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# **Dissertation**

**Presented in Partial Fulfillment of the  
Requirements for the Degree of Doctor of Philosophy**

**RELATIONSHIP AMONG DEMOGRAPHIC, ACADEMIC, AND  
CURRICULUM CHARACTERISTICS, EMPHASIZING ARTS EDUCATION,  
AND CRITICAL THINKING PERFORMANCE IN 12<sup>TH</sup>  
GRADE HIGH SCHOOL STUDENTS**

**By**

**Leslie Rowntree Black**

**Lynn University**

**2012**



Order Number: \_\_\_\_\_

**RELATIONSHIP AMONG DEMOGRAPHIC, ACADEMIC, AND  
CURRICULUM CHARACTERISTICS, EMPHASIZING ARTS EDUCATION,  
AND CRITICAL THINKING IN 12<sup>TH</sup> GRADE HIGH SCHOOL STUDENTS**

**Leslie Rowntree Black, Ph.D.**

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## ACKNOWLEDGMENTS

I cannot begin to express my gratitude to the individuals who have contributed to making this dissertation come to fruition. Of course, my thanks are extended to my dissertation committee: Dr. Ann Crawford, Dr. Debra Ainbinder, and Dr. Maureen Goldstein. I must also acknowledge two professors at Lynn University, Dr. Joan Scialli and Dr. Valerie Storey, who provided me with so much valuable input. Not to be excluded is Teddy, from the Ph.D. department, who always not only knew everything about the dissertation process, but also steadfastly guided me through it all.

I would like to dedicate this dissertation to my mother who did not live to see it happen. However, she was the one who instilled in me a robust sense of inquisitiveness for exploring answers to my many questions and a strong commitment to life-long learning. I would like to thank my beautiful and brilliant daughter, Kristina, who lent a hand in this arduous project in every way that she could. I am so blessed to have so many genuinely good friends who were my ring of dolphins, together buoying me up and rescuing me from the depths of possible failure, as this was always an impossibility in their minds. My dear friend Tom served as my colleague-in-arms, mentor, coach, and sometimes mental health counselor. Joyce lent her “eagle eyes” to proof-reading. To my other friends who formed this safety net of support, Kathe, Becky, Lesley, David and Bill, I will be forever indebted.

I survived many challenges in completing this aspiration of writing a study that would perhaps inform educational policy-makers about the importance of arts education, a subject dear to my heart. I would say in hindsight that the breaks in the process proved

to be as important as the times of continuity, thus allowing for time for thought and reflection and ultimately increasing my resolve to complete the journey – and it has been a grand one. This work adds to the legions of evidence for the incontrovertible fact that anyone can accomplish a goal if they continue to *believe* that they can attain that goal.

In a time of emphasis on high-stakes testing and the subsequent marginalization of the arts in the curriculum throughout the United States, I believe that this stands as a timely study. I am proud to have produced it and I am committed to being an advocate for arts education. Perhaps we will reach a time when the arts no longer must justify their place in schools.

*“The arts are fundamental resources through which the world is viewed, meaning is created, and the mind is developed.”*

*Elliot Eisner*

## ABSTRACT

# RELATIONSHIP AMONG DEMOGRAPHIC, ACADEMIC, AND CURRICULUM CHARACTERISTICS, EMPHASIZING ARTS EDUCATION, AND CRITICAL THINKING IN 12<sup>TH</sup> GRADE HIGH SCHOOL STUDENTS

By Leslie Rowntree Black

Dissertation Chair: Dr. Ann Crawford

The ability to think critically is an important condition for success in school and life. Promoting the development of critical thinking skills through arts education would have an impact on curriculum development, specifically the utilization of study in the arts as a learning strategy and the revisiting of the purpose of arts education. Arts education has the unique capacity to teach children to think creatively, imaginatively, and critically, while also benefiting subject-specific curriculum (Deasy, 2002).

Eisner (2005) asserts that the arts are as essential to students' intellectual development as study in mathematics or the sciences. The purpose of this non-experimental, exploratory (comparative), and explanatory (correlational) secondary research study was to investigate the relationships among student demographic characteristics, curriculum characteristics, : iv characteristics, and critical thinking as measured by performance on the Florida Comprehensive Achievement Test (FCAT) for Broward County 12<sup>th</sup> grade students. Secondary analysis of data previously collected by the researcher was used for answering the research questions and testing the hypotheses presented in the study.

The study is significant in that exploration of the topic may provide implications for reform in curriculum design to better focus on the promotion of students' acquisition

of essential skills for success in school and subsequently in the workplace, such as critical thinking. “In an educational system strapped for money and increasingly ruled by standardized tests, arts courses can seem almost a needless extravagance, and the arts are being cut back at schools across the nation” (Winner & Hetland, 2008, p. 1). As a result of the current emergence of technological advances and globalization, the need for students’ ability to acquire critical thinking skills in order to prepare for success in the workforce is not only observed in the United States but has global implications, as well (Hartman, Bentley, Richards, & Krebs, 2005).

Six research questions and three hypotheses were generated for this study about the relationships among student demographic characteristics, curriculum characteristics, academic characteristics, and critical thinking performance. These are based on the key gaps in the literature, the recommendations of this study, and the theoretical framework that was used to guide this study.

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## CHAPTER I

### INTRODUCTION TO THE STUDY

#### **Introduction and Background to the Problem**

One of the foremost responsibilities of the American educational system is to prepare students for success as valuable members of society and the workforce upon exit from K-12 public school. The business of education, at its elemental core, is about the continual preparation of students to ultimately become productive citizens. An issue of recent concern is that the young people currently being trained for this venture are expected to enter a workplace that requires not only basic skills, but superior cognitive abilities necessary to survive in a global work environment, one that is dependent on a worker's ability to think critically (Hartman, Bentley, Richards & Krebs, 2005).

“The careful appraisal of critical thinking should be an extremely important endeavor in our society, one worthy of a great deal of careful research adequately backed by financial support. As our world becomes increasingly complex and technical, the need for individuals with this capability will surely expand. Indeed, the development and identification of this characteristic could become the central focus of education and employee selection” (van Gelder, 2000, p. 7).

Actually, even as early as 1961, the Educational Policies Commission of the National Education Association (NEA) and the American Association of School Administrators (AASA) jointly asserted that the central purpose of American education is to create thinking individuals, and furthermore, this objective was worthy of being the highest priority of the school (Smith, 2005, p. 49).

Lampert (2006) contends that multiple findings in the research literature relating to critical thinking and its development through formal education show that an inquiry-based curriculum positively influences gains in critical thinking. Research conducted with respect to arts education (visual arts, music, and drama) determines that learning in the arts is largely inquiry-based (Murfee, 1996). Hence, research indicates that exposure to learning in the arts positively influences students' dispositions to think critically (Lampert, 2006, abstract, para. 1). Eisner (2005) asserts that the arts are as essential to students' intellectual development as study in mathematics or the sciences.

For centuries, scholars have contemplated the idea of critical thinking based upon a concern for an adequately educated citizenry and a quality workforce. Socrates wrote extensively on acquiring this kind of thinking capability over 2000 years ago. However, the American educational psychologist, John Dewey, is generally regarded as the father of the modern critical thinking conventions. Dewey contended that learning to think is the fundamental purpose of education (Dewey, 1933). Dewey referred to this form of thinking as "reflective thinking" and defined it as "active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of grounds which support it" (Dewey, 1934, p. 9). Another modern interpretation of critical thinking is Enniss (1962), who suggests that students should be assisted in the engagement of thinking that is reflective, reasonable, and directed on what to believe or do.

Psychologist Edward Glaser, who built upon the ideas of Dewey and co-authored one of the most highly used test of critical thinking, the *Watson-Glaser Thinking Appraisal* (1980), promoted the role of critical thinking as the universal goal of education. The Secretary's Commission on Necessary Skills (1991) confirmed that

students need to exit high school with the requisite critical thinking skills to succeed in the progressively changing global workplace.

Critical thinking is also referred to as “higher order thinking.” It comprises cognition functions dependent on analysis, synthesis, and evaluation, orders of thinking equivalent to the highest levels represented on the categorical dimensions of the cognitive thinking scale developed by seminal author and educator, Benjamin Bloom (Bloom & Krawthwohl, 1956). According to Facione (2007), by teaching young people critical thinking skills, educators equip them to be better decision-makers and improve their chances of not only improving their own lives, but also of becoming contributing members of society, rather than burdens on society.

The ability to think critically is an important condition for success in school and life. Promoting the development of critical thinking skills through arts education would have an impact on curriculum development, specifically the utilization of study in the arts as a learning strategy and the revisiting of the purpose of arts education. Arts education has the unique capacity to teach children to think creatively, imaginatively, and critically, while also benefiting subject-specific curriculum (Deasy, 2002).

Van DeWegne (2006) poses the question: What are educators doing to nurture the dispositions associated with imagination, critical thinking and intellectual risk taking—the same habits of mind associated with global competitiveness and the acquisition of a set of basic life skills involving problem solving, collaboration, and communication. Therefore, an area to investigate is education in the arts. After all, no decision is of greater importance than the determination of what exactly to teach in school programs (Eisner, 2005, 2002, 1998).

