; Renzulli & Renzulli, 2010).

Three objectives of the schoolwide enrichment model are developing talents in all children, providing a broad range of enrichment experiences for all students, and using the way students respond to these experiences with a follow-up for advanced learning (Renzulli & Renzulli, 2010). Three types of enrichment experiences are offered within the schoolwide enrichment model. Type I enrichment consists of experiences such as field trips, guest speakers, demonstrations, and other options that would expose students to new ideas not taught in the regular curriculum (Renzulli & Renzulli, 2010). Type II enrichment includes instruction to develop thinking skills, research, and communication (Renzulli & Renzulli, 2010). Type III enrichment is the most advanced level and depends on the individual's interest, motivation, and level of study (Renzulli & Renzulli, 2010). Type III focuses on the product created through connections made from Type I and Type II enrichment (Renzulli & Renzulli, 2010).

Renzulli and Reis (2000) stated that multiple research studies on the schoolwide enrichment model suggested the model is effective at serving not only high-ability students but also diverse ethnic and socioeconomic populations in a variety of educational settings. Studies have supported a positive effect on students with learning disabilities and those who underachieve (Renzulli & Reis, 2000). Research evidence has shown the use of the schoolwide enrichment model results in more advanced reasoning and thinking skills (Renzulli & Reis, 2000). Students involved in the schoolwide enrichment model have achieved higher on achievement tests than students who receive traditional teaching on the regular curriculum and remediation (Renzulli & Reis, 2000).

Many narratives positively support the schoolwide enrichment model. Beecher (2010) described a school system whose leaders were concerned with poor academic

performance on standardized achievement tests. One school administrator decided to implement the schoolwide enrichment model for the school improvement plan, and the district supported the decision (Beecher, 2010). The system had a diverse population and had implementation support from the board of education, parents, teachers, and school administrators (Beecher, 2010). The success of the improvement was shown in both quantitative and qualitative data that showed (a) the students' positive attitudes about school, (b) increased receptivity to learning, (c) improved achievement scores on assessments, and (d) reduction in the achievement gap (Beecher, 2010). The average percentage of students at or above grade level in reading, writing, and math showed improvements in all segments of the population (Beecher, 2010). Achievement gaps between students with differing socioeconomic statures narrowed from 62% to 10% (Beecher, 2010). All ethnic groups showed improvement, but Asians made the largest gains at 60% and Black students showed 20% improvement. Achievement gaps in writing were reduced by 9%, mathematics by 7%, and reading by 30% (Beecher, 2010). The total reduction in the achievement gap was 15%, while the district gap remained at 40% (Beecher, 2010). The study provided data-based evidence that the schoolwide enrichment model can improve achievement in all students (Beecher, 2010).

Richard Olenchak is an assistant professor in the Program for Gifted and Talented, College of Education, at the University of Alabama. Olenchak (1988) led a 2-year investigation of student creative productivity, enrichment, implementation steps, and attitudes among 120 teachers and 1,698 students in schools that implemented the schoolwide enrichment model. The purpose of the study was to observe variations in students' attitudes toward learning (Olenchak, 1988). Statistically significant positive

differences in students' attitudes toward learning were found. Qualitative and quantitative data were gathered by Olenchak (1988) on the perceptions of students, parents, teachers, and administrators on the schoolwide enrichment model. Olenchak (1988) investigated the overall process of schoolwide change in 18 elementary schools in six states. The schoolwide enrichment model effects on teacher attitudes towards their profession (N = 236) revealed statistically significant ($p < .001$) positives changes when intervening variables of grade level, gender, years of experience, years of training, and schoolwide aspects of discipline, administrative leadership styles, and conflict resolution were controlled for (Olenchak, 1988). Student attitudes toward learning were examined (N = 1,698) with the intervening variables of grade, teacher, classroom, climate, and teaching style controlled, and statistically significant positive changes ($p < .01$) resulted (Olenchak, 1988). Student interviews (N = 120) also showed statistically significant positive changes ($p < .001$) toward gifted education. Student creative productivity was studied as well (Olenchak, 1988). Students were found to purse individual and group investigations with a high percentage of completion that resulted in Type III products of exceptionally high quality (Olenchak, 1988).

Olenchak (1990) completed another study that further examined the effectiveness of the schoolwide enrichment model on student attitudes toward learning. The sample was 1,935 elementary students, kindergarten through Grade 6 and ages 5–12, from three treatment schools and three control schools across a southern middle-class school system (Olenchak, 1990). The treatment school involved staff in a minimum of 18 hours of training for the implementation (Olenchak, 1990). Consultants and system experts were available to the staff for further training throughout the year. The control school whose

administrator declined to participate operated with a traditional pull-out program for gifted education (Olenchak, 1990). The pull-out program isolated the events and programs for gifted students from the regular classrooms. Quantitative and qualitative interview data analysis indicated a positive influence of the schoolwide enrichment model (Olenchak, 1990). Statistically significant differences were found ($p < .01$) with respect to student attitudes toward learning (Olenchak, 1990). As in the previous study in 1988, classroom, climate, and style were important predictors, but treatment group also was a significant predictor of attitudes toward learning, accounting for nearly 80% of the variance in students' attitudes (Olenchak, 1990). These results suggest that the schoolwide enrichment model enrollment improved student attitudes toward learning among all students.

Qualitative data comparing interviews pretreatment and posttreatment revealed significant differences on 14 of 16 interview items ($p < .001$; Olenchak, 1990). The general populations of each treatment school expressed a dramatic increase in comprehension of the schoolwide enrichment model and its purpose (Olenchak, 1990). A surprise finding was the general desire among the students to maintain the schoolwide enrichment program.

Renzulli Learning (2020) is an interactive online system that provides personalized learning environments for students and quickly identifies student strengths, interests, learning styles, and preferred modes of expression. The system then matches each student with educational activities and resources. Field (2009) conducted an experimental study to investigate the effects of the Renzulli Learning system on student achievement in reading comprehension, reading fluency, social studies, and science. The

study included 383 elementary and middle school students from Georgia and California (Field, 2009). Students of all ethnicities and educational levels participated (Field, 2009). Students in the treatment groups were compared to students who did not have the opportunity to use Renzulli Learning. Field (2009) utilized a two-way repeated-measures ANCOVA to explore the differences in the experiment and control groups. After 16 weeks, students who participated in Renzulli Learning showed significantly higher growth in reading comprehension ($p < .001$), significantly higher growth in reading fluency ($p = .016$) and significantly higher growth in social studies achievement *(*$p = .013$) than those students who did not participate in the Renzulli program (Field, 2009). No differences were found in science achievement (Field, 2009).

Field (2009) also investigated differences between students identified as gifted and those not identified as gifted. Statistical analysis indicated no significant difference between these two groups (Field, 2009). This result means that Renzulli Learning was a benefit to both groups and proved to be a good learning tool for all students, not just identified gifted learners (Field, 2009). The studies from Olenchak (1988, 1990) and Field (2009) both supported in quantitative and qualitative measures that the Renzulli Learning system was a benefit to student learners. Students attitudes toward learning were improved as well as achievement in reading fluency, comprehension, and social studies (Field, 2009; Olenchak, 1988, 1990).

Much like in the early 20th century, Bronson and Merryman (2010) noted that existing school curricula do not foster an environment conducive to supporting children's creativity development in the early 21st century. They also reported that creativity scores of U.S. children in kindergarten through sixth grade have declined since the 1990s.

Bronson and Merryman (2010) reported findings from Garner Millar's longitudinal study of the Torrance's Kids project. Torrance's Kids are a group of 400 Minneapolis children who participated in a series of creative tasks in 1958 under Torrance himself (Bronson & Merryman, 2010). The tasks were divergent tasks such as giving a child a firetruck and asking open-ended question such as, "How can I make this toy better?" Millar (2002, as cited in Bronson & Merryman, 2010) followed up with these children when they were adults and recorded every patent, leadership position, music composition, hardware innovation, and many more accomplishments. According to Bronson and Merryman (2010), Johnathan Plucker of Indiana University reanalyzed the longitudinal data. The correlation to lifetime creative accomplishment was more than 3 times stronger for childhood creativity than childhood IQ (Plucker, as cited in Bronson & Merryman, 2010).

Gifted Education Implementation Past, Present, and Future

Past

Early studies of giftedness in the 1920s and 1930s were based on the belief that intelligence was inherited, and students that underperformed were subnormal and students that overperformed were supernormal (National Association for Gifted Children [NAGC], 2020). Pioneers such as Lewis Terman and Leta Hollingworth conducted some of the first research studies on gifted or supernormal students (NAGC, 2020). The field of gifted education continue to evolve (NAGC, 2020).

Due to the works of Guilford (1950), Getzels and Jackson (1962), and Torrance (1974, 1998, 2001, 2018), gifted education programs in schools had ways to assess and identify students for these programs. In 1972, the first federal definition for giftedness included creativity (Jolly, 2009). The 1993 federal definition of giftedness described

gifted individuals as those who perform at exceptional levels when compared with others of their same age, background, and environment (Crabtree et al., 2019).

Present

State and local education agencies implement gifted programming in different ways (Peters, 2018). The Georgia Department of Education defined a gifted education student as one who demonstrates a high degree of intellectual and/or creative abilities, exhibits an exceptionally high degree of motivation, excels in academic areas, and needs special instruction to achieve at levels that match the student's ability (Georgia Department of Education, 2018). The NAGC (2020) acknowledged that teachers encounter a wide range of knowledge and skills within their classroom. The NAGC (2020) recognized that teachers must have the skills to differentiate their instruction to meet the needs of students across all achievement levels.

Brighton et al. (2005) found that when teachers do differentiate, their focus is on students who are struggling; yet, the NAGC (n.d.) noted that differentiation within the regular classroom is one of the most common forms of programming for advanced students. The NAGC (n.d.) also asserted that special strategies such as acceleration, ability grouping, and specialized pull-out programming benefit gifted learners. Schools are typically age based, meaning that students of similar ages progress through their education at a fixed pace based on the assumption that individuals of the same age have had relatively the same opportunities and experiences (Mullis et al., 2011).

Acceleration strategies are categorized into two forms, subject or grade. An example of subject-based acceleration is studying one subject with students in a more advanced grade, curriculum compacting, or allowing students to take a single college

course or distance learning course, while students remain with the same-aged peers for other instruction (Plucker & Callahan, 2014). In grade-based acceleration strategies, students do not remain with same-aged peers, and examples are early entrance to a program, whether kindergarten or college (Plucker & Callahan, 2014). Another example of grade-based acceleration would be grade skipping (Plucker & Callahan, 2014). J. A. Kulik (2004) completed a meta-analysis that estimated an average effect of nearly a year's academic growth for accelerated students. Assouline et al. (2014) also reported positive effects of acceleration.

The turn of the 21st century brought new philosophical perspectives to the views of learning and talent in the United States (Plucker & Callahan, 2014). Educators grew tired of the constructs in place for gifted (Plucker & Callahan, 2014). Plucker and Callahan (2014) denoted that the primary implications changed from basic psychometric conceptions of early intelligence theories, such as Guilford's systematic theory of intellectual abilities, known as the structure of intellect, to more recent theoretical development models. As an example of a more recent model, Subotnik et al. (2012) defined giftedness as developmental and potential for giftedness as a key variable in the early stages of identification. This approach deals with potential versus outcomes and is very different from earlier theories. Subotnik et al. (2012) explicitly stated how the constructs change as people develop and emphasized that giftedness results from a combination of cognitive and psychosocial variables. Subotnik et al. (2012) endorsed views that intelligence is malleable and maintained the importance for young children to develop a creative approach (person) and for older children to acquire skills (process).

The two mindsets and skills are coupled with multidisciplinary content and are applied to the creation of products or performances.

Future

Plucker and Callahan (2014) called for a need of further research in areas of gifted education. Examples are the role of social and emotional issues in gifted students; a mismatch between intellectual, emotional, and psychomotor capabilities in gifted students; and racial and ethnic disparities in gifted program participation (Plucker & Callahan, 2014). Efforts to address underrepresentation and gaps among subgroups of bright students have increased over the past several decades, yet the gaps have grown over the past generations (Plucker & Callahan, 2014).

The NAGC (2019) reported an underrepresentation of Black and Hispanic students served in gifted and talented programs nationwide. Sally Krisel, president of the NAGC, specifically stated that ethnic minority children living in poverty and "performing at the same level as their gifted peers are 250% less likely to be identified for and served in gifted programs" (NAGC, 2019, para. 3). Naglieri and Ford (2015) stated underrepresentation of these groups is due to the methods and instruments used for identifying gifted learners. Naglieri and Ford (2015) posited that accurate and equitable evaluation of the underrepresented groups could be achieved by using nonverbal tests of general ability as part of the process to identify gifted students.

In contrast, Renzulli (2016) has fostered a more inclusive view of giftedness using the Three Ring Conception. The Three Ring Conception challenged the traditional criterion of top 5% of IQ scores used in gifted identification (Renzulli, 2016). The Three Ring Conception focuses on creative productivity and includes three interacting facets of

above average ability, creativity, and task commitment (Renzulli, 2016). Renzulli (1978) pointed out that no single cluster makes giftedness; rather, the interaction among the three clusters has been shown by research to be the necessary ingredient for creative productive accomplishment.

Renzulli (n.d.) identified a resistance to change as the unifying characteristic of today's schools. To improve education for the future, Renzulli (n.d.) called for practice to precede policy so that educators can adopt what works, instead of being told what to do by politicians or others removed from the classroom. Renzulli (n.d.) maintained that constant rhetoric about school improvement, mission statements, and standards needs to incorporate "a little common sense" (para. 1) and include the real purpose for school: learning should be enjoyable, satisfying, and efficient. Finally, Renzulli (n.d.) stated that for real change to occur, adoption of a gentle and evolutionary approach is needed so that educators can live with the change and not be threatened by it.

Related to Renzulli's (n.d.) recommendations of looking at practice before policy, and keeping learning enjoyable, satisfying, and efficient, Finland has served its gifted students differently than the United States. According to Laine and Tirri (2016), Finland was among the top scoring nations in the world, as measured by Programme for International Student Assessment (PISA) scores. Educators, researchers, and politicians in Finland debated for many years about how to serve gifted students (Laine & Tirri, 2016). Finland had an egalitarian atmosphere and observed that all students were gifted (Laine & Tirri, 2016). There was no official gifted education policy, and there was no official definition or identification (Laine & Tirri, 2016). There was no mention of the term *gifted*. The students in elementary school were served in mixed-ability classrooms,

and academic interventions were given using differentiation within the classroom (Laine & Tirri, 2016).