The topic of arts education and development of critical thinking skills was selected because the current national focus on accountability and standardized tests has weakened the place of the arts in public education. Yet, ironically, participation in the arts can provide powerful opportunities for rehearsal of higher-order thinking skills such as analysis, synthesis, and evaluation (Catterall, 2002). Teacher effectiveness in developing thinking and imaginative abilities of students is diminished when Fine Arts classes are viewed as merely pleasant diversions from the core academics or serve primarily as add-ons to fill out the curriculum schedule.

Visual arts education has been eroded in recent years as other priorities, such as test-driven curricula, have “relegated the arts to the sidelines of critical conversations in mainstream education” (Davis, 2005, p. 12). Also, music education is currently in an at-risk role because some taxpayers perceive it as having limited value in regard to impacting this society’s economic growth (Cady, 1992). On the other hand, Regelski (2005), who has written extensively regarding the unique capacities of music education, contends that the critical theory approach to music education provides music students with the means to become reflective practitioners and better critical thinkers. Theater classes are in the same vulnerable situation as Visual Arts and Music. However, problem solving, logical thinking, reasoning, and critical thinking are skills that students learn through participating in Drama coursework (Hery, 1996).

“When educational policy emphasizes the display and achievement of uniformity, when it diminishes the opportunity for imagination to flourish, when it considers metaphor and ambiguity to be problematic, both the argument and the need for the arts become even stronger” (Eisner, 2004, para. 3). *The No Child Left Behind Act of 2001*

(NCLB) (U.S. Department of Education, 2001) is restructuring public education in the United States, and, consequently, this restructuring has many grave implications for arts education. “NCLB stresses back-to-basics with a vengeance under the guise of excellence” (Chapman, 2004, The Alphabet Soup section, para. 2). The NCLB legislation creates an emphasis on high-stakes testing in reading and math, and therefore diminishes the importance of arts education in the curriculum. Study in the arts, however, contributes to students’ intellectual development due to the very nature of the dynamics inherent in Visual Arts, Music, or Drama classes—process, reflection on the process, and ultimately revision, or reflection on the reflection (Davis, 2005). Secretary of Education Riley made the following claim for the inclusion of arts education in the introductory remarks to a compilation of studies entitled *Champions of Change: The Impacts of Arts on Learning* (1999):

“Why is American education in such flux? In simplest terms, the reason is because America is in transition. We are a more diverse society facing daunting demands from global social and technological innovation. The American economy is shifting from a manufacturing-driven engine to a services-driven enterprise. If young Americans are to succeed and to contribute to what Federal Reserve Chairman Alan Greenspan describes as our ‘economy of ideas,’ they will need an education that develops imaginative, flexible and tough-minded thinking. The arts powerfully nurture the ability to think in this manner” (para. 2).

The marginal position of the arts in education is an outcome of the national accountability movement of the last several decades. “The search for evidence of transferability in supporting claims of educational value of the arts movement is



motivated by the realization that, one way or another, the arts are more obliged than other subjects to spell out their wider educational relevance” (Brown, 2001, Transfer of Knowledge section, para. 5). According to Eisner (2005), subjects whose educational value is misunderstood are often marginalized in the curriculum, thus robbing the students of the opportunity to experience the world through the lenses that the excluded field provides.

### **Purpose of Study**

The purpose of this non-experimental, exploratory (comparative), and explanatory (correlational) secondary research study was to investigate the relationships among (1) student demographic characteristics, (2) curriculum characteristics, (3) academic characteristics, and (4) critical thinking as measured by performance on the FCAT for Broward County 12<sup>th</sup> grade students. Secondary analysis of data collected by the researcher was used for answering the research questions and testing the hypothesis presented in the study. There were six specific purposes of the study, including one descriptive, two exploratory, and three explanatory purposes:

1. The descriptive purpose was to identify the demographic, academic, and curriculum characteristics, as well as critical thinking performance on the FCAT of 12<sup>th</sup> grade students from the Broward County School District.
2. The first exploratory purpose was to determine whether there were differences in critical thinking performance on the FCAT of 12<sup>th</sup> grade students according to demographic characteristics.

3. The second exploratory purpose was to determine whether there were positive relationships between critical thinking performance on the FCAT of 12<sup>th</sup> grade students and academic characteristics and curriculum characteristics.
4. The first explanatory purpose was to investigate whether the frequency of Fine Arts coursework in high school (grades 9-12) was a significant explanatory variable of critical thinking performance on the FCAT.
5. The second explanatory purpose was to investigate whether the cumulative GPA of Fine Arts coursework in high school (grades 9- 12) was a significant explanatory variable of critical thinking performance on the FCAT.
6. The third explanatory purpose was to determine whether demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade were significant explanatory variables of critical thinking performance on the FCAT.

### **Definition of Terms**

The prevalence of theoretical literature related to critical thinking occurs within the fields of psychology and educational research. Consequently, theoretical definitions of the variables established in this study are based on meanings established and commonly referred to in psychological research relating to cognitive development and in educational research with regard to defining, cultivating, and assessing critical thinking. The operational definitions are based on terms and measurements primarily developed by the educational research community and specifically employed in this study. The dependent variable, as established in all the research questions and hypotheses, is critical thinking skills, while the independent variables vary and include student demographic characteristics, academic characteristics, and curriculum characteristics.

## Critical Thinking

### Theoretical Definition

*Critical thinking* is the ability to form judgments, both reflective and purposive (Facione, Facione, & Giancarlo, 2000). “Students who develop critical thinking dispositions are inclined to employ critical, reflective thinking when engaged in problem solving and analysis across various domains” (Facione, 2007, p. 68).

### Operational Definition

For the purpose of this study, critical thinking ability of 12<sup>th</sup> grade students was measured by their Reading and Mathematics scale scores on the Florida Comprehensive Achievement Test (FCAT). Achievement levels, determined by the scale scores, reflect five levels of proficiency from 1 (*lowest*) to 5 (*highest*) and the raw scale scores range from 100 points (*lowest*) to 500 points (*highest*). Higher scores all demonstrate higher levels of critical thinking skills required by the increased cognitive complexity of test items (Florida Department of Education, FCAT Briefing, 2008). Cognitive complexity is defined as the level of cognitive demand associated with the FCAT test items. At the inception of the FCAT’s use as an assessment tool of student achievement in 1998, Bloom’s Taxonomy (Bloom & Krawthwohl, 1956) was the guide for levels of cognitive complexity. However, beginning in 2004, a new cognitive classification system representing a modification of Bloom’s Taxonomy that illustrated essentially identical hierarchies of thinking skills but eliminated bias has been utilized. The most recent resource for critical thinking assessment designed for the FCAT is founded upon the work of Dr. Norman L. Webb’s “Depth of Knowledge” levels (Webb, 1999).

## Arts Education

### Theoretical Definition

Study of the arts, i.e., visual, musical or performance art, shares the core elements of a guided practice of an art form or craft that results in a student product such as a painting, ceramic piece, musical recital, or play. More importantly, these courses of study all evidence the central components of a focus on the activities of *process* and *reflection* (Davis, 2005). According to Davis (2005), in arts education there is first a demonstration of doing, which is process, then thinking, which is reflection on the process, and finally redoing, or process informed by reflection. Consequently, assessment or evaluation, both critique by the instructor and self-critique, is an active part of the ongoing learning process.

### Operational Definition

In this study, arts coursework was classified as the classes that fall under the state established course descriptor numbers designated for Visual Arts, Music, or Drama. The amount of accumulated arts coursework per student was measured by the total number of classes within these three overarching categories recorded on the transcripts of students by the Broward Schools Total Educational Research Management System (TERMS) database. Data was collected only for sample students designated as 12<sup>th</sup> graders in the 2009 – 2010 calendar school year; students classified as grades 9–11 in the 2009–2010 school year were excluded from the study. This study included student data collected from one *high achieving*, one *middle achieving*, and one *low achieving* high school (as determined by the 2010 overall school grade) selected from each of the three geographic areas that comprise the Broward County Public School District, which encompasses a collective 31 high schools under its jurisdiction.

## **Student Demographic Characteristics**

### **Theoretical Definition**

Demographic characteristics refer to data collected according to selected population characteristics and subsequently categorized within specific groupings, such as sex, age, and race origin (U. S. Census Bureau, 2008).

### **Operational Definition**

In this study, student demographics were measured by a scale developed by the researcher to document the following student demographic characteristics: gender; age as measured by birth year; race; socioeconomic status as determined by free and reduced lunch status; frequencies of cumulative Fine Arts, Language Arts, and Mathematics coursework during high school; and, finally, highest FCAT Reading and Mathematics scores out of all attempts between 9<sup>th</sup> and 12<sup>th</sup> grades. Data were collected from the Broward Schools' master TERMS database and the data recording tool is provided in Appendix A, Part 1.

## **Curriculum Characteristics**

### **Theoretical Definition**

A course's curriculum not only outlines the actual content of the class, but also how the content is organized and presented. Curriculum established by public school districts of the United States encompasses federal-mandated and state-mandated learning benchmarks for each specific subject matter, recommended pedagogical methodology, and established approaches to assessment of learning outcomes. Curriculum design should be guided by three critical characteristics: incorporating national standards, developing an approach to specifying learning goals, and aligning learning goals,

instructional activities, and assessments (Krajcik, McNeill, & Reiser, 2008).