Mixed-ability grouping in the United States is a hot topic. Plucker and Callahan (2014) stated further research is needed with ability grouping in the United States. Gifted education scholars as well as advocates of gifted education have noted available research has demonstrated benefits of homogenous grouping over heterogeneous grouping, regarding student achievement and self-concept across ability levels (Plucker & Callahan, 2014). However, critics have claimed that homogenous grouping leads to lower student achievement and lower self-concept (Plucker & Callahan, 2014). Other claims from critics emphasize de facto segregation for poor and ethnic minority students (Plucker and Callahan, 2014). One teacher-union-funded think tank concluded that students placed in low-track classes fall even further behind (Burris & Allison, 2013).

Considerable research has been done on ability grouping. Slavin (1987, 1990) and C.-L. Kulik and J. A. Kulik are the most cited researchers on the subject. C. L. Kulik and Kulik (1982) and J. A. Kulik and Kulik (1992) found small or negligible effects for ability grouping at all levels without instructional modifications. These findings are important and emphasize that for ability grouping to work with any students, appropriate instructional differentiation must occur across ability levels (Plucker & Callahan 2014). Slavin (1990) concluded that unless "teaching methods are systematically changed, school organization has little impact on student achievement" (p. 491).

According to the OECD 2015 report of PISA scores, Finland outscored the United States in science, reading, and math (Kastberg et al., 2016). PISA is a system of international assessments given every 3 years that allows researchers to compare learning

outcomes of 15-year-old students in science, reading, and math across countries. PISA is coordinated by OECD and was first implemented in 2000 with 32 countries participating (Kastberg et al., 2016). In the 2015 report, 73 education systems were represented.

Finnish students have reached at or near the top of the PISA ever since it started in 2000. In the 2015 assessments, they ranked fifth in science, fourth in reading, and 13th in math (Kastberg et al., 2016). In comparison, U.S. students ranked 25th, 24th, and 40th, respectively, of the 73 tested countries (Kastberg et al., 2016). According to a report from Stanford University (Tung, 2012), Finnish schools outshine U.S. schools because the Finnish schools focus their curriculum on critical thinking, problem-solving, PBL, and learning to learn, whereas the U.S. schools have moved more to a standardized-test-based system. The 2015 PISA scores shown in Table 5 indicate U.S. students' performance in all subject areas was about average or below average when compared to the scores of students from 73 educational agencies around the world (Kastberg et al., 2016).

Table 5

Programme for International Student Assessment (PISA) Scores: 2015

Subject	Finland	United States	Mean scale score
Science	531	496	493
Reading	526	497	493
Math	511	470	490

Note. Scores from Finland and the United States are two of 73 total reporting agencies referenced for comparison purposes only. Mean score is for all 73 countries. Adapted from *Performance of U.S. 15-Year-Old Students in Science, Reading, and Mathematics Literacy in an International Context: First Look at PISA 2015*, by D. Kastberg, J. Y. Chan, G. Murray, & P. Gonzales, 2016, National Center for Education Statistics.

A great deal of literature exists arguing against providing gifted education in U.S. schools. Some have argued that segregating students according the gifted and nongifted

labels reinforces a social hierarchy in schools (Mansfield, 2015). Another argument contended that gifted education serves predominantly White, privileged children and again maintains the social caste system in schools (Mansfield, 2015). Mansfield (2015), a certified gifted educator in Texas who became a college professor at Virginia Commonwealth University, argued that in addition to privilege-giftedness, difficulties exist in defining giftedness and in too much subjectivity of various assessments used to identify gifted students. Mansfield (2015) advocated that all students should have access to the same opportunities. Mansfield (2015) pushed for current policies and practices to be transformed so that the U.S. education system would embrace a philosophy that supports excellence and equity for all students.

Summary

The preparedness of students entering the workforce has been the primary concern of the nation's educational and political leaders (Hossain & Robinson, 2012). The lead researcher recognized a lack of existing literature regarding the effectiveness of creativity development interventions on elementary students. Additionally, the researcher found little evidence of creativity development programs targeting all students in an elementary setting. For this study, the researchers used a quasi-experimental design to measure whether an intervention to increase creative thinking skills in elementary students was effective, based on data from a rating scale. This method and design were most appropriate to test the hypothesis because the use of archival data meant the data could not be manipulated (Babbie, 2013). The intent of the researcher was to add information to the research on creativity development interventions. The results of this study could significantly affect instructional approaches used to prepare students for the

21st century workforce. Sternberg (2018) posited that when creativity, intelligence, and wisdom are combined with teaching and learning, society will improve, and people will use their creativity to make the world a better place.

CHAPTER III

METHODOLOGY

The implementation of a divergent thinking intervention is hypothesized to prepare students for a world beyond graduation that values creative thinking (Bevins et. al, 2012; Chen & Kaufmann, 2008; Zhao, 2015). The literature review in Chapter 2 presented research results on creative studies performed based on a range of factors. These findings concluded that creativity is a skill needed for 21st century learners that can be developed and measured and that can be perceived differently based on location on the globe. Creative pedagogy is needed in education today to develop creativity. Millar et al. (2011) and Zhou (2015) concluded that creativity can be developed, nurtured, and fostered through education and training.

Therefore, this study examined the effect of the creativity development intervention on the divergent thinking of third-, fourth-, and fifth-grade students. The purpose of this study was to determine whether the creativity development intervention when implemented with all students into the elementary curriculum improved fluency, flexibility, originality, and elaboration skills, which are components of divergent thinking. Composite raw scores from a nonverbal, figural performance task were used to measure students' divergent thinking. This performance task was a standardized district assessment, the District Screener for Gifted Education (DSGE). The researcher sought to determine whether the creativity development intervention fostered creativity development in all students, including gifted-identified and non-gifted-identified

students. The student population of the school where this research study took place is diverse in socioeconomic status and ethnicity. Aligned with the purpose of this study, one main research question (Research Question 1) and two specific subquestions (Research Questions 2 and 3) emerged:

1. How does the creativity development intervention impact elementary students' creativity performance, specifically in fluency, flexibility, originality, and elaboration skills?
2. To what extent are students able to retain skills from the creativity development intervention to build fluency, flexibility, originality, and elaboration after not participating in the intervention for 9 weeks?
3. To what extent is the effect of the creativity development intervention on fluency, flexibility, originality, and elaboration moderated by gifted-identified and non-gifted-identified status of elementary students?

This chapter includes the methods and procedures for the study designed to answer these questions. First, this chapter includes a description of the research design employed in this study. Next, the role of the researcher is defined and explained. Then, the participants and the setting are described and explained, as well as the measurement tool and procedures. The intervention is also described in detail as the instructional treatment. The chapter concludes with the discussion of scoring procedures and statistical plan for analysis.

Research Design

The purpose of this study was to determine if the creativity intervention program implemented into the elementary curriculum at one elementary school improved fluency,

flexibility, originality, and elaboration skills, which are components of divergent thinking. Preexisting scores on the district assessment were analyzed to measure students' development of fluency, flexibility, originality, and elaboration. Because the study focused primarily on the effect a treatment had on test scores, a purely quantitative approach was taken (Goertzen, 2017). More importantly, based on Creswell and Creswell (2017), quantitative studies allow for generalizability. The results of this study could be broadly applicable to educators of students in third, fourth, and fifth grades, policy makers, elementary administrators, and other stakeholders. This study should focus attention and raise consciousness of child development to include not only aesthetic creativity with instruction, but also creative thinking, creating teaching, and creative learning opportunities into an everyday experience in elementary education. Therefore, a quantitative methodology was used to examine each research question.

A quasi-experimental design with repeated measures was used in this quantitative study. McMillan and Schumaker (2008) suggested that a quasi-experimental quantitative research method can be used to determine the effects of teaching methods, which in this study was the creativity development intervention. In addition, quasi-experimental design was determined to be an effective design because it addressed the practical approach needed for research implementation in a school setting. A quasi-experimental design resembles an experimental design, but the participants are not randomly assigned to conditions or order of conditions. Random selection would not be appropriate or ethical in a school setting, as students are assigned to specific teachers by administration to best support student needs. An assumption of this study was that teacher assignments were specific to student needs, in that students who qualified for gifted education were served

by a gifted certified teacher and students who qualified for English language needs were served with a teacher endorsed to teach English language learners.

Another reason random selection would not be appropriate is school personnel, parents, and even students might object to offering some students a treatment opportunity and denying it to others (Cook, 2001). Therefore, to ensure fair and equitable treatment of all students in the building, the training program, or intervention, was given to all students. The treatment, or experimental, group simply received the intervention during the first term of the 2019-2020 school year, whereas the control group received the intervention the second term. All students participated at different times in this rotation of schedule. Repeated measures and switching replications designs are typically employed to control for lack of experimental design and lack of random sampling.

Repeated-Measures Design

A repeated-measures design is also known as a within-subjects or within-group design and is implemented as a tool to control for lack of true experimental design. This design is used when a single group of participants is measured two or more times and the same sample group is used in all treatment conditions (Gravetter & Wallnau, 2013). Mitchell and Jolley (2012) stated that in a repeated-measures design, every participant receives only two levels of treatment: treatment and no treatment. This study used a repeated-measures design because, although between-subject factors were examined, the same group of students was measured under both the treatment and control (no treatment) condition. A two-way repeated-measures ANOVA was run to determine whether test scores differed between pretest, Posttest 1, and Posttest 2; whether scores differed

between treatment and control groups; and whether scores differed based on students being served in the gifted program and not served in the gifted program.

An advantage of a repeated-measures design is that it has a greater statistical power by controlling for difference between subjects (Gravetter & Wallnau, 2013). This design eliminates problems due to individual differences in that the participants are being compared to themselves and not to other participants (Gravetter & Wallnau, 2013). Due to the increased statistical power, fewer people are needed in the sample and still detect if the effect exists (Mitchell & Jolley, 2012). Data are collected at multiple points in time for each subject and can assess effects over time, which is suited well for studying learning and development or other changes that can take place over time (Gravetter & Wallnau, 2013). Specifically, students in Team A participated in a pretest during fall of 2019, received the 9-week implementation, and completed the first posttest. During the second term, Team A participated in regular scheduled instruction in media and research for 9 weeks and then took a second posttest at Week 18. Team B served as a control during the first 9 weeks, participated in the intervention the second 9 weeks, and took a posttest at Week 18. Team A scores were compared to their scores after treatment and at Week 18 to determine whether the treatment results sustained over time. See Figure 5.

A disadvantage of the repeated-measures design is that the structure of the design allows for factors other than the treatment effect of the participants score to change from one treatment to the next (Gravetter & Wallnau, 2013). These effects are associated with the treatment order but are not caused by the treatment. In other words, the participants become better in the second conditions due to practice from the first, leading to distorted results (Gravetter & Wallnau, 2013). Team A had multiple chances to practice and see

the same type of products and therefore could have improved just through practice, not necessarily because of the sustainable strategies taught with the treatment. Another disadvantage is the participants might become bored or tired between the two conditions, possibly affecting the results in the second condition. After a 9-week term, it was unlikely that the participates would become bored, but with third-, fourth-, and fifth-grade students, the researcher had to take this into account when looking at results.

Switching Replication Design

A switching replication design is ethical and addresses social interaction threats (Trochim & Donnelly, 2006). A switching replication design also offsets concerns of using a nonrandomized convenience sample for comparison. Ethically, a switching replications design is most viable in institutional contexts where programs repeat at regular intervals, such as schools on a semester schedule (Trochim & Donnelly, 2006). Socially, students, parents, or teachers may perceive the training as an advantage over those who do not receive the training (Trochim & Donnelly, 2006). Behaviors could develop within the control group such as rivalry, or negative feelings may occur such as resentfulness and demoralization (Trochim & Donnelly, 2006). Therefore, by ensuring that all participants receive the possible benefits of the training program, the switching replication design alleviates the investigator's ethical concerns over fairness and provides possible controls for powerful social threats to internal validity (Trochim & Donnelly, 2006). Even when randomization is not possible, the design denies and exposes the treatment to all participants in the same study (Trochim & Donnelly, 2006).

The switching replication design was used by allowing students to participate in a creativity development intervention on a 9-week rotation to accommodate an 18-week

semester schedule. Students received the creativity intervention for 9 weeks as well as media and research skills for 9 weeks within an 18-week semester grading period. The students in the first creativity training group, Team A, were the experiment group, and the students in the media group, Team B, were the control. After 9 weeks, the groups switched and rotated instruction so that all students participated in the intervention.

Second, switching replication design forces the cause to precede the effect (Johnson & Christensen, 2017). This design allows for two independent implementations of the program, which enhances external validity. Thus, all students in the school participated in the intervention at different times and then were measured on the skill assessment known as the DSGE.

This design included two groups, Team A and Team B (see Figure 5). All students participated in three phases of measurement: the pretest, first posttest (Team A only had treatment), and the second posttest (after Team B had the treatment). In the first phase, both groups were pretested. Then one group, Team A, received the intervention the first 9 weeks. After the first 9 weeks, both Team A and Team B took the posttest. At this time, Team A was the experimental group and Team B was the control group. In the second phase of the design, the original comparison group, Team B, received the program while the original program group, Team A, received regular instruction. After the second period of 9 weeks, Teams A and B both took a posttest. The repeated-measures analysis measured each subject at two or more points with respect to time. This allowed for the comparison of scores of different tests where each subject was measured under each treatment condition. The design notation is illustrated in Figure 5.

R_A	O_1	X	O_2		O_3
R_B	O_1		O_2	X	O_3

Figure 5. Switching replication design with multiple testing.
R = student group; O = pretest/posttest; X = intervention.

All students participated in a pretest at the beginning of the Fall 2019 semester to attain baseline data of what students knew and were able to do with fluency, flexibility, originality, and elaboration. Team A, the experimental group, then participated in a 9-week session on creativity development. Team B was the control group and participated in lessons focused on basic library skills, digital citizenship, and literature appreciation during the same 9-week period. After 9 weeks, all students in both teams took a posttest. The groups then switched, and lessons from the first 9 weeks were replicated with the opposite group; Team B received the lessons on creativity development and Team A received the lessons on basic library and research skills, digital citizenship, and literature appreciation. All students then participated in a second posttest at Week 18. Temporal precedence was met because the treatment was administered before the posttest. The researcher had some control over the program and established a schedule for an experiment group and a control group. The scheduling and research design allowed for ruling out alternative explanations for the observed effect.

The variation between cause and effect was tested and allowed for valid causal inferences based on statistical data. Replication with the same group of participants allowed the researcher to identify variance not associated with treatment differences and could increase reliability because of the increased number of applications (Huelar, 2012). Student participants in Team A took a pretest, received the training, and then took a

posttest. Computation of means, standard deviations, and *F* tests of significant difference in means were completed for each of the variables, which were groups, with a covariate of gifted and nongifted groups, and time. After 9 weeks, Team B received the training program. Team B pre- and posttest data were run again using SPSS. Team A also took a second posttest at Week 18, which provided data to answer Research Question 3 regarding sustained effect.

According to Johnson and Christensen (2017), three requirements must be met to establish a causal effect: empirical association, temporal priority of the independent variable, and nonspuriousness. This causal explanatory study met empirical association criteria by observing correlations between the training and posttests. Temporal priority was met by the training occurring prior to the posttest. Nonspurious association was met by having a controlled condition that was highly structured to meet the criteria Torrance (2001) suggested, such as easy, yet challenging, nonbiased, and fun. One teacher was trained on the components of the program and the expectations of intervention activities and outcomes. A walkthrough evaluation form was reviewed with the teacher prior to starting the first class. The activities were not repeated in regular classroom settings that would give some students advantages over others.

A two-way repeated-measures ANOVA was run to compare the mean differences in composite DSGE scores (dependent variable) between Team A and Team B (independent variable) and gifted-identified and non-gifted-identified students (independent within-subject variable) and time of the test (between-subjects variable). The primary purpose of the 2x3 mixed ANOVA was to understand if there was an interaction between these factors and the dependent variable, which was the test score.

The mixed ANOVA was used to find out whether pretests and posttests differed significantly from each other and whether the treatment and control differed significantly from each other, while controlling for the influence of gifted services.

Role of the Researcher

The role of the researcher in quantitative studies is theoretically nonexistent, and participants act independently of the researcher as if he or she were not there (Simon, 2011). However, as an assistant principal of instruction working within the building where the intervention took place, this researcher played a heavy role in the participation and functionality of this research study. The researcher scheduled the rotation of classes, planned the lessons, trained the adult who administered the lessons and assessments, monitored the adult and students throughout the course, and compiled the assessment team to score the individual assessments.

The researcher also incorporated steps to ensure lack of bias whenever possible. The design of the study plays a crucial role in supporting nonbiased results. Repeated measure analysis and the switching replications design ensured that students were compared at different time points and were only compared to themselves. The researcher never interacted with the students to persuade answers, only to monitor that the lessons were taught throughout the program in the same manner. The researcher only looked at the students' services to ensure that the teams were as equally divided as possible. The researcher wanted students learning English as a second language on both teams as well as students with Individualized Education Programs on both teams. Gifted students were also balanced equally across both teams. Once the teams were as equitable as possible,

students were no longer compared to each other, only to their own scores. Interrater reliability was established between the scorers of the assessment.

Participants

Population and Setting

The population in this study consisted of 614 students from third, fourth and fifth grades from a suburban elementary school in central Georgia. This school is in a growing community. The school's overall performance as reported by the Governor's Office of Student Achievement is higher than 74% of schools in Georgia and performs higher than the district average as well. The students' academic growth is higher than 61% of schools in the state and higher than the district average on growth scores. Further, 63% of third-grade students are reading at or above grade-level target as measured by the state assessment of achievement given in the spring of each year. The school is an upper elementary school that only houses third, fourth, and fifth grades. The student mobility rate is 11%. The school is also not a Title I school, which means that it does not receive state funds to support low socioeconomic students. Only 24% of students at this school receive free and reduced-price lunch. Of the 614 total students, only students who completed the full academic semester were in the comparison group. Students who moved in, or moved out, were not included in the sample.

The student population at the study site was 52% male and 48% female during the 2019-2020 school year. Third-grade students represented 32.8% of the total population, fourth-grade students represented 31.6%, and fifth-grade students represented 35.4%. By race, the total student population was 49% White, 24% Black, 11% Hispanic, 10% Asian/Pacific Islander, and 6% multiracial. Further, 11% of students were economically

disadvantaged, 8% were students with exceptionalities, and 14% were English language learners. This elementary school population was 31% gifted identified; gifted students received special services daily by teachers certified in gifted education.

The population of the 132 gifted-identified students was broken down by gender and race. Male students were 40% of the total gifted population and females 60%. The breakdown of gifted identified students by race was 58% White, 17% Black, 15% Asian/Pacific Islander, 8% Hispanic, and 3% multiracial. Twenty-four students in Grades 3–5, or 18% of the gifted population, are Hispanic or Asian/Pacific Islander students participating in the English as a second language program.

Sample

The participants were chosen through a convenience sampling and nonprobability purposeful sampling. Mertens (2010) defined a convenience sample as taken from a population readily available to the researcher. Gall et al. (2007) added that data from participants in a convenience sample may be data collected by an institution. The DSGE scores are submitted annually to the school Department of Gifted Education and used as evidence for gifted placement. The study was conducted at the school where the researcher was employed and served as the building test coordinator; therefore, the researcher had access to the archival data. However, Institutional Review Board protocols were followed. An application was approved by the university Institutional Review Board and school system. A letter of approval from the district office of professional learning was obtained. Institutional Review Board approval is included as Appendix B.

Nonrandom purposeful sampling was used to meet predetermined criteria necessary for the study to be conducted (Cozby & Bates, 2012). This study used

preexisting data in an ex post facto design. In this study, participants were male and female elementary students in Grades 3, 4, and 5 who participated in the creativity development intervention to develop divergent-thinking or creative-thinking skills. Students in Team A participated in the intervention first, in the first 9-week session (treatment group), while Team B students received research skill lessons (nontreatment group). During the second 9-week session, research skills lessons were taught to Team A, while Team B participated in the creative development intervention. The same teacher and the same lesson plans repeating with both groups were two factors controlling for teacher differences within the class, grade level, and team. See Table 6 for class scheduling information. The final sample consisted of 286 students in Team A and 303 students in Team B.

Table 6

Class Schedule Information, Teams A and B

Time	Grade level	Student *n*
Team A, treatment first 9-week term (*n* = 314)		
Monday a.m.	3	31
	4	25
	5	27
Tuesday a.m.	3	32
	4	24
	5	27
Wednesday a.m.	3	21
	4	25
	5	27
Thursday a.m.	3	24
	4	25
	5	26
Team B, treatment second 9-week term (*n* = 300)		
Monday p.m.	3	22
	4	27
	5	29
Tuesday pm.	3	22
	4	24
	5	27
Wednesday p.m.	3	22
	4	24
	5	26
Thursday p.m.	3	25
	4	26
	5	26

Team A and Team B both included students from all grade levels and all subpopulations. Four subpopulations within the school are economically disadvantaged, English language learners, students with disabilities, and gifted learners. These subpopulations are reported by the state on the school report card and are identified in

this study to match state reporting. Classes were created by the administrative team that equally distributed gender, ethnicity, as well as behavior issues. The administrative team carefully placed students protected under Section 504 of the Rehabilitation Act (504 plans), as well as students protected under Individualized Education Programs, to ensure balanced and fair representation across the grade levels.

Instrumentation

The instrument used to collect the data was the DSGE creativity test. The DSGE is a standardized test given across the district. The assessment consists of a figural component that measures for fluency, flexibility, originality, and elaboration, very similar to the TTCT. One figure is given on the DSGE, but three tasks are required on the TTCT. The CSR (see Appendix A) is used to calculate scores based on fluency, flexibility, originality, and elaboration, like the TTCT scoring procedures, yet not as detailed as the TTCT streamlined scoring rubric. The DSGE was appropriate to give to the entire school population because it gives a glimpse of students' divergent thinking abilities and could be scored using the CSR because of the large scale of participants.

Implementation of the Screener

The gifted department of this school system decided to model the system-wide screener, the DSGE, after instruments approved by the state and currently being used to assess students for gifted services in the county. The purpose of this screener is to allow placement of high-achieving students into the gifted classroom by identifying students who have the potential to do well on gifted assessments when given the full battery. The committee selected and modified part 1 from the TTCT, which is a drawing stimulus to be administered to meet the creativity component. The committee also determined that

gifted lead teachers would be trained on scoring part 1 responses following specific guidance from the TTCT scoring manual (Torrance, 2018; Torrance et al., 2008). Gifted lead teachers and partner teachers were trained on fluency, flexibility, originality, and elaboration. They were also trained on evidence of creative strengths. Training materials and examples came directly from training materials used at the Torrance Center from the University of Georgia during their certification course. All possible steps were taken to make sure the creativity portion of the screener mirrored the exact process used when administering and scoring the TTCT. Both assessments, the DSGE and the TTCT, test for fluency, flexibility, originality, and elaboration skills. The key is training of the scorers so that they know what to look for with the specific components (Kim, 2006). Literature supported that the skills overlap (Kim, 2006); therefore, the committee concluded that one drawing can show the components will meet the needs of the district, according to the director of Gifted Services in a 2019 interview with the researcher. The TTCT (Scholastic Testing Service, 2017) is much more thorough and elaborate, so the researchers chose to use a shorter version of this assessment for administrative and identification purposes.

The scoring rubric, the CSR, used for the district screener, the DSGE, does not generate subscores based exclusively on each construct. The CSR allows for the overlapping of constructs within each subscore (see Appendix A). Guilford (1962) stated that divergent thinking is multidimensional and consists of several factors (fluency, flexibility, originality, and elaboration), therefore supporting the overlapping of constructs.

The CSR yields three subscores and a composite score. The first subscore is obtained by the number of points awarded based on the number of details within the picture. This score not only represents a fluency score but incorporates points for elaboration as well. If a student does not draw a picture, the student is awarded 0 points, the minimum point value for this section. A simple drawing with 1–5 details is awarded 2 points, a drawing with 6–10 details is awarded 4 points, and a drawing with 11–15 details is awarded 6 points. If the picture is a very detailed drawing with 15 or more details added to it, the student receives 8 points, which is the maximum point value for this section. It is important to note that this first section is not to see how well the students draw, but rather the number of ideas (fluency) the students can think of from a simple stimuli and how many details or ideas keep going beyond the minimum necessary for the response.

In the second section of the CSR, the rater awards points based on the title of the drawing, similar to the TTCT Abstractness of Titles section that is scored on a continuum from 0 to 3. On the CSR, a one-word label receives 0 points. Words and phrases about the drawing receive 1 point. A descriptive title explaining the drawing receives 2 points, and a descriptive title that is fresh, original, and unexpected receives the maximum awarded point value of 3. Originality is defined in the TTCT Training Manual as anything that is statistically infrequent. The word *unexpected*, although not specifically defined, is implied to mean a display of abstract thinking where titles do not connect to anything in the picture but symbolize the picture. To clarify, a picture of a sunset on the ocean with bird flying and people lying on a beach could be entitled “Tranquility.” The picture could be named “The Sunset,” but tranquility is the idea behind the drawing

whereas the sunset names the setting and is less original or likely to be used more frequently as the title.

The third and final component is based on additional points that show creative strengths and are added to the first two measures of the CSR. On the TTCT, 13 creative strengths are evaluated during the figural activities. One response may contain none of the strengths or may contain several. Many of the strengths occur frequently and some occur simultaneously. On the CSR, a student may earn up to 9 points on the following criteria. If the drawing tells a story, 1 point is awarded. If there is a display of emotion or movement of some kind, 1 point for each trait is given. Another point is awarded for unusual visualization such as looking at the drawing from a different perspective or looking at the drawing from above or below it. A point for internal visualization is given if the scorer is viewing the inside of something in the drawing. One point is given if the drawing shows humor, or if the drawing displays a fantasy scene (e.g., witches, sorcery, or dragons). Another point is given for richness, which means that the drawing involves the senses, meaning that the image drawn by the student is vivid and appeals to the sight of the scorer; if the image is strong, sharp, and distinct in the mind of the audience or scorer, 1 point is awarded. The last point is awarded if the drawing is colorful, meaning that the picture or image is emotionally stimulating. For example, the scorer can hear the cat “meowing” or feel the heat from the pavement depending on how the student depicts the idea. Appendices C and D show examples of figural drawings. Table 7 compares the district assessment, the DSGE, with the TTCT.

Table 7

Comparison of District Screener for Gifted Education (DSGE) and Torrance Tests of Creative Thinking (TTCT)

Indicator	DSGE	TTCT
Target actions	Used district wide for creative potential identification	Used world-wide for formal testing of creative potential
Age target	Appropriate for Grades 3–5	Appropriate for prekindergarten through adult
Number of items	1 figure	3 figures
Length	10 min	30 min (10 min per figure)
Number of indicators	9 additional indicators	13 addition indicators
Scoring method	Streamlined scoring guide modified from TTCT by district	Streamlined scoring guide Norm and criterion referenced
	Constructs overlap, and point values are awarded	Each construct receives a separate score

The dependent variable for this study was the divergent thinking skills as measured by the DSGE and scored using the CSR (Appendix A). The independent variable was participation in the creativity development intervention. For Research Question 3, an additional independent variable was identification as gifted.

Validity

No formal validity and reliability data exist on the DSGE. The DSGE and corresponding rubric, the CSR, were written by experienced diagnosticians along with the director of gifted education within the school district. This assessment or measure has been used for several years and has undergone at least three revisions. With each revision, edits were made to follow the construct of the TTCT more thoroughly. An effort

to include as many of the theories and concepts of the TTCT while making the assessment brief, yet meaningful, was a priority for the test writers. The 2019-2020 school year was the 3rd consecutive year that this instrument was used without any edits or revisions. The writers indicated that information gained from this assessment gives an accurate first glimpse of all students in the district to decide whether further testing, using the full battery of the TTCT, is needed.

As stated previously in the literature review, the TTCT has demonstrated excellent reliability and validity (Kaufman et al., 2012; Kim 2006, 2017). According to the figural TTCT manual (Torrance et al., 2008), the interrater reliability from five studies ranged from .57 to 1.00, with a median of .97. Torrance et al. (2008) also explained that it is possible to keep interrater reliabilities greater than .90 among scorers for the Scholastic Testing Service. Clapham (1997) stated that construct and content validity of TTCT have been established over many studies over decades. Over 2,000 publications dealing with the tests have affirmed and supported that the TTCT has construct and content validity (Torrance, 1998). Kim (2006, 2017) stated that the TTCT has predictive validity with the evidence of studies demonstrating that TTCT results are predictive for adult creative achievements. Based on these data, the TTCT emerges as a positive model assessment tool that is reliable and valid.