### **Operational Definition**

For this study, specific variables relating to curriculum were obtained from the Broward Schools' TERMS database. These included the total number of Fine Arts courses (including the frequency of specific Fine Arts courses in the areas of Visual Arts, Music, and Drama), as well as the frequency of coursework in Language Arts and Mathematics during 9<sup>th</sup> through 12<sup>th</sup> grades.

The curriculum requirements for graduation determined by the Broward County School District are that students successfully complete the following courses in grades 9 through 12:

- Four credits in courses with a major focus in composition, reading, and literature (referred to as *language arts* courses)
- Four credits in mathematics courses, one of which must be Algebra I or higher
- Three credits in science courses, two of which must have a lab component
- Three credits in social studies courses, including World History, American History, ½ credit of Government and ½ credit of Economics
- One credit in Fine or Performing Arts
- One credit in Physical Education
- Eight elective credits, which may include additional courses within the areas required (Broward County Public Schools, 2010).

## **Academic Characteristics**

### **Theoretical Definition**

Academic characteristics may be described as the cumulative grade point average (GPA) of the total of all courses in high school, grades 9 through 12. Individual course grades that contribute to the overall cumulative average are based on an 8-point scale established by the Broward County School District (A, B+, B, C+, C, D+, D, F), with assigned quality points ranging from 0 points for an F to 4.0 points for an A. Honors classes earn one extra point for A, B, and C grades and Advanced Placement courses earn two additional points for A, B, or C grades.

### **Operational Definition**

For the purpose of this study, the cumulative grade point average (GPA) of total Fine Arts coursework (i.e., Visual Arts, Music, and Drama), the GPA of coursework under the umbrella of Language Arts (composition, reading, literature), and the GPA of Mathematics classes were measured. All coursework were recorded on a data collection tool designed by the researcher.

### **Justification**

The study is significant in that exploration of the topic may provide implications for reform in curriculum design to better focus on the promotion of students' acquisition of essential skills such as critical thinking necessary for success in school and subsequently in the workplace. "In an educational system strapped for money and increasingly ruled by standardized tests, arts courses can seem almost a needless extravagance, and the arts are being cut back at schools across the nation" (Winner & Hetland, 2008, p. 1). However, as a result of the current emergence of technological

advances and globalization, the need for students' ability to acquire critical thinking skills in order to prepare for success in the workforce is not only observed in the United States but also has global implications, as well (Hartman, Bentley, Richards, & Krebs, 2005). Even more compelling is the necessity for public school children's ultimate attainment of life skills centered on problem-solving that the arts have the unique ability to cultivate. Winner and Heltand (2008) found that arts classes teach a specific set of thinking skills, such as reflection, self-criticism, and the willingness to experiment and learn from mistakes, which are rarely addressed elsewhere in the curriculum.

An Arts curriculum provides opportunities for consistent and repeated practice in problem-solving and decision-making, which are essential in the preparation of students to be successful in school and, even more importantly, as effective members of society. If students are truly to be prepared for success in the 21<sup>st</sup> century workforce, then educational policymakers and curriculum planners, at all levels, need to embrace arts education as an integral component for teaching critical thinking.

A plethora of theoretical literature regarding the impact of arts education on the development of critical thinking skills exists; however, empirical studies concerning the issue are scarce. Therefore, this study is designed to contribute to the body of empirical research on the subject of the impact of arts education and to provide valuable information to educational policy-makers, curriculum planners, and educators.

The study is feasible because student data records are available to the researcher, a sufficient number of student records can be collected, the cost is negligible, and the research can be conducted in a reasonable amount of time. Ethical considerations were made to insure the anonymity of individual students and schools used in the study.



Finally, the study was researchable since all the variables were quantifiable and could be analyzed by statistical methods, both descriptive and inferential.

### **Delimitations and Scope**

The delimitations and scope of this study are described as follows:

1. This study was restricted to public high school students who were in 12<sup>th</sup> grade during the 2009-2010 school year and received documented scores for the Reading and Mathematics components of the FCAT. Private school and charter school students were excluded.
2. The geographic setting was Broward County, Florida.
3. The target population was 12th graders who had graduated in 2010 from a selection of one *high* achieving, one *middle* achieving, and one *low* achieving high school (as determined by overall school grade) from each of Broward County's three geographic regions—North Area, Central Area, and South Area.
4. Students who had spent less than two years in the English for Speakers of Other Languages (ESOL) programs and who were designated as Exceptional Student Education (ESE) students who received a certificate of completion in lieu of a standard diploma were excluded.
5. The scope of the variables included student demographics, academic characteristics, curriculum characteristics, and level of critical thinking skills as measured by the FCAT Reading and Mathematics components.

## **Organization of the Study**

This study is comprised of five chapters. Chapter I provides an overview of the study, including the background to the problem, the purpose, the justification, the variables, and a definition of terms. Chapter I also lists the delimitations and scope of the study. Chapter II presents a review of literature and the theoretical framework which led to the research questions to be answered and the hypotheses to be tested by the study. The review of literature produced a hypothesized model that evolved from the gaps in the literature. Chapter III describes the research design, target population, sampling plan, and instrumentation, ethical considerations, methods of data analysis, and the methodology evaluation. Chapter IV supplies the findings which answered the research questions and tested the hypotheses that were presented by the study. Finally, Chapter V provides a conclusion, discussion and interpretation of the results, and recommendations for future research.

## CHAPTER II

### LITERATURE REVIEW, THEORETICAL FRAMEWORK, RESEARCH QUESTIONS, AND HYPOTHESES

#### Review of the Literature

The ability to think critically has taken on renewed significance in the realm of education, as well as in the current workforce. One of the basic questions facing educators has always been, “Where do we begin in seeking to improve human thinking?” (van Gelder, 2005, p. 1). A U. S. government-sponsored report entitled, *A Nation at Risk*, (National Commission on Excellence in Education, 1983) called for the educational community to take a serious look at the faltering achievements of American students, noting that the competence level in critical thinking skills was lower than it should be for virtually every level of American education. The report “voiced an at least decade-long concern shared by both educators and laypersons that instruction in critical thinking should be emphasized in formal courses of study at all rungs of the educational ladder” (Walters, 1994, p. 3). Yet again, in 1989, President Bush and a commission of governors began work on the formulation of *Goals 2000. The American Education Act* which was approved by both the United States Senate and Congress and was ultimately signed into law on March 31, 1994. The *Goals 2000* report implored colleges and universities to take critical thinking objectives more seriously by improving the abilities of college students to be more effective thinkers, communicators, and problem solvers (Burbach, Fritz, & Matkin, 2004).

It has become essential for education leaders to explore new strategies that encompass such 21<sup>st</sup> century skills as critical thinking, problem solving, innovation and

creativity. “Without this focus, our schools will deliver an incomplete and inadequate education” (Box, 2009, p. 37). The idea that people who can think critically make better citizens, who ultimately are more predisposed to contribute to the preservation of key democratic ideals, is generally agreed upon (Hale, 2008). Moreover, it is believed that citizens who improve their critical thinking skills will be prepared to contribute to a country’s ability to survive—economically and politically—in an ever increasing complex and interconnected world (Costa, 2001; Ennis, 1996; Hare, 1998; Paul, 1995). “How can we hope to thoughtfully address the economic issues, conflicts, world poverty, and many other urgent worries that trouble our planet, if we don't take the way we think seriously? We cannot. To effectively deal with these issues, we must cultivate the spirit of critical thinking throughout human societies” (Elder, 2009, para. 3).

Research proposes that coursework in the arts (visual art, music, and drama) has the unique capacity to enhance critical thinking (Gullat, 2007; Lampert, 2006; Smithrim & Upitis, 2005; Winner & Hetland, 2000). Prominent theorists such as Catterall (2002, 1999, 1998); Deasy (2002); Eisner (2005, 2002, 1998); and Gardner (1983) have argued that the arts are integral to the education of the “whole child” and provide life-long benefits to students in terms of critical thinking abilities. Research has shown a positive effect in achievement for students involved in arts coursework. In fact, data collected by Vaughn and Winner (2000) have shown that for the 13 years preceding the study, students involved in the arts outscored their peers on the SAT by an average of more than 90 points. The data has been documented by the College Board since 1987 and is based on a very large sample—over 10 million students who volunteer to take a survey, the Student Descriptive Questionnaire—as part of the registration process for the SAT.

Several theoretical rationales have been offered for the arts playing a role in the promotion of cognitive development. “The arts serve to broaden access to meaning by offering ways of thinking and ways of representation consistent with the spectrum of intelligences scattered unevenly across our population—for example, resonating with the multiple and differing intelligences identified by Howard Gardner” (Friske, 1999, p. 4). Gardner has contended that, even though it was not his original intended audience, the chief audiences of his theories on Multiple Intelligences (MI) have by far turned out to be educators, those interested in creating innovative learning environments that promote critical thinking (Gardner, 2004). This may be attributed in part to the advances in neuroscience and an increase in general knowledge relating to the evolution, development, and organization of the human brain. Gardner’s concern nevertheless is that “the vast amount of time now dedicated to meeting local, state, and national mandates makes it very difficult for even the most ingenious educational practitioners to devote much time to MI activities.... My hope, however, is that the many persons and institutions with interests in MI theory will continue to explore its educational implications” (Gardner, 2004, p. 215).