The DSGE tool was created locally by the district where the researcher works. In an interview, the director of gifted education and gifted lead teacher described the construction of the DSGE:

> The Torrance Test of Creative Thinking (TTCT) is on the Georgia Department of Education: Approved Gifted Assessment list, implying that it has been vetted at

> the state level to be a valid and reliable instrument for measuring creativity and can be used to assess creativity for gifted identification. When creating the screener, it was decided by the gifted department to model the system-wide screener after the instruments that are approved by the state and are currently being used to assess students for gifted services in our county. (personal communication, April 19, 2018)

This researcher reduced the plausibility of the most likely threats to validity by checking for conformity of assumptions with various statistical tests described in the Data Analysis section. An a priori G*Power test was completed to ensure the sample size was sufficient to reduce type II error, described in more detail in Data Analysis.

Reliability

As stated previously in the literature review, the TTCT has demonstrated excellent reliability (Kaufman et al., 2012; Kim 2006, 2017). According to the figural TTCT manual (Torrance et al., 2008), the interrater reliability from five studies ranged from .57 to 1.00, with a median of .97. Torrance et al. (2008) also explained that it is possible to keep interrater reliabilities greater than .90 among scorers for the Scholastic Testing Service.

Interrater reliability for the DSGE was established by using the same two raters from the same test on more than two occasions. Interrater reliability is especially important when judgments can be considered relatively subjective (Hallgren, 2012). McHugh (2012) from the National University in San Diego stated that using percentage in agreement is a traditional and common method to obtain interrater reliability. This statistic is directly interpreted as the percentage of the data where two raters scored in

agreement with each other. Another benefit is that this method permits the researcher to discover if errors are random and evenly distributed or if a rater frequently records values different from the other (McHugh, 2012). If raters are well trained and little guessing is likely to take place (as with a detailed rubric), a researcher may safely rely on percentage agreement method to determine interrater reliability (McHugh, 2012).

Two raters computed the first 10 student scores using the scoring rubric independently. The first round, interrater agreement was 70%. The raters met and discussed the differences in scores. The researcher gave them another set to score independently. The second round showed interrater agreement of 80%.

Intervention

The treatment consisted of a 9-week intervention to develop divergent-thinking skills. Student schedules were created to rotate through a series of classes in physical education, art, music, computer lab, and media center throughout the year. Physical education, art, and music and media classes stayed in the rotation for the entire year. However, the lessons in media classes switched at each 9-week grading period so that skills for creativity could be measured with a control and experimental group. Therefore, Team A received lessons focused on creativity skills in the morning and Team B received lessons on media and research skills, digital citizenship, and literature appreciation in the afternoon. After the first 9-week period, student courses flipped, and Team A received lessons on media and research skills, digital citizenship, and literature appreciation while Team B received lessons on creative skills.

The researcher divided eight classes in fourth and fifth grade so four classes comprised Team A and four classes comprised Team B for each grade level. Third grade

had 11 classrooms, so the researcher divided one class equally among the team to create four groups. The researcher created a rotation so that every student on either team participated in art, music, physical education, and media lab each week.

Lessons were developed from the research to support divergent thinking, enhance creativity skills, and work on a modified PBL assignment for 9 weeks (see Table 8). Lesson plans can be found in Appendix E. Each intervention class began with open-ended questioning to build student collaboration. The researcher created a presentation on creative thinking skills to guide the teacher and students' thinking. The teacher then gave a lesson focusing on the four types of divergent-thinking skills: fluency, flexibility, originality, and elaboration. The teacher briefly explained the objective and assigned the task.

The students completed a figural task and then compared with a partner or the class. Flexible thinking and originality were practiced with a "How Many Uses" task. Students had 2 min to list as many uses as they could think of for an arbitrary item such as a paper clip or a toothbrush. Student-centered learning allowed for student choice and self-paced assignment. Students used a computer program call Brain Pop to choose a topic of their interest to read about, research, and complete 6 out of 12 activities from their choice board within the 9-week period. Brain Pop is a subscription-based website with high-interest, curriculum-based content with videos and accompanying resources that students can navigate independently. The website topics include science, social studies, English, math, engineering and technology, health, arts, and music. This model lesson was adapted from the Renzulli Learning (2020) system approach to a resource the school already had available (see Table 8). This project allowed students to have a voice

in what they were learning. Students would choose topics that allowed them to inquire and challenge themselves to meet learning goals they created themselves. Students were highly engaged as they worked through challenging problems within their topic of choice. Each student completed authentic work tasks and received formative feedback from their instructor. One-on-one conferences were held to encourage students to reflect on their own learning, and students came up with ways to make their work better. Table 8 shows intervention activities; also see Appendix E. Students not receiving the creativity development intervention participated in lessons on media and research skills, digital citizenship, and literature appreciation, but all students completed a figural drawing at the beginning of the semester as a pretest, at the end of the 9 weeks, and again at the end of the semester at Week 18.

To assess treatment fidelity, the treatment teacher used a unit plan that was scripted to ensure standardization of treatment. The intervention teacher also maintained a checklist of completed components and collected the samples of student work. Administrators also completed observations periodically to support and monitor the intervention teacher.

Table 8

Description of Activities in the Creativity Development Intervention

Torrance descriptors	Renzulli descriptors	Experiment group: Creativity development intervention	Control group
Natural everyday processes Suitable for all ages		Opening: building collaboration activity	Literature appreciation: read aloud Students make connections to history, current events, own personal lives
Easy yet challenging Unbiased Open ended	Enjoying Satisfying	Minilesson focusing on fluency, flexibility, originality, elaboration skills Students complete independently or in teams Activities centered around minilesson	Digital citizenship: • Digital etiquette lessons • Digital rights and responsibilities • Digital literacy
Fun	Student driven Choice High interest Goal setting	Individualized learning path Brain Pop website Before end of class, students reflect and document their own learning	Research and media skills Galileo: What is it, how to use it Media Center Detective: Where can I find…?

Note. The descriptors from Torrance and Renzulli are discussed in detail in the literature review. Key words or descriptors were added to support the design of the intervention lessons.

Data Collection Procedures

Data were collected in the following manner over one school semester, fall of 2019:

1. Students were divided into two teams, A and B, based on classes using the intervention.
2. All students took the pretest at the beginning of the semester, Week 1 (see an example in Appendix C). The pretest established a baseline score for each student. The activity was scored by two trained scorers and recorded on student rosters. Rosters were turned in to the researcher.
3. The treatment, the creativity development intervention, was administered according to the switching replication design. During the first 9 weeks of the semester, Team A (n = 286) served as the experimental group, receiving the intervention. Team B (n = 303) served as the control group, receiving research and technology instruction.
4. At the end of the first 9-week report period, all students (N = 589) participated in a figural drawing activity as a class for 10 min. Scorers received new class rosters and recorded student scores on a new recording sheet. This roster was turned in to the researcher as assistant principal for instruction.
5. The treatment was then replicated with the groups switching instructional objectives. Group A (n = 286) received research skills lessons. Group B (n = 303) now received the creativity development intervention.
6. At the end of the semester, Week 18, all students (N = 589) took the posttest, which was the same 10 min figural drawing activity (see Appendix D). Scorers used a new class roster to record student performance. This roster was turned in to researcher.

7. A power analysis was run to ensure the design was strong enough to detect reasonable departures from the null hypothesis (StatSoft, 2013).
8. Permission was obtained from the district for the student data to be used in this study. As assistant principal for instruction, the researcher had permission from the school.
9. Permission was obtained from the university Institutional Review Board to conduct the ex post facto analysis.
10. The test scores from the three tests, Weeks 1, 9, and 18, and other variables relevant to the study (gifted-identified and non-gifted-identified status) were compiled on an Excel spreadsheet by the district.
11. The district provided de-identified the data to protect student privacy.
12. The researcher examined the data and cleaned the data for missing scores or other anomalies.
13. The researcher entered data into SPSS for analysis.

Data Analysis

Research Question 1 was the overarching research question of the study. Research Question 2 addressed sustainability of the impact of the intervention, and Research Question 2 addressed a potentially confounding variable. The three research questions that guided the study were the following:

1. How does the creativity development intervention impact elementary students' creativity performance, specifically in fluency, flexibility, originality, and elaboration skills?

2. To what extent are students able to retain the skills from the creativity development intervention to build fluency, flexibility, originality, and elaboration after not participating in the intervention for 9 weeks?
3. To what extent is the effect of the creativity development intervention on fluency, flexibility, originality, and elaboration moderated by gifted-identified and non-gifted-identified status of elementary students?

The variables of interest in this study were analyzed with a 3x2 repeated-measures ANOVA. The IBM (2017) SPSS statistical analysis software was used to calculate both descriptive statistics and inferential statistics in this study. The dependent variable was the scores on the DSGE. Team A and Team B served as the between factors, and time served as the within factor. In Research Question 3, the covariate was gifted or nongifted identification. If a positive effect of intervention existed, scores from the DSGE would improve for all students, whether or not they were identified as gifted, and students would maintain a score higher than the pretest even after a 9-week period of time of nonparticipation in the intervention.

Data must pass a list of seven assumptions for the 3x2 repeated-measures ANOVA to give valid and interpretable results. Two independent variables were participation in the intervention and gifted-identified status. The dependent variable was the measure or score on the DSGE, scored using the CSR. Tests for outliers, normality, homogeneity of variance, and sphericity were computed within the SPSS package. Examples of tests to be run were the Shapiro-Wilks test of normality, Levene's test for homogeneity of variances, and Mauchly's test of sphericity. Descriptive statistics were calculated for measures under each treatment condition. Frequency distributions, the

means, and standard deviations for the composite score from the treatment and control groups were presented.

The advantages of using the two-way repeated-measures ANOVA include a reduction in both error and bias because the total number of tests are reduced. Two-way repeated-measures ANOVA uses one test with one alpha level to evaluate the mean differences and therefore avoids the problem of inflated experiment wise alpha levels (Gravetter & Wallnau, 2013).

Power Analysis

An a priori G*Power test was run to ensure the sample size would be sufficient. In the planning stage, the G*Power test calculated a minimum sample size of 86 for each group to show the effect (study results) of inferential statistics using *p*-values (results are not due to chance) with 80% power. *P*-values depend on sample size; therefore, it is important to know sample size in the planning stage to ensure, when comparing the differences between the control and treatment groups, that results are not due to chance. A power analysis using G*Power 3.1 to determine the statistical power of the research design was completed to avoid a Type II error. A Type II error, or false negative, is when a statistically significant difference is not observed, when, in fact, there is one. Statistical power is the probability that a design will lead the researcher to reject a null hypothesis (Murphy et al., 2014). Standardized parameters for common statistical tests where alpha = .05, effect size = .25,and power = .80 result in an 80% chance of correctly rejecting the null hypothesis of no significant effects with a minimum of 86 participants and used in this analysis (see Figure 6).

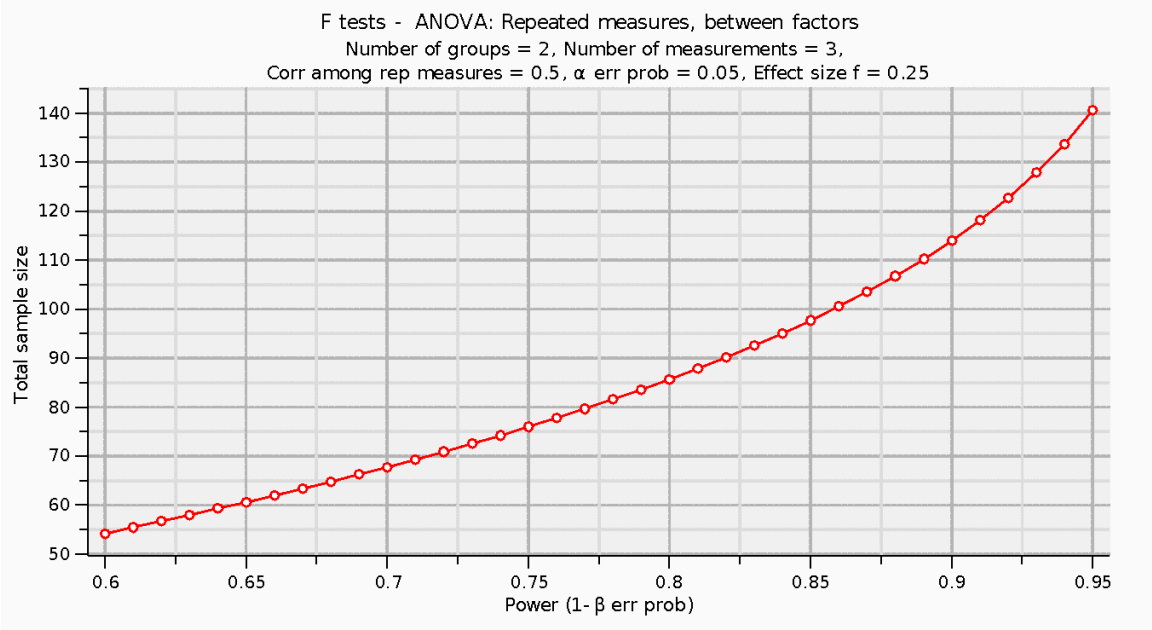

Figure 6. Graph of a priori power analysis. ANOVA = analysis of variance.

Summary

The purpose of this study was to determine if the creativity development intervention implemented into the elementary curriculum at one elementary school improved fluency, flexibility, originality, and elaboration skills, which are components of divergent thinking. The quasi-experimental research used a switching replication study and repeated-measures analysis with preexisting data. Information was provided about the research questions, research design, participants, instrumentation, procedures and data collection, and data analysis. In the next chapter, the results of the study are reported.

CHAPTER IV

RESULTS

The purpose of this study was to determine whether the creativity development intervention implemented into the elementary curriculum at one elementary school improved fluency, flexibility, originality, and elaboration skills, which are components of divergent thinking. Divergent thinking skills were assessed using the District Screener for Gifted Education (DSGE) from the 2019-2020 school year. These scores were examined using a quantitative approach comparing pretest scores of third-, fourth-, and fifth-grade students with posttest scores at a school where the creativity development intervention had been implemented. A quasi-experimental, repeated-measures design with switching replication was used to determine whether the creativity intervention would significantly increase students' skills in fluency, flexibility, originality, and elaboration to meet the demands of the 21st century workplace. Ultimately, this researcher hoped to show that creativity development can be nurtured in the educational setting for all students, and not just the gifted few.

In this chapter, the results of the analyses are presented. Results are presented by research question:

1. How does the creativity development intervention impact elementary students' creativity performance, specifically in fluency, flexibility, originality and elaboration skills?
2. To what extent are students able to retain the skills from the creativity development intervention to build fluency, flexibility, originality, and elaboration after not participating in the intervention for 9 weeks?

3: To what extent is the effect of the creativity development intervention on fluency, flexibility, originality and intervention moderated by gifted-identified and non-gifted-identified status of elementary students?

First, participant information is provided. Then, descriptive statistics and assumptions are presented. Following results by research question, the chapter concludes with a summary of the statistical findings.

Participants

This section explains the sample that was selected for the experiment. To collect data sufficient for the quasi-experimental study, the researcher relied on a sample of 589 students. In the planning stage, 614 total students were scheduled for the intervention; however, due to withdrawals and new enrollments, only 589 students had complete data once students' missing data points were removed. Only the students with a score for all three tests were utilized. The students were divided into two teams, known as Team A and Team B. The sample included different groups of students, as shown in Table 9. For example, Team A was 50.7% White students, 31.1% students of color, 21.3% gifted-identified students, 21.3% students with disabilities, and 18.2% English language learners. Team B was 46.9% White students, 36.6% students of color, 23.8% gifted-identified students, 23.8% students with disabilities, and 16.5% English language learners. Note the data did not include race/ethnicity for all students.

Table 9

Characteristics of Two Groups of Participants

Characteristic	Team A	Team B
N	286	303
Grade		
3	101	105
4	92	94
5	93	104
Gifted status		
Gifted identified	61	72
Not gifted identified	225	231
Students with disabilities	61	72
English language learner	52	50
Race/ethnicity		
White	145	142
Black	64	63
Asian American	17	15
Multiracial	8	27
Hispanic	0	4
American Indian	0	1
Pacific Islander	0	1

Note. Ethnicity data were not available for all students.

Sampling from different grades was effective in eliminating any sampling error that could result from differences between grades. This was specifically done to increase reliability of data collected and validity of the findings of this research. In testing the hypotheses of the study, the researcher also controlled for exceptionalities by keeping number of students with gifted status, students with disabilities, and English language learners as equal as possible between the two groups.

Findings

Descriptive Statistics Summary

Table 10 shows the mean scores and standard deviations for both groups of students at all three times of testing. All students took the pretest at the beginning of the semester, Week 1. The pretest established a baseline score for each student. The treatment, the creativity development intervention, was administered according to the switching replication design. During the first 9 weeks of the semester, Team A served as the treatment group, receiving the intervention, while Team B served as the control group. For Research Question 1, change in scores between pretest and Posttest 1 was compared between the treatment group, Team A, and the control group, Team B. During the second 9-week period, Team A did not receive the treatment, but Team B did. For Research Question 2, Team A Posttest 2 scores were compared to Posttest 1 scores to see if the intervention had a sustained effect. For Research Question 3, Team A scores were disaggregated by gifted-identified and non-gifted-identified status.

Table 10

Pre- and Posttest Scores by Group

	Pretest		Posttest 1		Posttest 2	
Group	*M*	*SD*	*M*	*SD*	*M*	*SD*
Team A	5.68	3.22	11.00	4.40	12.71	4.54
Team B	6.01	3.12	6.99	3.64	13.12	3.74

Note. Team A received intervention between pretest and Posttest 1. Team B received intervention between Posttest 1 and Posttest 2.

All students took the pretest at the beginning of the semester, Week 1. The pretest established a baseline score for each student. Team A pretest scores are presented in Figure 7. Team B pretest scores are presented in Figure 8. Posttest 1 scores at Week 9 for

Teams A and B are presented in Figures 9 and 10, respectively. Distributional shapes, spreads, and centers were similar for pretest results. However, after treatment, distributional shapes appeared bimodal, implying potentially different gains or improvements by students within each group.

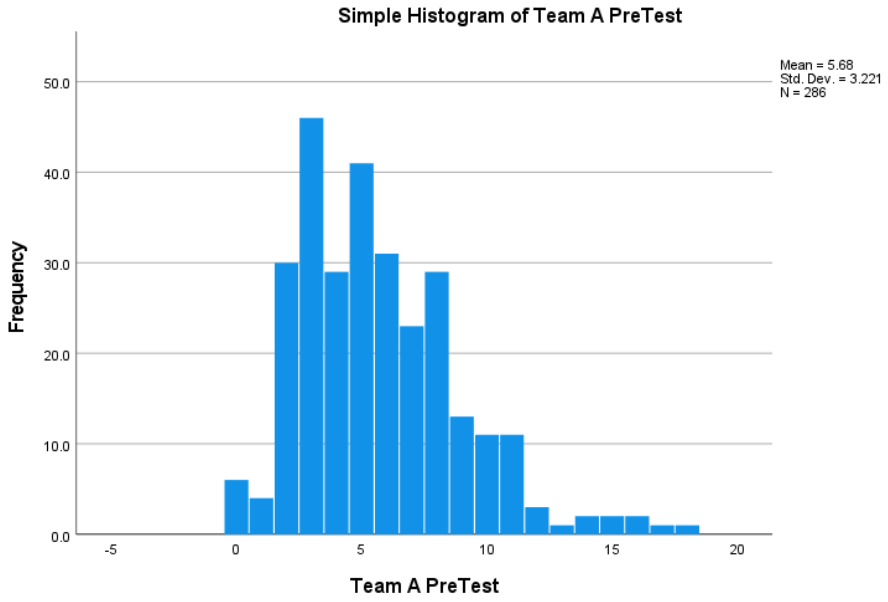

Figure 7. Histogram of pretest scores for Team A.

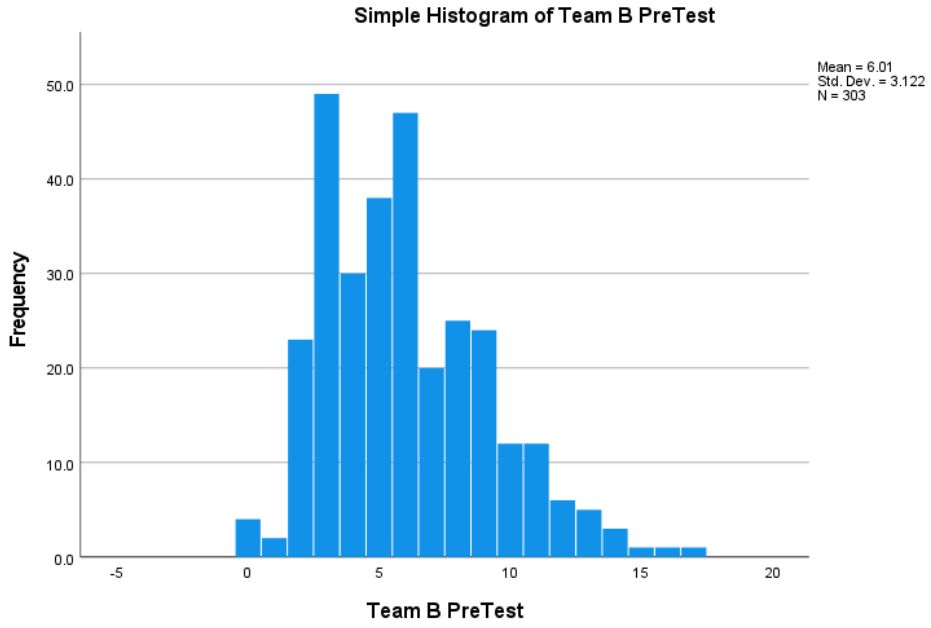

Figure 8. Histogram of pretest scores for Team B.

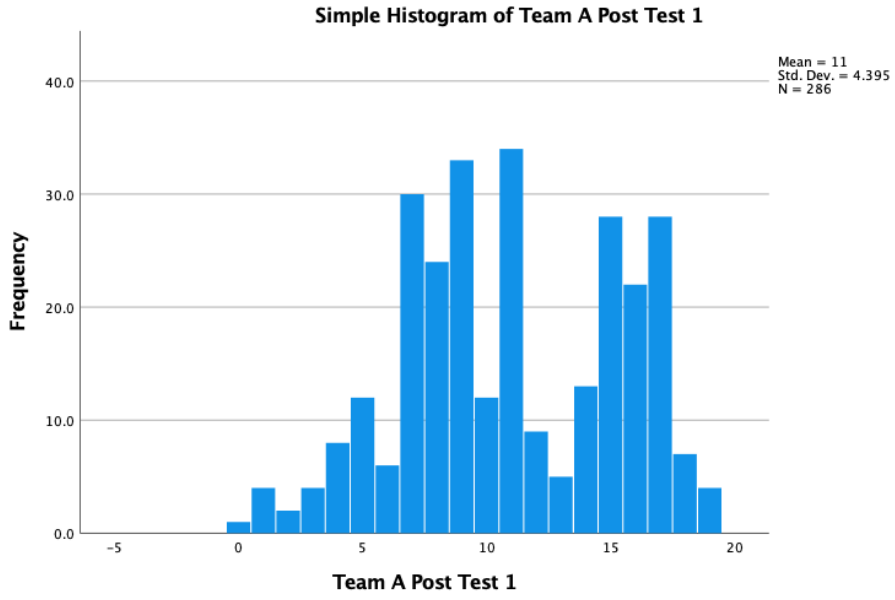

Figure 9. Histogram of Posttest 1 scores for Team A, the treatment group.

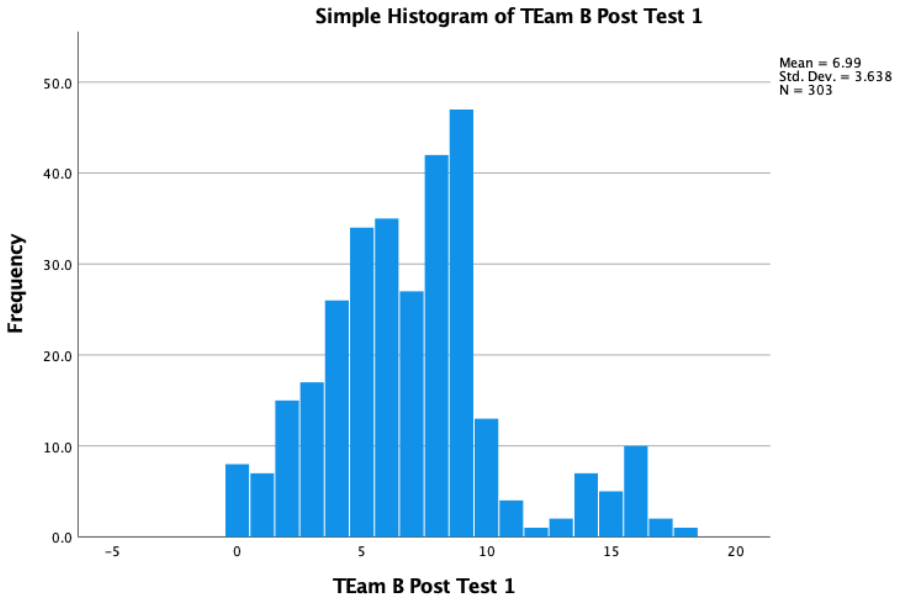

Figure 10. Histogram of Posttest 1 scores for Team B, the control group.

During the second 9-week period, Team B received the intervention. Team A received general instruction, as Team B had during the first 9-week period. Posttest 2 scores for the DSGE at Week 18 are shown for Team A and Team B in Figures 11 and 12, respectively.

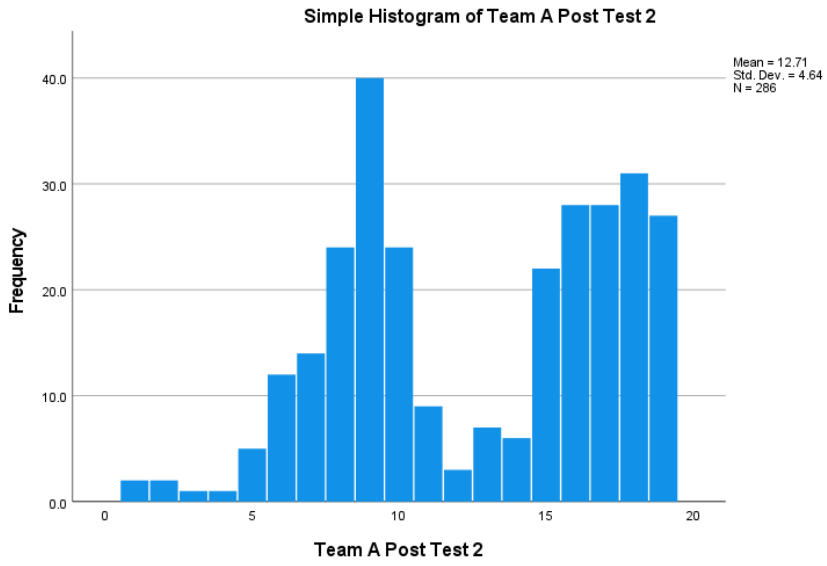

Figure 11. Histogram of Posttest 2 scores for Team A.

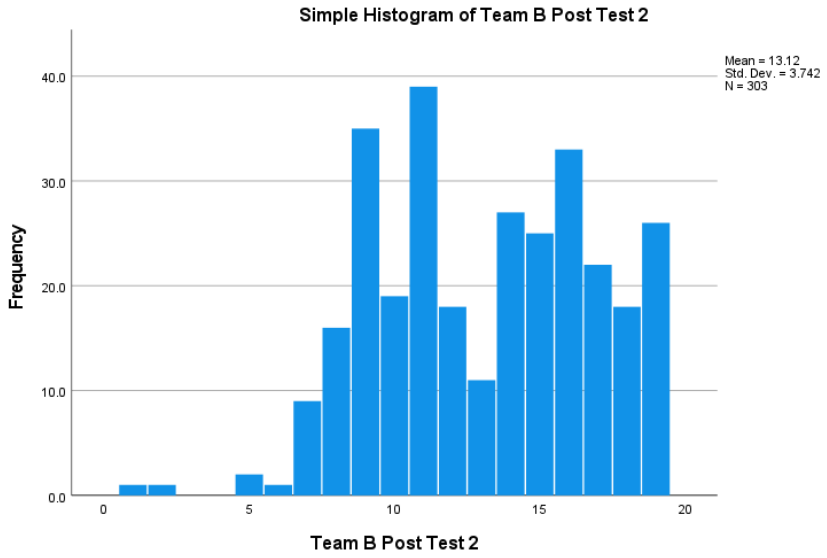

Figure 12. Histogram of Posttest 2 scores for Team B.