Although many theories have suggested that education in the arts has a positive relationship with the development of critical thinking, scant empirical research exists to support these theories. In fact, much of the empirical research yields mixed results. This produces a gap between what is known and not known about the relationship of critical thinking skills and arts education. The purpose of this critical analysis of theoretical and empirical research is to examine the literature related to the relationship between arts education and critical thinking skills and to identify areas for future scholarly inquiry.

This review presents a discussion of the characteristics of critical thinking, measurements of critical thinking, and the impact of arts education on critical thinking. Bloom's model of the hierarchical classifications of thinking (1956) and Webb's Depth of Knowledge thinking levels (2002) are used to organize and frame the theoretical and empirical literature pertaining to higher levels of thinking in this review. In addition to the review of literature about critical thinking and arts education, this chapter provides a synopsis of the literature and explains the theoretical framework on which the literature is based. The chapter concludes with research questions, hypotheses, and a hypothesized model illustrating the relationship between critical thinking skills and arts education.

### **Critical Thinking Skills**

#### **Theories of Critical Thinking Skills**

The notion of critical thinking can be traced back to early Greek philosophers such as Socrates, Plato, and Aristotle. These intellectuals recognized the need to improve the quality of human reasoning and problem solving, developing the first criteria for critical thought. Consequently, the groundwork was laid 2500 years ago for what is now termed *critical thinking*. Socrates developed a process of questioning, referred to as the Socratic Method, which was designed to help people see inconsistencies and assumptions inherent in their beliefs and reasoning. Socrates' questioning technique "led students beyond speculation and belief to understanding and knowledge" (Fasko, 2003, p. 3). By doing so, Socrates emphasized the principles of thinking clearly and consistently, thus exemplifying the power of organized and directed questioning to facilitate critical thought. The Socratic Method challenges people to question their claims to knowledge and understanding, in effect, challenging them to critically reflect on their assumptions

(Warren, 1994).

Throughout history, other eminent philosophers such as Francis Bacon (1605/1964) have written extensively on the importance of schools fostering high quality intellectual skills, such as critical thinking. As did Socrates, Bacon insisted that people must question their assumptions, both personal and cultural. Bacon advocated a system of thinking that was based on a process that was purposeful, measurable, and verifiable, thus laying the foundation of the modern scientific method. Bacon also recognized that high-level thinking must be systematically cultivated.

In the more recent past, critical thinking theory is evident in Dewey's (1934) writings about *reflective* thinking. By reflective thinking, Dewey meant thinking that was aware of its causes and consequences (Lipman, 1991). Additionally, Dewey defines critical thinking as an active, as opposed to a passive process, one in which the students think for themselves, collecting relevant information, and making judgments about it, rather than learning in a primarily passive way from someone else. Dewey's definition aligns with Socratic philosophy in claiming that an essential element of critical thinking is careful, skillful reasoning. According to Hare (1998), Dewey vigorously pursued the theme of critical thinking and developed a concept of formal education that focused on the importance of thought, inquiry, and intellectual independence. Moseley et al. (2005) contend that "In Dewey's view, the development of reflective thought is the most important goal of education and enables the individual to take control of and responsibility for their own thinking in order to participate effectively as a member of a democratic society" (p. 12). Dewey's stress on the need for the educational system to cultivate intellectual dispositions based on student-centered learning is as timely today as

during the introduction of the progressive educational movement. In fact, “To many in the critical thinking movement today, it was Dewey’s emphasis on reflective thinking that was the true harbinger of critical thinking in this century” (Lipman, 1991, p. 35).

Glaser (1941) built upon the work of Dewey. According to Glaser, critical thinking can be defined in terms of three practical characteristics: “(1) an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one’s experience, (2) knowledge of the methods of logical inquiry and reasoning, and (3) some skill in applying those methods. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of evidence that supports it and the further conclusions to which it tends” (Glaser, 1941, p. 5). Like Dewey, Glaser also insisted that thinking be based on well-founded reasons rather than thinking which is guided by bias, subjective opinion and/or social conformity.

One of the most famous contributors to the development of current thought on critical thinking is Ennis (1996, 1962). Ennis’s (1962) definition of critical thinking is as follows: “Critical thinking is a process, the goal of which is to make reasonable decisions about what to believe and what to do” (p. xvii). It is Ennis’s contention that critical thinking is not a thing or a goal in and of itself, but rather a process for making informed decisions that affect one’s life. Ennis’s description echoes earlier definitions by Dewey and Glaser; however, there is an added focus on deciding what to do, which was not mentioned in prior explanations of the nature of critical thinking (Fisher, 2001). Ennis and Smith (1961) were the originators of the term *critical thinking*.

Another leader in the critical thinking movement is Paul (2002, 1995, 1993), who has created a model of critical thinking based on two essential elements that students



must master. According to Paul and Elder (2002), students must be able to identify the “parts” of their thinking, and they need to be able to “assess their thinking to ultimately learn how to upgrade their thinking performance” (p. 534). Paul avoids formal terminology as taxonomies, focusing more on reasoning that pertains to everyday problems or issues. He does, however, emphasize the metacognitive aspects of critical thinking, independent thinking, and the importance of learning to assess one’s own thinking. Paul (1993) also noted the distinction between strong critical thinking and weak critical thinking. He maintains that there is a distinction between sophistic or weak critical thinkers, who use thinking skills for arguments to defend their own vested interests, and true critical thinkers, who set aside their own biases, applying critical thinking to seek truth. The element of self-criticism—or thinking *about* one’s thinking—is a key component of Paul’s model.

Paul (1993) contends that critical thinking can be defined in numerous ways, one of which is the following: Critical thinking is a unique kind of purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon the thinking, taking charge of construction of thinking, guiding the construction of the thinking according to the standards, and assessing the effectiveness of the thinking according to the purpose, the criteria, and the standards. (p. 21)

Paul, Elder, and Bartell (1997) state that critical thinking is “the intellectually disciplined process of actively and skillfully conceptualizing, applying, synthesizing, and evaluating information gathered from or generated by observation, reflection, reasoning, or communication, as a guide to belief and action” (p. 4). One limitation of Paul’s model

may be its very general nature, which makes it more difficult to use in specific assessments.

Paul and Elder (2001), who have written extensively on the subject of critical thinking, stress that critical thinking is a *process* and not an end. Elder (2009) contends that “critical thinking is self-guided, self-disciplined thinking that is aimed to take the reasoning we all do naturally to a higher level. It is the art of analyzing and evaluating with the goal of improving thought” (p. 9). Lipman (1991) defines critical thinking as “skillful and responsible thinking that (1) facilitates judgment because it, (2) relies on criteria, (3) is self-correcting, and (4) is sensitive to context” (p. 116). Additionally, Lipman argues that thinking of the highest quality is not only skillful, but also takes practice to develop. Fasko (2003) suggests that “critical thinking is the propensity and skills to engage in mental activity with reflective skepticism focused on deciding what to believe or do ... and that can be justified” (p. 8). Again, the scholars agree that critical thinking entails a thorough awareness of the thinking in which one engages. Halpern (1996) posits the following definition of critical thinking:

Critical thinking is the use of those cognitive skills or strategies that increase the probability of a positive outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed—the kind of thinking involved in problem solving, formulating inferences, calculating likelihoods, and making decisions; then the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task. Critical thinking also involves evaluating the thinking process (p. 5).

Critical thinking entails making judgments in a reflective manner. Van Gelder (2005) presents six lessons from cognitive science about critical thinking. The lessons are as follows:

- **Critical Thinking is Hard:** Critical thinking is a complex activity built up out of other skills that are simpler and easier to acquire.
- **Practice Makes Perfect:** Everyone knows that mastering a skill takes practice, and plenty of it. The skills of critical thinking are no exception.
- **Practice for Transfer:** Students must practice the art of transferring the skills from one situation to another. If they can master that higher-order skill of transfer, then they do not have a problem of transfer of the primary skill.
- **Practical Theory:** To learn a theory requires learning a new vocabulary - that is, new words and the corresponding concepts, and furthermore, understanding the concepts means mastering a body of language. Much the same is true of critical thinking. The serious critical thinker understands the theory of critical thinking.
- **Map It Out:** A core part of critical thinking is handling logically structured arguments. Arguments constitute a body of evidence in relation to some proposition. In lieu of expressing the argument in a verbal, linear sequence, an argument map should be laid out. When arguments are presented in diagrammatic form, the students are better able to follow extended critical thinking procedures.

- Belief Preservation: The mind has intrinsic tendencies toward illusion, distortion, and error. To some extent this tendency is nurtured or inculcated by our societies and cultures. These tendencies are known generically as “cognitive biases and blind spots” (p. 42). At root, belief preservation is the tendency to make evidence subservient to belief, rather than the other way around. Critical thinking cultivates a willingness to be more fluid and to explore alternatives.