Results for Research Question 1

Assumptions. A 3x2 repeated-measures mixed ANOVA was used to determine if there was a statistically significant interaction effect between two independent variables, also known as within-subjects variables, on a continuous dependent variable. In other

words, a 3x2 repeated-measures mixed ANOVA determined if an interaction existed between the three test scores and the two teams. The following are the conditions that should be satisfied for ANOVA analysis.

First, dependent variables for this study were time and test score. Both variables were measured at the continuous level. Two independent variables, or within-subjects factors, also must consist of two or more categorical levels. The within-subjects factor is another name for an independent variable in a repeated-measures mixed ANOVA where the same cases are measured on the same dependent variable on two or more occasions. The within-subjects factors for this study were Team A and Team B.

To carry out an ANOVA, a researcher should show that three more conditions must relate to the nature of the data to provide a valid result. First, there should be no significant outliers in three or more levels of the within-subjects factor. Second, the distribution of the dependent variable in the three or more levels of the within-subjects factor should be approximately normally distributed. Third, the variances of the differences between all combinations of levels of the within-subjects factor must be equal, which is known as the assumption of sphericity.

To address the first assumptions, there were six outliers on the pretest for both Team A and Team B. The studentized residual values for the pretest on Team A were 3.83, 3.52, 3.21, and another value of 3.21. Team B had two residual value outliers at 3.49 and 3.16. These outliers only affect two levels and did not violate this assumption, as outliers have to affect a minimum of three levels (Laerd Statistics, 2017). All outliers were on the pretest for both the experimental group, Team A, and the control group, Team B. Examining the data set revealed no apparent data entry or measurement errors.

All scores fit within the range of scores from 1–20. There was no good reason to reject any as invalid. Also, because outliers were only applicable to the pretest scores and not to either posttest score, the researcher decided to leave the data with the outliers and not change or remove any data points. Faraway (2015) advised that researchers not automatically screen out data that does not fit the model.

To test for normal distribution, the Shapiro-Wilks test for normality was examined. The Shapiro-Wilks statistic was less than .05 ($p > .05$) for all cases. This means that the data were not normally distributed in all cases. This was seen in the histograms in Figures 9–12. Although this was a violation of one of the assumptions, ANOVAs are robust to deviations from normality, especially in cases of large sample size as in this study (Laerd Statistics, 2017).

Figures 7 and 8 depict that scores on the pretest were skewed. Scores were consistently lower for both teams before the intervention occurred; hence scores were lower and more to the right on the histogram. Figures 11 and 12 display a bimodal distribution of scores on Posttest 2 after the intervention had been given to both teams of students. The scores actually moved away from the mean score for both teams. The picture represents that some groups of students maintained low scores and other groups of students maintained high scores.

For all tests, occasions skewness and kurtosis statistics were also reviewed from the descriptive statistics to determine if the location and variability of the data set were normal. Trochim and Donnelly (2006) stated if the skewness and kurtosis values are between +2/-2, then a researcher can accept normal distribution. Based on the statistics in

Table 11, all values met Trochim and Donnelly's (2006) requirements of being within the limits of +2/-2 and could be normally distributed.

Table 11

Skewness and Kurtosis Statistics and Standard Error

		Skewness		Kurtosis	
Test	Team	Statistic	*SE*	Statistic	*SE*
Pretest	A	.936	.144	1.162	.287
	B	.701	.140	0.262	.280
Posttest 1	A	-.097	.144	-0.876	.287
	B	.626	.140	0.596	.280
Posttest 2	A	-.214	.144	-1.206	.287
	B	-.169	.140	-0.738	.280

The pretest histograms showed that the scores were all skewed with student mean scores for Team A (M = 5.68, SD = 3.22) and Team B (M = 6.01, SD = 3.21). Most of the scores are clumped together around the value of 6. For Posttest 1, scores for both Team A (M = 11, SD = 4.40) and Team B (M = 7.16, SD = 3.64) the scores moved in an unanticipated direction and scattered from the mean score of 11. The scores were either clumped below the mean or above the mean. Finally, the Posttest 2 scores for Team A (M = 12.71, SD = 4.64) and Team B (M = 13.12, SD = 3.74) showed the same bimodal movement of the scores away from the mean. This suggested that students developed, but that a group of students stayed below the mean or a group of students continually scored above the mean. This result poses a question for future research that is beyond the scope of this study.

Although the Shapiro-Wilks test showed evidence of a violation of normality, ANOVAs are robust to deviations from normality (Laerd Statistics, 2017). Given the

robustness of ANOVA, the interest in the bimodal aspects of how the data appear in the histograms, as well as the results of skewness and kurtosis analysis, this researcher team chose to move forward with the ANOVA analysis.

The researcher investigated the effects of the within-subjects factors at every level. Tests of within-subjects effects were made for each simple main effect of treatment and time. The within-subjects data did not present information about differences in means between the two treatments.

To test for equal variance, Mauchly's test of sphericity was used. Mauchly's test of sphericity indicated that the assumption of sphericity had been violated for the two-way interaction, $x^2(2) = 567.99$, $p = .000$. Maxwell and Delaney (2004) suggested using the Greenhouse-Geisser correction, especially if the estimated epsilon (Ɛ) is less than 0.75. The data met the assumption of sphericity. Based on the tests of within-subjects effects, there was a statistically significant two-way interaction between treatment and time, $F(1.07, 305.69) = 255.10$, $p < .001$, $Ɛ = .74$.

Levene's test showed that the variances are not equal across the pretest, Posttest 1, and Posttest 2, $F(1, 586) = 40.54$, $p < .05$. The histograms in Figures 7–12 demonstrate that the scores around the mean were different from each team.

Although two assumptions for ANOVA were not met, it is important to understand that due to the robustness of ANOVA, the strong design of the research, the large sample size, the histograms showing a change in skewness from pretest (see Figures 7–12), and the parallelogram that illustrated the change in scores over time (See Figure 13), the research team felt that there was enough strong evidence to continue with the

analysis of the mixed ANOVA. Because of the robustness of the test the violations of assumptions should not affect the overall statistics.

The researcher investigated the effects of the within-subjects factors at every level. Tests of within-subjects effects and pairwise comparisons were made for each simple main effect of treatment and time. The within-subjects effects did not present information about differences in means between the two treatments; therefore, pairwise comparisons were reviewed.

Inferential results. The researcher analyzed preexisting DSGE data to determine whether participation in the intervention increased student scores on the posttest, as compared to the pretest and as compared to a control group. As shown in Table 12, Team A, the treatment group, increased their score on the DSGE creativity screener by 5.32 points, or 93.7%. Team B, the control group, increased their score by 1.15 points, or 19.1%. The scores on Posttest 1 were significantly higher for Team A than for Team B, the control group, $F(1, 285) = 145.457$, $p < .001$, 95% confidence interval [3.34, 4.64], showing the treatment, or participation in the intervention, did have an effect on student scores. Figure 13 presents an interaction between the time and treatment (the two within-subjects factors). The interactions show different patterns, are not parallel, and overlap each other. There might be an interaction effect.

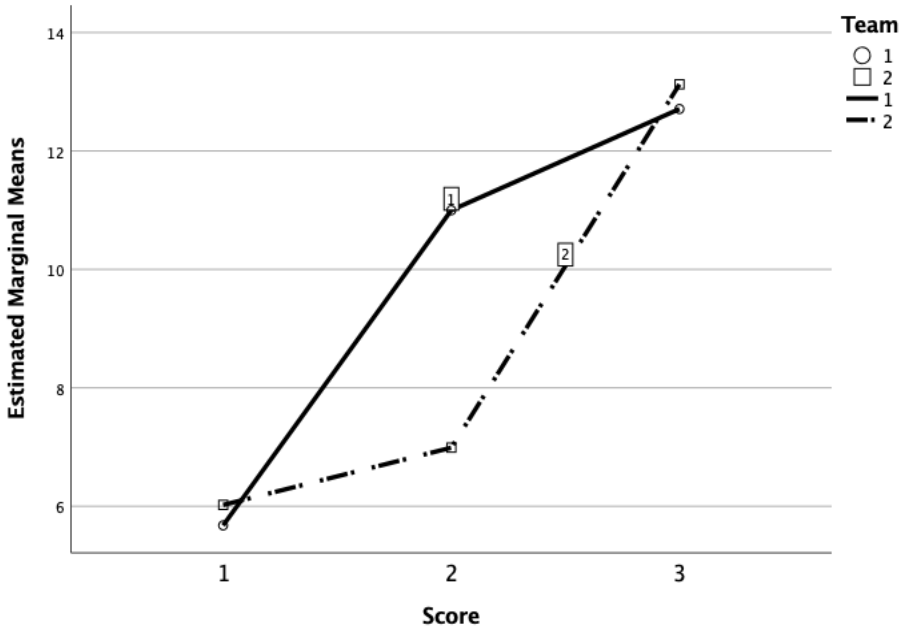

Figure 13. Interaction effect between time and treatment. Team 1 = Team A; Team 2 = Team B

Table 12

Pre- and Posttest Change in Scores by Group

Group	Pretest	Posttest 1	Difference	95% CI
Team A (treatment)	5.68	11.00	5.32***	[4.69, 5.95]
Team B	6.01	7.16	1.15	

Note. Team A received intervention between pretest and Posttest 1. Team B received intervention between Posttest 1 and Posttest 2. CI = confidence interval.
***$p < .001$.

The quadratic relationship that was formed (see Figure 13) suggested that pretest scores were obtained, a treatment was given, and an improvement in scores correlated with the timing of the treatment for Team A. Team B shows a significant improvement that also correlated with the time period of Team B receiving the intervention. This

diagram in Figure 13 showed strong evidence that the intervention did have an effect on student creativity scores.

A 2x3 mixed model ANOVA was completed with team as an independent within-subjects factor and scores of the pretest, Posttest 1, and Posttest 2 as a between-subjects factor. The researcher investigated the effects of the within-subjects factor at every level. Tests of within-subjects effects were made for each simple main effect of treatment and time. The within-subjects effects did not present information about differences in means between the two treatments.

There was a significant interaction between treatment and time on scores, $F(1.824, 519.801) = 121.495$, $p < .001$, $\varepsilon = .912$. Therefore, simple main effects were computed. The analysis revealed a main effect of Team, $F(2, 1172) = 941.116$, $p < .00$, eta squared = .62, and Score * Team, $F(2, 1172) = 120.609$, $p < .01$, eta squared = .17, was significantly different (see Table 13). Thus, there was no significant difference between the two teams along time, that is at pretest, Posttest 1, and Posttest 2 scores.

Table 13

Main Effects of Team

Variable	*df*	*F*	*p*	Partial eta squared
Time	2	941.116	.000	.62
Time * Team	2	120.609	.000	.17
Error (Time)	1172			

Since sphericity was violated, $W(2) = 46.06$, $p < .001$, the Huynh-Feldt correction was used. Eta^2 effect size ($\eta^2 = .62$) for score and for team ($\eta^2 = .17$) indicated that the effect of the interaction between the scores and the teams was substantial. Bakeman

(2005) suggested common guidelines to characterize eta squared (η^2) with zero-order correlations of .1 to .3 as small, those of .3 to .5 as medium, and those .5 and above as large, as Cohen (1988) recommended for repeated measures designs. These results suggest that the team that the students were assigned to did not really matter; however, the time students took the DSGE did matter.

Mean scores were statistically different from Team B (M = 6.01, SD = 3.12) compared to Team A (M = 5.68, SD = 3.22) on the pretest before either group participated in the intervention, $F(1, 286) = 4.93$, $p = .027$, $d = .017$. The mean score of Team A was 0.33 points lower at the beginning of the intervention than Team B's mean score (see Figure 13). Though they were statistically different, the effect size was small. The effect of this intervention for retention of skills (d = .017) was found to be smaller than Cohen's (1988) convention for small effect (d = .20).

Results for Research Question 2

To answer Research Question 2, the research team further analyzed results from tests in Research Question 1 using 2x3 mixed ANOVA analysis to compare Posttest 1 scores with Posttest 2 scores for Team A. Team A Posttest 1 (Week 9) scores on the DSGE in fall of 2019 were compared to Posttest 2 (Week 18) after students in Team A went 9 weeks without receiving the intervention. Further analysis from data on Research Question 1 led to review of pairwise comparison between each time of test. Mean scores were 6.83 points, 95% CI [6.229, 7.432] higher on Posttest 2 from the pretest and 3.692 points, 95% CI 3.269, 4.116] higher from Posttest 1 to Posttest 2. Team A showed a statistically significant increase in scores from Posttest 1 (M = 11, SD = 4.40) to Posttest 2 (M = 12.71, SD = 4.64), 95% confidence interval [1.27, 2.15], $p < .001$. This finding

showed scores continued to improve, suggesting retention of the skills from the intervention.

For further investigation, the researcher ran a two-sample paired *t* test once differences in scores from Team A were calculated and transformed in SPSS. Assumptions were met as scores or dependent variable are continuous and the observations were independent of one another. There were no outliers to report. A Shapiro-Wilks test showed a significant departure from normality, W(286) = .97, $p <$ .001. However, a skewness of -0.38 (*SE* = .14) and kurtosis of .66 (*SE* = .29) were less than +/- 1, and Trochim and Donnelly (2006) stated that values +/- 2 can be accepted as normally distributed.

Students from Team A retained and increased (*M* = 1.86, *SD* = 2.84) points over a 9-week period of no treatment, or not participating in the intervention, *t*(285) = 11.1, $p <$ .001, *d* = .66; CI_{95}: 1.53, 2.19. The effect of this intervention for retention of skills (*d* = .66) was found to be larger than Cohen's (1988) convention for medium effect (*d* = .5). Results are presented in Tables 15–17. The solid line in Figure 13 from Posttest 1 to Posttest 2 also demonstrated continued growth during the timeframe that Team A did not participate in the intervention, but instead participated in media center skills lessons.

Results for Research Question 3

To answer this question, the researcher transformed student scores using SPSS to find the differences in scores following treatment. Team A values were derived from the difference between Posttest 1 and the pretest (Team A = Posttest 1 – Pretest). Team B values were derived from differences in Posttest 2 and Posttest 1 (Team B = Posttest 2 – Posttest 1). The values from each team were merged together, and then an independent-

sample *t* test was conducted with gifted classification being the independent variable and the student growth scores being the dependent variable.