Critical thinking is defined by Facione (2000, 2007) as thinking that has a purpose, such as proving a point, interpreting meaning, or solving a problem. Facione has spent over 20 years building his empirical research on the theoretical framework created by the collective consensus of a group of 46 theorists who were chosen by the American Philosophical Association (APA) in 1987 to assess the status of critical thinking education and critical thinking assessment. The panel published the findings in a report titled *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction* (1990). Referred to as “The Delphi Report,” the subsequent result of this collaborative work of critical thinking experts presents the following definition of critical thinking: “We understand critical thinking to be purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based” (Facione, 1990, p. 2). Thus, the core of critical thinking is comprised of cognition functions dependent on analysis, synthesis, and evaluation, those identical to the highest levels on

the categorical dimensions of cognitive thinking developed by Bloom (Bloom & Krawthwohl, 1956).

Bloom (1956) introduced his seminal theory for the categorization of thinking skills in a 1956 book which represented a culmination of work initially begun in collaboration with other educational psychologists also interested in studying the dynamics of human thinking. As a result of discussions at the Convention of the American Psychological Association (APA) in 1948, Bloom was inspired to spearhead a group of educators to undertake the task of developing a system of classification for thinking behaviors. Eight years after the group began, the work was completed and a handbook detailing the group's finding was edited by Bloom and entitled *The Taxonomy of Educational Objectives* (Bloom & Krawthwohl, 1956). However, this handbook has commonly been referred to within educational circles as "Bloom's Taxonomy" and remains the de facto standard for identifying levels of thinking.

Since the publication of *The Taxonomy of Educational Objectives*, Bloom has authored or coauthored 18 books on the nature of thinking, which have, in turn, been translated into 22 languages. Bloom's Taxonomy is one of the most widely applied and most often cited references in education (Krawthwohl, 2002). Taxonomy and classification are interchangeable in the theoretical framework, but Bloom contended that "taxonomies have certain structural rules that exceed in complexity the rules of a classification system (Bloom & Krawthwohl, 1956, p. 17). Bloom's Taxonomy (1956) identifies three types of learning domains: *cognitive* or mental skills, referred to as knowledge; *affective* skills or growth in feelings and emotional areas, which are attitudinal; and *psychomotor*, relating to manual or physical skills.

Bloom provides a schematic model of cognitive thinking skills organized in distinct hierarchical levels, each requiring more complex intellectual abilities. This theoretical framework identifies six levels of thinking and correlating competencies, ranking from lowest to highest orders of thinking as follows: knowledge, comprehension, application, analysis, synthesis, and evaluation. Bloom's last three tiers—analysis, synthesis, and evaluation—are referred to as “higher-order” thinking skills which require students to “extend themselves beyond the information-gathering stage to consideration of what that information means, how it can be applied, and the consequences of application” (Dyrud & Worley, 2002, p. 1).

Figure 2-1 depicts the six major cognitive categories, starting from the simplest behavior and ending with the most complex. The categories illustrate degrees of difficulties; thus, the first must be mastered before the next can take place. In other words, a student able to function at the application level would have already mastered the material at the knowledge and comprehension levels (University of Wisconsin Teaching Academy, 2003).

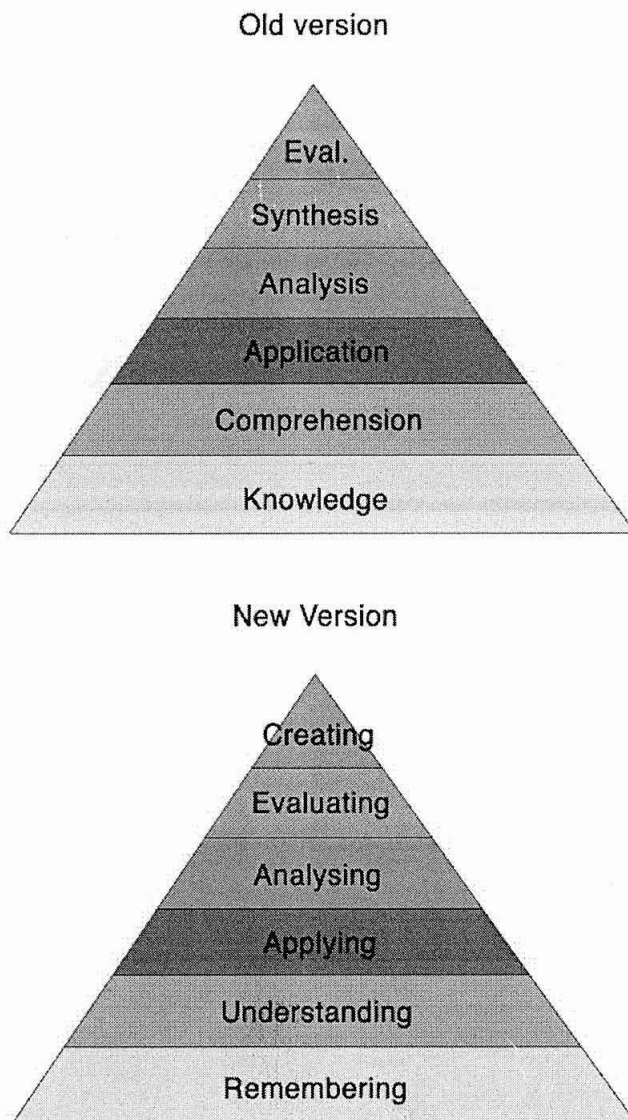
Category	Example and Key Words
<p><b>Knowledge:</b> Recall data or information.</p>	<p><b>Examples:</b> Recite a policy. Quote prices from memory to a customer. Knows the safety rules.  <b>Key Words:</b> defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states.</p>
<p><b>Comprehension:</b> Understand the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.</p>	<p><b>Examples:</b> Rewrites the principles of test writing. Explain in one's own words the steps for performing a complex task. Translates an equation into a computer spreadsheet.  <b>Key Words:</b> Comprehends converts, defends, distinguishes, estimates, explains, extends, generalizes, gives <b>Examples</b>, infers, interprets, paraphrases, predicts, rewrites, summarizes, and translates.</p>
<p><b>Application:</b> Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place.</p>	<p><b>Examples:</b> Use a manual to calculate an employee's vacation time. Apply laws of statistics to evaluate the reliability of a written test.  <b>Key Words:</b> applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.</p>
<p><b>Analysis:</b> Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.</p>	<p><b>Examples:</b> Troubleshoot a piece of equipment by using logical deduction. Recognize logical fallacies in reasoning. Gathers information from a department and selects the required tasks for training.  <b>Key Words:</b> analyzes, breaks down, compares, contrasts, and diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, and separates.</p>
<p><b>Synthesis:</b> Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure.</p>	<p><b>Examples:</b> Write a company operations or process manual. Design a machine to perform a specific task. Integrates training from several sources to solve a problem. Revises and process to improve the outcome.  <b>Key Words:</b> categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes.</p>
<p><b>Evaluation:</b> Make judgments about the value of ideas or materials.</p>	<p><b>Examples:</b> Select the most effective solution. Hire the most qualified candidate. Explain and justify a new budget.  <b>Key Words:</b> appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, and summarizes, supports.</p>

Figure 2-1. The six major cognitive categories of Bloom's Taxonomy. From "Taxonomy of educational objectives: The classification of educational goals, by a committee of college and university examiners. Handbook 1: Cognitive domain," by B. Bloom and D. Krawthwohl. Copyright 1956 by Longmans, NY.

During the 1990s, a former student of Bloom's, Anderson, led a new assembly that met for the purpose of updating Bloom's Taxonomy. The representatives of the group included cognitive psychologists, curriculum theorists, instructional researchers, and assessment specialists. After six years of work on the subject, Anderson and Krathwohl (2001) revised Bloom's original taxonomy. The changes occurred in three categories: terminology, structure, and emphasis (Forehand, 2005). The changes in the terminology used to describe the different levels resulted in a change from nouns to *verbs* when titling the levels. Furthermore, the lowest level, "knowledge," was changed to "remembering." Finally, "comprehension" and "synthesis" were retitled to "understanding" and "creating."

Krathwohl (2002) contends that the revisions, although basically aligning with the original Taxonomy, added a two-dimensional quality to the categories by stressing the subcategories as well. The comparison of the Bloom model and the new Anderson and Krathwohl version are presented in Figure 2-2.





*Figure 2-2.* Comparison of the Bloom model and the new Anderson and Krathwohl version. From “*A taxonomy of learning, teaching and assessing: A revision of Bloom’s taxonomy of educational objectives,*” by L. W. Anderson and D. R. Krawthwohl. Copyright 2002 by Longman, NY. Reproduced with permission from Lorin Anderson.

In many aspects, *Webb's Depth-of-Knowledge Model (DOK)*, developed in 1999, is similar to Bloom's Taxonomy. Both models are written as hierarchies of progressively more complex levels of thinking; however, Webb's DOK is not a taxonomy. Similar to the Bloom Taxonomy levels, the DOK measures rigor and complexity; however, in Webb's model the verb is not the distinguishing factor. Instead, the *context* of the verb is how one delineates between the different DOK levels. While Bloom's has six levels of thinking, Webb's representation of thinking complexity has four levels assigned to both objectives within standards and assessment items. Each level describes and shows a progression of the *rigor* of what is being taught and learned (Webb, 1999).