Assumptions. Five assumptions must be met before a *t* test is considered to be accurate and valid. First, data values must be independent. Measurements for one observation do not affect measurements for any other observation. Data in each group must be obtained from a random sample from the population, and data in each group are approximately normally distributed. Data values must be continuous, and finally the variances for the two independent groups are equal. The assumption that the values must be independent and measurements of the two scores do not affect each other is also met because the scores from the first test do not affect the scores from the test after the intervention. The independent variable is two categories of students, which were gifted-identified and non-gifted-identified students from both teams. Three outliers were observed, and, upon further inspection, it was noticed that students decreased significantly in scores and were from both teams. Due to the large sample size and the fact that the students were from both teams, it was decided to continue with the test.

A Shapiro-Wilks test showed a significant departure from normality, $W(589) = .98$, $p < .001$. Skewness and kurtosis showed values very close to zero, where zero is a perfect distribution. Differences in values were nonnormally distributed with a skewness of .22 ($SE = .10$) and kurtosis of .14 ($SE = .20$), but since the values were so small and so close the zero, the distribution was accepted. Also, according to Trochim and Donnelly (2006), since the values were between +/- 2 , normal distribution was accepted. Levene's test indicated unequal variances, $F = 12.35$, $p < .001$, so degrees of freedom were adjusted from 587 to 185.68.

Inferential results. Values were 3.25 points higher for gifted-identified students ($M = 8.26$, $SD = 4.8$, $N = 133$) than for non-gifted-identified students ($M = 5.01$, $SD = 3.92$, $N = 456$), $t(185.68) = 7.97$, $p < .001$, $d = .80$. The effect size for this analysis ($d = .80$) was found to be equal to Cohen's (1988) convention for a large effect ($d = .80$). Table 14 shows the numbers of gifted-identified and non-gifted-identified students in both groups, Team A and Team B, as well as mean scores and standard deviations.

Table 14

Descriptive Statistics for Change in Scores After Intervention, by Gifted-Identified Status

Student status	*N*	Mean growth	*SD*	*SE* Mean
Gifted identified	133	8.26	4.83	.419
Not gifted identified	456	5.01	3.92	.184

These results suggested that scores increased for all students after completion of intervention. Although gifted-identified students had a significantly higher mean, the amount of growth in scores for non-gifted-identified students is noticeable (see Figure 14). The histogram in Figure 14 indicates that there were students not identified as gifted who grew more than others in their creativity development. Identifying these students is beyond the scope of this study.

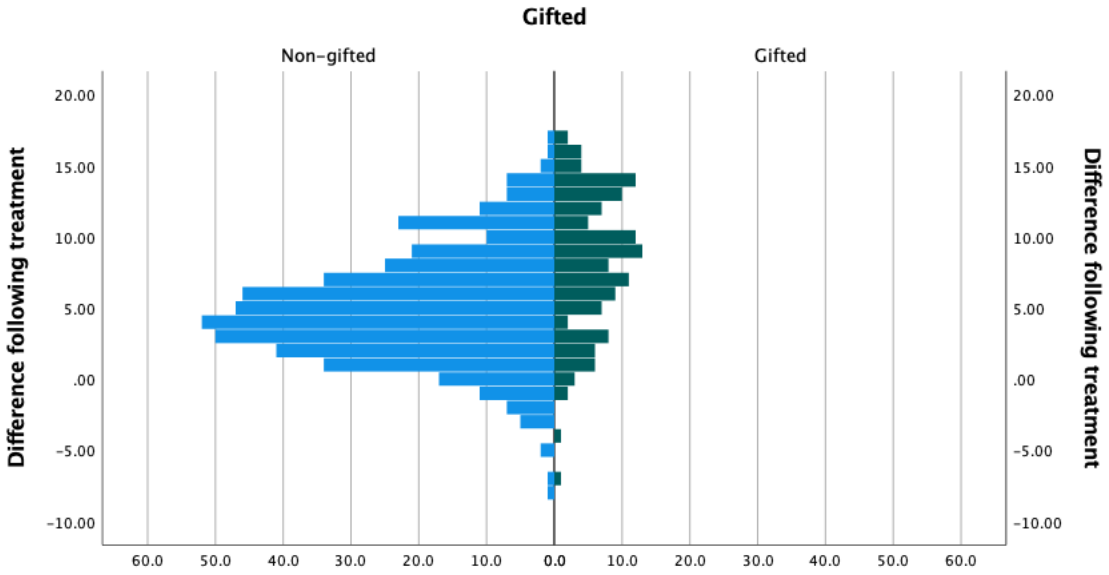

Figure 14. Histogram of increase in creativity score after treatment, by gifted-identified status.

Summary

In conclusion, the data analysis revealed unanticipated results and introduced more questions for future research. Violations of assumptions led to deeper investigation for normality and sphericity. The researcher justified the use of the ANOVA due to the quadratic relationship that was shown, the large sample size, and the distribution of the scores. Research Question 1 determined the impact that the creativity development intervention had on elementary students' creativity performance, specifically in fluency, flexibility, originality, and elaboration skills. A large effect was determined. Figure 13 shows the significant improvement was found in Posttest 1 between Teams A and B. Posttest 2 shows that all students improved from the pretest.

Tests of between-subject effects showed that over time, one team did have an effect greater than the other based on average change over all three testing periods. The interaction for Score * Team was so large that one can conclude both teams did improve. Team B started a little above Team A on pretest mean but also scored a little above the mean of Team A in Posttest 2. Both teams changed at different times, and the times correlated with intervention completion. The data also suggested that it did not matter which team a student participated in because both teams made about the same growth, just at different times.

Research Question 2 determined whether students were able to retain the skills from the creativity development intervention to build fluency, flexibility, originality, and elaboration after not participating in the intervention for 9 weeks. Evidence showed that students in Team A, the first intervention group, retained and improved skills after not participating in the intervention for 9 weeks. Specifically, Team A showed a statistically significant increase in scores from Posttest 1 to Posttest 2, during the 9 weeks following the completion of the intervention.

The third and final research question determined the extent of the effect of the creativity development intervention on fluency, flexibility, originality, and elaboration when moderated by gifted-identified and non-gifted-identified status of elementary students. The researcher ran an independent-samples *t* test to determine the differences in creativity rubric scores at pretest and Posttest 1 at Week 9, as well as Posttest 2 at Week 18. Results of the *t* test showed that gifted students showed greater improvement, but all students improved in creativity development following the intervention.

In conclusion, the creativity development intervention positively impacted students' creativity scores on the screener. Further, gifted and non-gifted-identified students improved. Discussion of the findings are in the next chapter.

CHAPTER V

DISCUSSION

The purpose of this quantitative study was to determine if the creativity development intervention implemented into curriculum at one elementary school improved four components of divergent thinking skills which are fluency, flexibility, originality, and elaboration. This chapter includes a discussion of major findings as related to the literature on creativity development for all elementary learners and the implications that may be valuable for use by legislators, educational leaders, teachers, and parents. Also included is a discussion on the connections to this study and educational policy, equity, and training. The chapter concludes with a discussion of the limitations of the study, areas for future research, and a conclusion.

To focus this research, three questions were posed. Research Question 1 was the main, overarching research question for the study.

1. How does the creativity development intervention impact elementary students' creativity performance, specifically in fluency, flexibility, originality, and elaboration skills?
2. To what extent are the students able to retain the skills from the creativity development intervention on fluency, flexibility, originality, and elaboration after not participating in the intervention for 9 weeks?

3. To what extent is the effect of the creativity development intervention on fluency, flexibility, originality, and elaboration moderated by gifted-identified and non-gifted-identified status of elementary students?

Research Question 1 compared scores from Team A (treatment) to Team B (control). Posttest scores were then compared to pretest scores. The results of the comparison between the two teams showed scores were significantly higher for the treatment group, Team A, which showed that participation in the intervention did have a positive effect on students. Both groups, Team A and Team B, showed improvement from pretest to post test. Figure 13 shows a relationship that correlates score improvements to the times each team participated in the intervention. These results indicate that it did not matter to which team a student was assigned, both teams improved with the intervention.

Retention of skills was observed in the results to Research Question 2. A deeper look at the results of the mixed ANOVA reveals that Team A mean scores were 6.83 points higher on the Posttest 2 from pretest and 3.69 point higher from Posttest 1 to Posttest 2. Team A did not participate in the intervention activities between Posttest 1 and Posttest 2. Team A participated in media center skills such as literature appreciation and digital citizenship lessons. Further investigation with a two-sample paired *t* test showed that Team A retained and increased over a 9-week period of no treatment. Team B also increased minimally when they did not participate in the intervention. Figure 13 demonstrated this. This suggests further research is needed to determine how students' scores improved even when they did not participate in the intervention.

Research Question 3 determined the extent of the effect on gifted- and non-gifted-identified students. An independent sample *t* test compared the means of growth scores. The results revealed that gifted students scores were 3 points higher than the non-gifted-identified students. However, the amount of growth in scores for the non-gifted-identified students is noticeable. The gifted students began with an advantage much like tall basketball players have an advantage over short ones. It is easier for taller basketball players to score points, just as it is easier for students already identified as creative thinkers who have been taught using strategies for creative thinking. Non-gifted-identified students have not necessarily been taught in the same creative ways. One suggestion for further research is to determine the students that grew and how their instruction in the regular or general education classroom differed. Is the commonality in the students score increases due to a specific teacher or teaching strategy utilized in a specific classroom? Another question that is raised: Are gifted identification procedures truly effective? According to these results, several students might have been overlooked.

Creativity for All

One major consistent answer from all three research questions is that creativity improved for the total population. Students improved after the intervention and retained or improved scores even after they did not participate in the intervention. Both gifted and non-gifted-identified students improved overall as well. Although the gifted students had an advantage over the non-gifted-identified students and scored higher, the non-identified students had many students that showed growth (see Figure 14).

The intervention lessons were strategically planned to include a three-element framework to enhance divergent thinking skills by teaching actual skills in fluency,

flexibility, originality, and elaboration. Lessons included explicit teaching for creative skills, time for students to creatively learn through exploration of concepts that interested them, and also creative teaching from a highly enthusiastic teacher willing to try new things. The conceptual framework was creative pedagogy, the idea that creativity can be developed (Torrance, 1963) and all individuals have the potential to be creative (Craft, 2001; Fryer, 1996; Lin, 2011). Research from Boaler (2002) and Renzulli and Renzulli (2010) and around the world, from Finland to China, has supported teaching creativity. Findings of this study support that allowing teaching methods of creativity to flourish will support students' creative thinking and promote higher achievement.

Boaler (2002) investigated how students encountered math and how different students understood math based on a different pedagogy and different atmosphere. In Boaler's (2002) study, students at high and low achievement levels scored higher than students at similar levels taught with the traditional teaching methods using textbooks and rigid teaching methods. Renzulli and Reiss (2000) stated that multiple studies on a schoolwide enrichment model suggest that the model is effective in serving not only high-ability students, but also diverse ethnic, socioeconomic populations in a variety of educational settings. These same studies also reported a positive effect on students with learning disabilities and low achievement scores. The school that participated in this study worked hard to carve time in the master schedule to allow every child the opportunity to develop creative thinking skills. Findings in the current study showed the creativity development intervention was effective among gifted-identified as well as non-gifted-identified students. Findings suggest a positive result in providing more time to

support creative thinking, creative learning, and creative teaching. Maybe teachers need to give students less time of remediation and more time of enrichment.

Limitations of the Study

Along with benefits and contributions of this research come several limitations. Limitations to generalizability that arose from conducting this study included the assessment of only one area of creativity. A figural assessment developed from one district to gain a snapshot of student thinking skills was used. Runco (2004) stated that creativity transcends to a vast array of characteristics such as innovation, openness, self-expression, curiosity, originality, and flexibility. Plucker and Renzulli (1999) as well as Sternberg (1990) and Gardner (1983) advocated that learners have multiple gifts. Therefore, students can be creative in other ways that were not necessarily measured by the figural assessment.

The rubric used to score the assessment is limited to the district. The rubric was created by the school system gifted and talented department specifically for use within the school system. It was designed to be a shorter, easy to grade, version of the Torrance Test of Creative Thinking (TTCT). The rubric was much shorter that the TTCT streamline scoring procedure and designed to gain a quick snapshot of student creative performance. Scorers had to grade thousands of assessments; therefore, they were specifically trained to look for specific items on the rubric and compute composite scores. Composite scores are supported by literature since the components overlap each other in thinking processes. Specific training was limited to teachers that had participated in the Torrance Scoring training at the Torrance Center for Creativity, University of Georgia.

These teachers were then trained for the shorter version from district leaders using the scoring rubric (see Appendix A).

The duration of time used in this study is another limitation. This study was limited to only one semester period of 18 weeks. The study was also limited by a sample from a single elementary school.

Another limitation was the students develop a learning effect or practice effects where they learn how to do better on the test through taking it multiple times. The students could have become familiar with test items and could do better out of habit. Students also can become desensitized from the stress of performing well. Steps were taken by the researcher to make the activities varied enough so as to not repeat the same tasks and game-like enough to not be stressful for the students.

Recommendations for Future Research

Researchers such as Zhao (2015) and Miller et al. (2011) have endorsed creativity as an important aspect for a student's future. However, creativity scores of U.S. children in kindergarten through sixth grade have declined since the 1990s (Bronson & Merryman, 2010). Bronson and Merryman (2010) also stated that existing school curricula do not foster environments conducive to supporting children's creativity development in the early 21st century. Bronson and Merryman reported the correlation between lifetime creative accomplishments was more than 3 times stronger for childhood creativity than childhood IQ. However, knowing how important creativity is for a student's future, studies are scarce on creativity development and all students—the entire student population, not just the students served in the gifted and talented program. To date, most of the research in creativity has included gifted students and adults as

participants. Research also has included very young students and the amount of play and imagination. Research on creativity in educational settings should include diverse learners to provide the highest quality instruction to the greatest number of students.

Zhao (2015) and Miller et al. (2011) also determined that creativity can be nurtured and developed through education and training. Huitt (2007) stated that schools provide the best opportunity for students to get what they need. Since creativity has been described as one of the most important economic resources of the 21st century (P21, 2019), and lifetime accomplishments are stronger for creativity than IQ (Bronson & Merryman, 2010), this study examined how participation in a creativity intervention practicing divergent thinking skills improved student skills in fluency, flexibility, originality and elaboration.

The present research on creativity development yielded several directions for future research. First, a study using qualitative research could be used to determine the reason for the bimodal distribution of scores. Interviews with students and teachers could be given with questions that focus on determining student performance. The cause could be cognitive differences in the group, different exceptionalities, or a teacher effect. Another study could be a longitudinal study to determine if indicated gains of the experimental group can be sustained over years, even into adulthood. It would be beneficial if yet another study could incorporate the problems associated with the study of creativity that educators need to be aware of, such as definitions and measurement of creativity and creative development in an academic setting.