Level one, referred to as "Recall Level," requires simple knowledge such as verbatim recall or rote response. Some examples of level one performance in reading are using a dictionary to find the meaning of words or identifying figurative language in a reading passage. There is little comprehension involved at this level, as it requires only very basic surface knowledge of the material. Level one activity is, however, important because levels of DOK progress in steps that are cumulative, i.e., they build upon one another. As with Bloom's Taxonomy, the levels of thinking are hierarchical; hence, students cannot reach a higher level before first mastering a lower level. Level one thinking in mathematics would include the recall of a fact, definition, term or simple procedure, as well as performing a simple algorithm or applying a formula.

Level two or the "Skill/Concept Level," involves more comprehension of material than level one and includes the engagement of some mental processing beyond recalling. At this level, students begin to apply skills and process concepts, making simple

decisions about how to approach a problem. Some examples that represent a level two performance of reading skills are:

- Use context cues to identify the meaning of unfamiliar words.
- Predict a logical outcome based on information in a reading selection.
- Identify and summarize the major events in a narrative.

Examples of level two mathematics skills would be to follow a recipe, identify characteristics of a phenomenon, collect data, or interpret information from a simple graph.

Deep knowledge actually becomes more of a focus at level three of the DOK—“Strategic Thinking Level.” At this level, students begin to do such things as analyze, evaluate, reason, and plan. Students must also be able to support their thinking, as well as deal with abstractions and open-ended conclusions. Some examples that represent level three thinking in reading are:

- Determine the author’s purpose and describe how it affects the interpretation of a reading.
- Summarize information from multiple sources to address a specific topic.
- Analyze and describe the characteristics of various types of literature.

Several examples of level three, “Strategic Thinking” mathematical operations would be activities that require students to draw conclusions from observations, cite evidence and develop logical arguments, explain phenomena in terms of concepts, all while providing justification for reasoning.

Higher order thinking is central and knowledge is deep at level four, referred to as the “Extended Thinking Level.” Students must have learned the basics at level one,

applied them at level two, and strategically thought about them at level three before they can extend their thinking by completing much deeper and more complex tasks at level four. The assessment item at this level could likely require extended time or activity but does not necessarily have to do so. According to Webb (1999), higher-level thinking is absolutely central to level four. At this level, students are required to successfully do such things as synthesize, hypothesize, evaluate, and analyze. Examples of some level four reading requirements are:

- Analyze and synthesize information from multiple sources.
- Examine and explain alternative perspectives across a variety of sources.
- Describe and illustrate how common themes are found across texts from different cultures.

Level four activities also may include designing and conducting experiments; making connections between a finding and related concepts; combining and synthesizing ideas into new concepts; and critiquing experimental designs. Webb's DOK is presented in Figure 2-3.



## Measurement of Critical Thinking Skills

Tests of critical thinking (CT) can generally be categorized as requiring either production responses or selection responses. The production response style of test requires that the test-taker says or writes something in response to a stimulus, which is then scored according to specific criteria described by the developer of the instrument. On the other hand, selection response critical thinking tests are typically in a multiple-choice format in which the test-taker reads a brief passage and selects the correct answer to a question relating to the passage. “Multiple-choice tests of CT share many features in common, as nearly all measure the ability to apply rules, concepts, and principles of formal/informal logic or scientific inquiry” (Frisby & Traffanstedt, 2003, p. 34).

An example of a popular selection response critical thinking test is the *Watson-Glaser Critical Thinking Appraisal* (WGCTA). In 1980, along with fellow researcher Watson, Glaser developed the WGCTA, which has become one of the most widely-used instruments for measuring gains in critical thinking resulting from instruction or to predict success in academic programs in which critical thinking is important (Burch, Fritz, & Matkin, 2004; Gadzella, Masten, Stacks, & Stephens, 2005; Gadzella, Masten, Stacks, Stephens, & Zascavage, 2006). The WGCTA is an 80-item paper and pencil inventory that includes 16 items on five subtests, each measuring different aspects of critical thinking. The subtests include: (1) *inference*: discriminating among degrees of truth or falsity of inference drawn from given data, (2) *recognition of assumptions*: recognizing unstated assumptions or presuppositions in given statements or assertions, (3) *deductions*: determining whether certain conclusions necessarily follow from information in given statements or premises, (4) *interpretations*: weighing evidence and

deciding if generalizations or conclusions based on the given data are warranted, and (5) *evaluation of arguments*: distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question or issue (Watson & Glaser, 1980). The questions consist of problems, statements, arguments, and interpretations of data similar to those that are encountered on a daily basis in places such as the workforce or school or in articles in newspapers and magazines.

Watson and Glaser (1980) note that they regard Forms A and B of their inventory as equivalent and alternative tests. In other words, the raw scores on one form may be interpreted as having the same meaning as the identical raw scores on the other form. To determine the reliability, the researchers made estimates of the test's internal consistency (split-half reliability coefficients ranged from .69 to .85), stability of test scores (test-retest at a three-month interval was .73 with means and standard deviations being reported as identical across time), and the scores on alternate forms ( $r = .75$ ). Although the authors assert that validity was determined through construct and content analysis, as well as from studies using both Form A and Form B, the studies are not cited.

A strength of this instrument is that Watson and Glaser (1980), along with subsequent researchers, have computed a wide variety of reliability indexes using different groups of participants and different methods of assessment of the characteristics of the test. A weakness would be the lack of mention by the authors of the specific studies actually used to test validity. The test manual is straightforward and easy for the administrator of the testing to grasp, as are the instructions for grading (Helmstadter, 2004). A limitation may be that although the test is well constructed, it evaluates critical thinking abilities through reading only. The authors do not address the question of

whether students might score differently if the test utilized another learning modality, such as listening.

In 2004, Burbach, Fitz, and Matkin conducted a quantitative empirical study for the purpose of confirming that a college-level introductory leadership course that integrated a number of active learning techniques would increase critical thinking performance. The course was an integrative studies course intended to engage students in actively developing their ability and desire to analyze, evaluate, and communicate complex material and positions. The *Watson-Glaser Critical Thinking Appraisal* (WGCTA) Form B (Watson & Glaser, 1980b) was used to collect data. The participants were 80 students, 19 years of age or older, enrolled in six sections of an introductory leadership course taught by three instructors at a Midwestern university. The number of participants from each class section was 18, 18, 17, 14, 9, and 4 respectively. Of the 80 participants, there were 57 men and 23 women; 26 were freshmen, 21 were sophomores, 14 were juniors, and 19 were seniors. Their ages ranged from 19 to 35 years ( $M = 20.7$ ,  $SD = 2.1$ ).

A pretest was administered at the beginning of the course and a posttest was given after 14 weeks. A paired-samples  $t$  test was conducted to determine whether students' skills increased by the end of the semester. Two subtests scores of the WGCTA (Deduction and Interpretation) and the total critical thinking test score were significantly higher ( $p = .05$ ) at the end of the course. The researchers report that Evaluation of Arguments subscale scores approached significance and the coefficient alpha was .81. There was no significant difference in regard to gender or particular course section.



The authors' literature review was thorough and current, presenting a history of critical thinking theory, as well as previous empirical studies. The authors admitted that the study had limitations regarding the inability to control external variables. Burbach, Fitz, and Matkin (2004) concluded that the practice of linking teaching intentions with outcomes relating to critical thinking is suspect; thus, establishing a feedback loop, as in this study, could provide data essential in maintaining or enhancing the likelihood that critical thinking skills are developed.

Another team of researchers, Gadzella, Masten, Stacks, and Stephens (2005) created a quantitative empirical study with the purpose of investigating the reliability and validity of the Watson-Glaser Thinking Appraisal-Form S to measure critical thinking for students pursuing a teaching career. Although the WGCTA Forms A and B were the most frequently used inventory at the post-secondary level to measure critical thinking, many researchers felt that the Forms A and B (consisting of 80 items) were too long and time-consuming. Therefore, in 1994, Watson and Glaser prepared an abbreviated version, Form S, which contains 40 multiple-choice items, with item options ranging from 2 to 5. The Gadzella et al. study (2005) focused on the use of the newer instrument, WGCTA-Form S. The participants of this study were 137 students enrolled in Educational Psychology at a state university. That data analysis showed that the alpha for the total WGCTA was .76 and the split-half correlation was  $r = .44$ . The total WGCTA-FS was correlated significantly with course grades ( $r = .32$ ). The authors' report that the test manual for the updated Form S indicates that both the internal consistency and split-half reliabilities for Form S were .81.

The total score possible on the WGCTA-FS, used in this study, is 40. For the participants the range was 14 to 39 (mean = 24.2 and standard deviation = 5.0). The course grade percentages for this group ranged from 43% to 99%. The subtests and total reliabilities of the WGCTA-FS were computed by the researchers. For the total group, the alpha was  $r = .76$ . The split-half reliability (for odd-even numbers) was  $r = .44$ . The validity of the WGCTA-FS for the group of participants was established by correlating the subtests and the total critical thinking scores with the course grades. The correlation between the total critical thinking scores and course grades was  $r = .31$ . The range for the course grades was considerably large, so the researchers elected to divide the group into two sub-groups: high-grade achievers (students earning A and B grades,  $n = 113$ ) and low-grade achievers (students earning C grades and lower,  $n = 24$ ). Differences between these two groups on the five subtests and total group were computed using the analyses of variance. Data showed that the high-grade group scored significantly higher than the low-grade group.