The insights gained from this study could help organize a curriculum framework that could include creativity development in the academic setting and could maximize

children's creative potential. Determining the instruction in creativity within the content areas such as math, science, and social studies would be another important study. Does promoting creativity development in the content areas promote achievement in these content areas in a similar way? Two studies from the literature (Gajda et al., 2018; Nami et al., 2014) suggested a strong correlation between creativity, intelligence, and achievement. Would promoting a creative pedagogy of utilize creative teaching and creative learning increase student achievement in content areas, and would intelligence or IQ increase as well?

The results from this current study showed that an increase in creativity even weeks after the intervention. Future studies could be qualitative in nature to determine if students receive creative teaching and learning opportunities in the general education setting. Interviews from teachers and examination of educational teaching standards as well as possible observations of teaching strategies used and compared to divergent thinking skills could prove to be beneficial for future development of creativity.

Further studies on how the intervention affected student motivation would also be useful. Does allowing creative learning opportunities promote student engagement and motivation to perform well in school? These studies would test the development of creativity in students in all four areas of eligibility for gifted education that the state of Georgia uses to place students in the gifted and talented program: creativity along with motivation, achievement, and mental ability (Georgia Department of Education, 2018). Testing developing creativity in all students in four areas of eligibility could prove that the gifted and talented program could just be a point on a timeline from the history of

creativity as practitioners and researchers evolve and learn more about creativity in education.

It is highly recommended from this research study that the school district needs to establish validity and reliability of the DSGE instrument if the district plans to continue the use of this measurement in making programming decisions. Further research should examine the validity and reliability of the DSGE among diverse student populations.

Implications of the Study

This study has potential for playing an important role in education reform. Education policies and practices could change to create a successful future for the 21st-century learner.

Implications for educational policy. The first implication from this study for the field of education is the importance to make research-based decisions before making changes in any practice. Findings from this study support that intentional incorporation of divergent thinking skills should be implemented within curriculum and daily instruction for elementary students. Training for educational leaders, teachers, and preservice teachers should be provided so all staff can develop awareness and productive thinking strategies.

Torrance (1974) stated that creativity is a strong predictor for future achievement. For students to be successful in the future, all students should receive instruction to support creative thinking. The data from this study support that all students can learn divergent thinking skills, and creative instruction should not be restricted to the students who qualify for gifted education. All students deserve the best instruction to help them for their future, and without explicit attention to creativity, their scores may lag behind

others. Past studies (Kim, 2006; Renzulli, 2002; Runco, 1993) supported that students considered at risk, economically disadvantaged, and culturally diverse benefit from creativity development. Demographic information and findings from this study indicate that all students can learn divergent thinking skills.

Implications for educational practice. Educational leaders need to foster and allow creative teaching methods. As the literature suggested, the definition of creativity is continually evolving. Leaders should pick a definition and build a consistent understanding of creativity within the building or even system. Then educators have a consistent understanding of what creativity is and begin working towards showing improvement in creative learning. The definition would be expected to evolve as both the students and teachers learn and grow creatively.

School leaders must build an environment that will allow teachers to practice fluency, flexibility, originality, and elaboration in their teaching and professional learning endeavors. Teachers can then create the same environment to their individual classrooms throughout the building to promote the same components in all content areas that they teach.

The literature in Chapter 2 aligned specific research-based teaching strategies to enhance the four different components of divergent thinking. A few examples include allowing students to brainstorm ideas often (Aiamy & Haghani, 2012; Al Masri, 2019) to build skills in fluency. Sellars (2011) studied students who had choice and ownership in their learning practices and found significant improvements in students' flexible thinking skills. Thomson et al. (2016) and Spiro et al. (1988) found that thinking in different perspectives developed increased flexibility in thinking as well. Grant (2016) suggested

teaching in conditional terms instead of absolutes, teaching values instead of rules, and using jigsaw activities in classrooms to develop students' original thinking skills. Shively (2011) stated that elaboration skills take learning to the highest level and offered suggestions to build elaboration skills in content areas from writing to science. Ritchie and Karge (1996) claimed that the elaboration process is key for recall of information and long-term retention. One example of a teaching strategy suggested by Ritchie and Karge (1996) to build elaboration skills was making analogies to help students elaborate more.

The literature supported that the goals of education, from basic recall of facts or skills to long-term transfer of facts or skills, are supported while students practice thinking creatively. Creativity development is not another item on the list to teach but should be respected and incorporated into everyday teaching of all domains and content.

This study supports the findings of a previous study by Field (2009) on the Renzulli Learning system that that all students benefited from the system, not just the gifted learners. This study shows that all students benefited from divergent thinking skills, not just gifted students. Also, because the skills continued to increase, students continued to use the skills they were taught even outside of the intervention setting. Students should be given time for enrichment activities such as the ones given in the 9-week intervention and should have the opportunities to be taught by teachers trained in instruction for gifted learners.

School leaders concerned about state test scores and state laws of accountability may use information from this study to stimulate growth in student cognitive processes or thinking skills necessary to do well on academic work. This study utilized programs that were already available by the school. Legislators, schools leaders, and parents can build

on the information given in this study to help develop or implement fun interventions and training programs to incorporate creative development within the school curriculum. The entire educational constituency can collaborate and implement initiatives to help all children attain new levels of creativity development to help all children be successful in the 21st century. The successful implementation of such initiatives may provide children a strong foundation for a successful life beyond the classroom and a chance to be more effective contributors to society in the future.

Conclusion

Guilford (1975) pointed out, "Knowledge as an outcome of education is no longer enough" (p. 37). This is a powerful and insightful statement made 46 years ago. Guilford's realization seems consistent with findings from the present study, which indicated that a 9-week intervention could teach creative skills and show student improvement in creativity. The students in the treatment group in this study were a diverse group: 49.3% students of color, 21.3% gifted, 21.3% with disabilities, and 18.2% English language learners. Although results were not disaggregated by background, the student mean scores on a creativity assessment increased.

Standards and accountability have taken creativity away from schools (Baer, 2015). Creativity should not be seen as a barrier for meeting standards but as a way to cultivate deeper understanding of concepts by using divergent processes as well as convergent. Zhao (2015) acknowledged that a shift must occur from the teaching of skills and knowledge to incorporating more development of a child's potential for the 21st century. Gajda et al. (2017) found a positive relationship between creativity and academic achievement. Wallach and Kogan (1965) offered scientific evidence that one can be

creative and intelligent and have high academic achievement, yet high intelligence and high academic achievement does not mean an individual is creative. The main purpose of educators is to prepare students for life and opportunities beyond school. So why is there so little focus on creativity? The time for a shift in teaching and learning is now. National, state, and local emphasis should be placed on developing children's creative potential as well as their academic potential. All students deserve opportunities to develop to their highest potential.

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APPENDICES

Appendix A

The CSR

Drawing Rubric	
No picture	0 points
Simple drawing with 0 – 5 details	2 point
Drawing with 6 – 10 details	4 points
Drawing with 11 – 15 details	6 points
Very detailed drawing with 15 or more details	8 points
Title Rubric	
Nothing written or a one-word label	0 points
Words/Phrases about their drawing	1 point
Descriptive title explaining their drawing	2 points
Descriptive (fresh, original, unexpected, etc.) title explaining their drawing	3 points
Creativity Additional Points Each of these gives the student **1 additional point**	
Storytelling	Does the drawing tell a story?
Emotional Expressiveness	Does the drawing contain emotion or expression?
Movement or Action	Does the drawing show movement or action?
Unusual Visualization	Are you looking at the drawing from above, below, very close up or far away?
Internal Visualization	Are you seeing the inside of something in the drawing?
Fantasy	Does the drawing contain fantasy? Witches, dragons, magic wands, etc.
Humor	Does the drawing contain something silly or funny?
Richness	Does the drawing involve the senses?
Colorfulness	Is the drawing unusual or vivid? It sticks with you even after you move on?

Appendix B

Institutional Review Board Approval

From: irb <irb@columbusstate.edu>
Date: Wed, Oct 7, 2020 at 1:43 PM
Subject: IRB Application Protocol 21-011 Conditional Approval
To: Rose Ellis [Student] <ellis_rose@columbusstate.edu>, Basil Conway <conway_basil@columbusstate.edu>
Cc: CSU IRB <irb@columbusstate.edu>, Institutional Review Board <instituional_review@columbusstate.edu>

Institutional Review Board

Columbus State University

Date: 10/07/2020

Protocol Number: 21-011

Protocol Title: A Quasi-Experimental Study on Creativity Development

Principal Investigator: Rose Ellis Campbell

Co-Principal Investigator: Basil Conway

Dear Rose Ellis Campbell,

The Columbus State University Institutional Review Board or representative(s) has reviewed your research proposal identified above. It has been determined that the project is classified as exempt under 45 CFR 46.101(b) of the federal regulations. Conditional approval is granted pending the approval from the listed outside performance site(s).

Please note any changes to the protocol must be submitted in writing to the IRB before implementing the change(s). Any adverse events, unexpected problems, and/or incidents that involve risks to participants and/or others must be reported to the Institutional Review Board at irb@columbusstate.edu or (706) 507-8634.

If you have further questions, please feel free to contact the IRB.

Sincerely,

Andrew Dorbu, Graduate Assistant

Institutional Review Board
Columbus State University

Appendix C

Sample Figural Pretest

Grade 5
Pre Test

Creativity 3 CSM
Nonverbal 5

Student Nam A 105 _____
(first) (last)

Look at the shape below. Imagine what it could be turned into. Draw your idea. Use this shape as part of your drawing. Make up a title for your drawing.

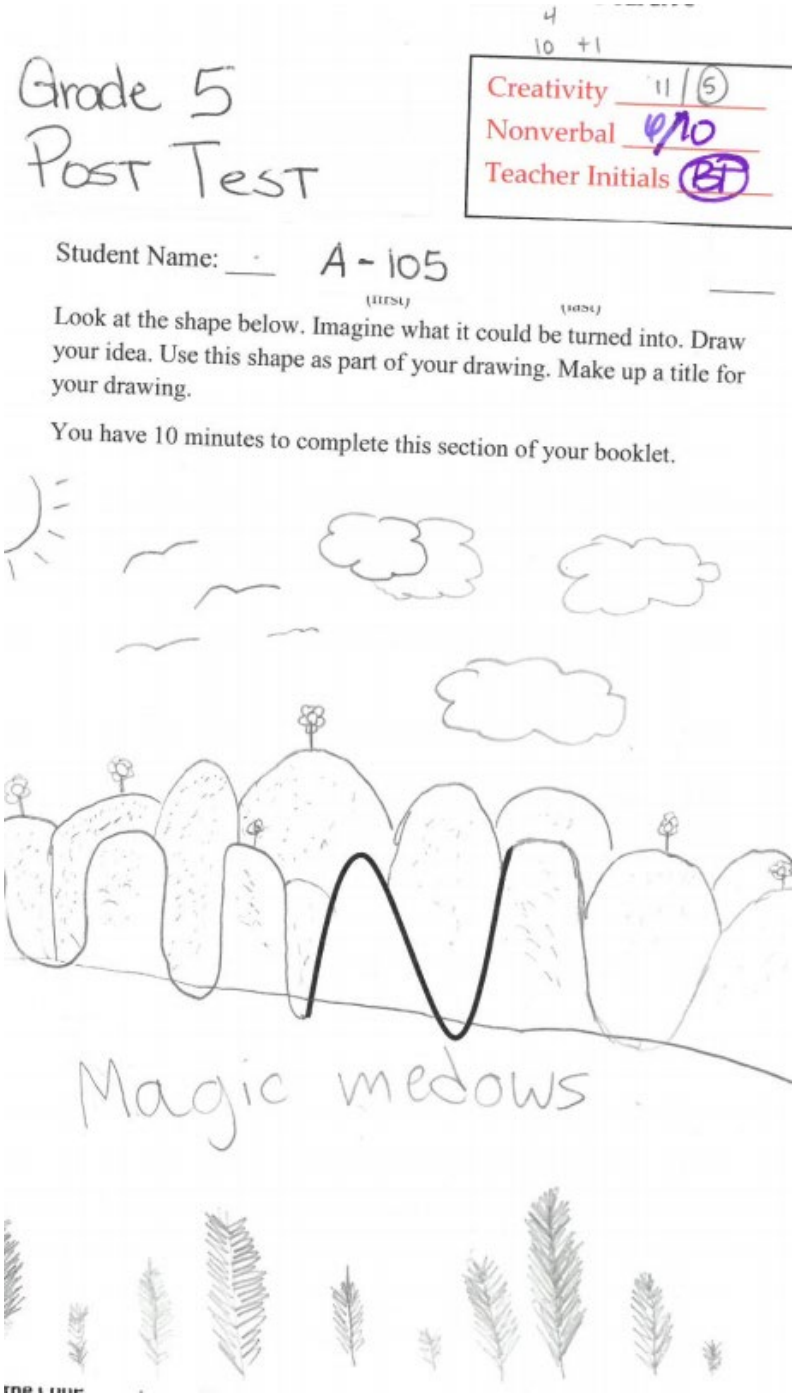
You have 10 minutes to complete this section of your booklet.

D=2
T=1
B=0
3

Triangle

Appendix D

Sample Figural Posttest



Appendix E

Creativity Development Intervention Schedule

Week	Activity 1 (5–10 min)	Activity 2 (5–10 min)	Activity 3 (5–10 min)	Activity 4 (30 min)
1	Introduce procedures for project-based learning (PBL)			Interest Survey
2	Instruction on fluency: PowerPoint (PT) Slides 1–3	Figural Drawing 1	How many uses can you name in 2 min about this paper clip? (Remove ideas that are repeated.)	PBL: Choice Board. Students choose a topic of their interest to read about, research, & complete Choice Board of 6 out of 12 activities.
3	Instruction on fluency: PPT Slides 4–6	Figural Drawing 2	How many uses: toothbrush	
4	Explicit instruction on flexible thinking: PPT Slides 7–9	Figural Drawing 3	How many uses: various items in box, student chooses one.	
5	Instruction on flexible thinking: PPT Slide 10	Figural Drawing 4		
6	Instruction on originality & elaboration: PPT Slides 11–14	Figural Drawing 5		
7	Instruction on originality & elaboration: PPT Slide 15	Figural Drawing 6		
8	Review of PPT slides	Figural Drawing 7	Presentations of PBL to class	
9	Complete presentations of PBL projects to class			