The research findings in this study supported the decision to divide the total group into high-grade and low-grade groups and the appropriateness of using the WGCTA-FS. The authors recommend that even though the WGCTA-FS is a shorter version than the original WGCTA Form A and Form B, students should be given sufficient time to complete the inventory. In addition, the recommendation was made for other empirical studies in this area to be encouraged.

In keeping with the recommendations, Gadzella, Masten, Stephens, Stacks, and Zascavage (2006) conducted another similar study using the WGCTA-FS. However, this time the participants were drawn from a variety of academic fields. The 586 university

students who served as participants encompassed psychology majors, students enrolled in educational psychology, and special education majors. In this study, the group included undergraduate as well as graduate level students. The responses to the WGCTA-FS were analyzed for the total group and the subgroups within the total group. The purpose of this study was to investigate further whether the WGCTA-FS was a reliable and valid instrument for measuring critical thinking.

The subjects were all enrolled at a southwestern state university: 56 were majoring in psychology, 228 enrolled in educational psychology, 155 enrolled in special education, 79 enrolled in graduate studies, and 68 had not yet declared a major. The data used in this study were the students' responses to the WGCTA-FS and their end-of-the-semester course grades. The internal consistencies (Cronbach alphas) for the total WGCTA-FS scores and the Pearson product-moment correlations between the WGCTA-FS scores and courses grades for the total group and each of the subgroups were analyzed by the researchers. The authors reported that the data for the total group and the subgroups showed that the internal consistencies ranged from .74 to .92. The correlations between the total WGCTA-FS scores and course grades for the total group and subgroups ranged from .20 to .62. The researchers noted that there were a number of low course grades reported, particularly for students who had not declared a major; thus this would account for the low correlation (.20) between the WGCTA-FS scores and course grades for the undergraduate group and the .30 correlation between WGCTA-FS scores and course grade for the total group. Gadzella et al. (2006) concluded that the WGCTA-FS was a reliable and valid instrument for measuring critical thinking and that the data showed that the WGCTA-FS alphas and correlations between the WGCTA-FS scores and

the semester course grades were within the ranges reported in the WGCTA-FS manual (Watson & Glaser, 1994).

Another prevalent selection response type of test for critical thinking abilities is the *California Critical Thinking Skills Test*, an instrument developed to measure CT in college-aged individuals. This tool addresses similar concepts as those tested in the Watson-Glaser Critical Thinking Appraisal (Brunt, 2005). The research team of Facione, Facione and Giancarlo (2000) explored whether the disposition toward critical thinking and critical thinking itself could be measured and analyzed empirically. The research expanded upon the 1990 APA “Delphi Report” regarding critical thinking and was conducted by a consortium of 46 theoreticians. The Delphi investigation provided the following description of the ideal critical thinker:

The ideal critical thinker is habitually inquisitive, well-informed, and trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit ( Facione, 1990, p. 2).

The Delphi report provides “a wonderful opportunity for tool development, since it expressed a consensus construct of critical thinking, offering a list of core critical thinking (CT) skills and sub-skills” (Facione et al., 2000, Empirical Research section, para. 5). Building upon this, Facione et al. initially developed the California Critical Disposition and Thinking Inventory (CCTDI), a measurement tool which identified seven

dispositional factors of critical thinking. Hence, the CCTDI was developed to measure the extent to which an individual possesses the *attitudes* of a critical thinker. The seven sub-dispositions were identified as: (a) inquisitiveness; (b) open-mindedness; (c) analyticity; (d) systematicity; (e) CT self-confidence; (f) truth-seeking; and (g) maturity of judgment. The initial design of the instrument included 225 statements expressive of disposition toward or away from using CT, using a Likert style agrees-disagree prompt. Each CCTDI item requires the test-taker to form a judgment about the best responses, from those provided, to a question involving an everyday situation or problem. The initial statements were refined through focus group conversations and narrowed to 150 items.

Next, a pilot test was administered to a random sampling of the target population (10<sup>th</sup> graders, accounting and nursing professionals, and college students). This yielded the final tool, which consisted of 75 total items. Given that this instrument was multidimensional in nature, it did not measure a singular construct, but a long list of 7, 12, 72 or more different dispositions and correlative dispositions. The researchers determined that the Cronbach-alpha of 0.9 was an acceptable reliable measure for the CCTDI (Facione, et al., 2000).

In addition to the development of the CCTDI, Falcione et al. (2000) developed the California Critical Thinking Skills Test (CCTST) which analyzes cognitive skills relating to analysis, inference, evaluation, and inductive and deductive reasoning. The CCTST contains 34 items, each with four response options. One of the items is correct and each correct answer is assigned one point. The researchers established test norms ranging from 2 to 29, with a standard deviation of 4.46. The mean was reported to be 15.89.

Hence, a score of  $< 15.89$  represents a weakness in critical thinking skills, while a score of  $> 15.89$  represents a strength in critical thinking skills. The reliability was specified as 0.68 to 0.70, using the Kuder-Richardson internal reliability coefficient. The researchers concluded that a strong overall disposition toward critical thinking is integral to the use of critical thinking skills.

An empirical study that utilized the California Critical Thinking Disposition Inventory (CCDTI) and the California Critical Skills Test (CCST) developed by Facione et al. (2000) was conducted by Shin, Jung, Shine and Kim in 2006 for the purpose of investigating the critical thinking dispositions and skills of senior nursing students in selected regions of Korea. The title of the study was *The Critical Thinking Dispositions and Skills of Senior Nursing Students in Associate, Baccalaureate, and RN-BSN Programs*. The researchers conducted a comparative study of the critical thinking dispositions and skills of students in three-year (ADN), four-year baccalaureate (BSN), and five year RN-to-BSN programs. Shin et al.'s (2006) literature review was thorough and current, including such seminal works as the "Delphi Report" reported by the American Philosophical Association in 1990 and the Facione et al. studies relating to critical thinking conducted in 1991, 1994 and 2000. Research questions were clearly presented, yet no hypotheses were specified.

The research design was non-experimental, utilizing a convenience sampling from students enrolled in ADN ( $n = 137$ ), BSN ( $n = 102$ ), and RN-to-BSN ( $n = 66$ ) programs in Seoul, Gyeonggi Province, North Chungcheong Province, and North Jeolla Province in South Korea. Ethical aspects of the study included formal written permission from all participating educational facilities and students. The importance of anonymity and

confidentiality of the data was stressed. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 10.0. The reliability of the CCTDI and the CCTST were reported as being calculated using Cronbach's alpha, but no specific percentages were cited.

Shin et al. (2006) determined that there was a significant positive correlation between CCTDI scores and CCTST scores of all participants in the study and that the five-year program students scored significantly higher on each instrument than the four-year program students, followed by the three-year program participants. However, the data revealed that the mean scores for all nursing students taking the CCTST was 11.36, thus falling short of the 15.89 mean established by Facione et al. (2000). Shin et al. (2006) concluded that the lower scores were attributed to the lack of an educational environment in Korean schools that promoted critical thinking.

A notable strength of this study was that it addressed a significant problem in the development of curriculum in South Korean nursing programs—the lack of focus on the development of critical thinking skills—which are essential skills in contemporary nursing practice. An additional strength was a comprehensive literature review and the use of well-developed instruments. The study added to the knowledge base about the mutually reinforcing relationships between critical thinking dispositions and critical thinking skills and supported the research findings of Facione et al. (2000, 2007).

The *Ennis-Weir Critical Thinking Essay Test* is another general test of critical thinking, although distinct in that it is in *essay* format. In the Ennis-Weir Critical Thinking test, the test-taker is presented with a complex argument in the form of a letter to a fictitious newspaper editor about a familiar problem. The test-taker is required to

read and evaluate the arguments presented in the letter, then write a response that defends their judgments. Naturally, this structure allows for a more open-ended response. The test is based on Ennis's (1985) definition of critical thinking as "reasonable and reflective thinking that is focused upon deciding what to believe or do" (1962, p. xvii).

The authors of the Ennis-Weir Critical Thinking Essay provide sufficient criteria for assessing the students' responses. However, they do not provide specific information regarding the test's content validity. The reported reliability estimates, which are based on interrater comparisons, are .86 and .82. The Ennis-Weir test has advantages over other multiple choice assessments of critical thinking, in that it allows the test-taker to creatively formulate responses and defend them. Werner (1991) contends that, while this measure *expands* the ability to analyze the critical thinking skills of the test-taker, the process is considerably more time consuming in nature. Furthermore, the open-ended makeup of the responses incurs more subjectivity in assessment and thus, a lack of standardization, making this measure less effective as a formal comparison of student responses, yet one that still provides a rich diagnostic tool (Werner, 1991).

An empirical study that combines the use of the Ennis-Weir Critical Thinking Essay Test, along with the California Critical Thinking Disposition Test, was reported by Reed and Kromrey (2001). The purpose of this study was to assess the effect of infusing Paul's (1993) model of critical thinking into a one-semester U. S. history course for community college students. The researchers contend that the model of critical thinking developed by Paul was chosen because of its "sound historical and theoretical base (drawing on both philosophical psychological approaches to critical thinking); its general applicability to improving both academic and real world reasoning; its appropriateness



for infusion into any course material; and its concern with intellectual criteria and dispositional attributes in addition to thinking skills” (Reed & Kromrey, 2001, p. 3).

The research design was experimental, utilizing participants from four sections of a U.S. history class (1877 to present), at a moderate-sized community college in central Florida. Two sections were randomly selected as experimental groups, while two served as control groups. The experimental group (n = 29) consisted of 20 females and 9 males, including 21 students under 22 and eight students who were 22 years of age and older. The control group (n = 23) consisted of 14 females and nine males, with 15 students under 22 and 8 students 22 and older. All groups were given pretests and posttests including an Advanced Placement History examination, the Ennis-Weir Critical Thinking Essay Test, the California Critical Thinking Disposition Inventory, and a History Content Exam. Reed and Kromrey’s (2001) literature review was thorough and current, particularly in the review of the Paul’s model for critical thinking. According to Paul (1993), there are eight elements or building blocks central to any reasoning process: 1) the purpose of the thinking, 2) the question at issue or problem to be solved, 3) fundamental concepts (e.g., ideas, theories, and principles), 4) information (data, facts, observations), 5) point of view (frame of reference, perspective), 6) inferences (interpretations, conclusions, solutions), 7) assumptions (notions taken for granted), and 8) implications (consequences).

This study was the first empirical test of Paul’s (1993) model, focusing on the effectiveness of the model to enhance critical thinking skills. Paul’s approach to critical thinking was modeled and encouraged by the researcher, who also served as instructor. With the exception of training in Paul’s (1993) model, all of the participants used the

same textbook, received the same assignments, and took the same exams. Students in both the experimental and control groups took the Ennis-Weir Exam, the CCTDI, and the History Content Exam as pretests at the beginning of the semester and again as posttests at the end of the semester. The researchers argued that the reliability and validity of all the tests had been rigorously reviewed, but did not expressly specify the results in the study. Data analysis included descriptive statistics to summarize achievement scores at the beginning (pretest) and end (posttest) of the course and an ANCOVA using pretests as covariates to determine if group means differed significantly from each other. The findings of the study were that the experimental group scored statistically significantly higher than the control group on the essay instrument, the Ennis-Weir Exam. There were, however, no significant differences found on the participants' CCTDI or the test for history content knowledge. The strength of the study is that the tests used were, indeed, standardized instruments with a history of accepted content validity and reliability. Despite the limitations of a small sample from a single institution, the practical implications of the study are noteworthy. The researchers thus maintain that replication is needed. Variables such as age, gender, ethnicity, or socio-economic status might be considered in future studies of this nature.

The instrument used for the purpose of assessing critical thinking in this study is the Florida Comprehensive Achievement Test (FCAT). The FCAT is part of Florida's overall plan to increase student achievement by implementing higher standards. The FCAT is administered in grades 3-11 and is based on benchmarks in the Sunshine State Standards (SSS), which identify knowledge and skills students are expected to acquire at each grade level, with an underlying expectation that students also demonstrate *critical*

*thinking* (Florida Department of Education, 2008). Prior to 2004, the cognitive-level classification system of FCAT items was based upon Bloom's Taxonomy. From 2004 to the present, however, FCAT items are now classified using the Webb Depth of Knowledge model (Florida Department of Education, 2008).

Internal consistency reliabilities for the FCAT are reported using two methods, Cronbach's alpha and Item Response Theory (IRT) marginal reliabilities (Florida Department of Education, 2007), (FLDOE). For the FCAT reading measure, coefficient alpha reliabilities for 2001-2003 were as follows: 2001, .80; 2002, .80; and 2003, .78. The FCAT mathematics coefficient alpha reliabilities for 2001-2003 were: 2001, .79; 2002, .77; and 2003, .76 (FLDOE, 2007). With satisfactory FCAT Reading and Mathematics coefficient alphas, the FCAT scores will be used to answer the research questions and test the hypotheses using regression analysis.

### **Teaching of Critical Thinking Skills**

An educational system focused on "the elusive statistical chase of mandated testing has caused a crisis in the field of workforce development" (Stevens, 2005, Statement of Problem section, para. 1). Today's jobs require higher critical thinking skill levels than in the past. Naturally, the responsibility of the educational community is to fulfill these essential requirements of the contemporary workplace.

A question asked by van Gelder (2005) is: Should the focus of education be training for the enhancement of critical thinking skills? "Almost everyone agrees that one of the main goals of education, at whatever level, is to help develop general thinking skills, particularly critical-thinking skills" (van Gelder, 2005, p. 1). Clearly, the most effective way to develop any skill is to engage in continuous, deliberate practice of that

skill. If students are to be able to engage in critical thinking, then a fundamental requirement would be to include exercises requiring critical thinking in both school and professional development curricula, in our instructional assignments, and in our educational assessments (Facione, Facione & Giancarlo, 2000).

Critical thinking does not necessarily require being taught in a course specifically designed to teach thinking skills but can be developed in each subject matter content. The appropriate learning scenario is one in which “learners are active; they ask questions, seek information, link it to a relevant question, and are able to tolerate ambiguity and uncertainty” (Pithers & Soden, 2000, p. 243). Teachers in every discipline should continually encourage students to reflect on and analyze their ideas.

An emphasis on critical thinking skills during instruction can be traced back to the philosopher John Dewey, who wrote on the importance of reflective thinking in the educational process (Dewey, 1934). Although current educational theorists use different terminology from Dewey’s, the idea of developing students’ critical thinking skills continues to be a central goal of the educational process. “Despite all of the difficulties in assessing gains in critical thinking, there is a diverse body of evidence showing that thinking can be improved with instruction that is specifically designated for that purpose” (Halpern, 1993, The Evidence section, para. 1).

## Arts Education

### Characteristics of Visual Art Education

Oddleifson (1994) provides the following description of visual art education:

The arts are cognitive domains that trigger multiple forms of learning by engaging students in long-term, open-ended projects that integrate production of original works with perception of the work of others. Effective arts education, using such open-ended projects, is an important model for all educators. It involves a process of critique of and reflection on one's own work, and it naturally produces exhibitions, portfolios, and performances that are more meaningful than other, more traditional forms of assessment. Arts education holds promise for community development by enhancing cultural and civic pride, fostering intercultural understanding, and giving professionals in the community opportunities to mentor public school students. (p. 450)

Art education introduces students to new ways of expressing ideas and emotions. Furthermore, art serves as a vehicle by which students can learn about and understand their own culture, as well as other cultures. “The overarching goal of visual arts teaching is to enrich students’ lives with a set of lifelong skills, perspectives, sensibilities, and understandings that enhance their ability to know, see and relate to experiences through the arts” (The National Board of Professional Teaching Standards for Art, 2008, Goal section, para. 2). Creating art gives students the opportunity to “encounter and value different perspectives in their own thinking” through collaboration and peer critique (Davis, 2005, p. 14).

Visual art is often viewed from an idiosyncratic perspective—purely an aesthetic pursuit. Ironically, the arts are frequently dismissed as merely emotional, not cognitive. “Their emotional content is the part that makes them so cognitively potent” (Rabin & Redmond, 2006, p. 63). Hence, art education is an intellectual discipline of substance because it involves the use of complex symbols to communicate, similar to language or mathematics (Murfee, 1996, *The Arts are Rigorous* section, para. 2).

### **Characteristics of Music Education**

In the past several decades, neuroscientists have intensified their research into music and its role in the developing brain. The buzzword “Mozart Effect” has been mentioned often in mainstream popular media, drawing attention to music education and its impact on childhood neurological development. The term “Mozart Effect” arose from the work of the research team of Shaw and Rauscher (1993, 1999) and their colleagues at the University of California, Irvine. The “Mozart Effect” refers to the finding that passive listening to music composed by Mozart produces temporary increases in spatial abilities (Shaw, 1999; Shaw & Rauscher, 1993; Hetland, 2000).

Besides the short-term effects of listening to music, however, the primary efforts of Shaw and Rauscher (1993) focused on exploring the link between music and intelligence. The research team conducted a two-year experimental study in 1994 including four groups of preschoolers: one group received private piano/keyboard lessons; another group received singing lessons; a third group received private computer lessons; and one group received no training. The children who received piano/keyboard training performed 34% higher on tests measuring spatial-temporal ability than the other groups. Thus, the researchers assert that music training, specifically piano instructions, is

far superior to computer instruction in dramatically enhancing children's spatial-reasoning abilities, as well as generating neural connections that are used for abstract reasoning, particularly those necessary for understanding mathematical concepts. Additionally, Shaw authored a book, *Keeping Mozart in Mind*, (1999) that reiterated his 25 years of research relating to the study of music and the subsequent impact on higher brain functioning such as spatial-reasoning abilities. Spatial-temporal agility is an important component of mathematical ability and aptitude (Hetland, 2000; Shaw & Raucher, 1993; Shaw, 1999). Shaw's research findings are supported by those of Schellenberg (2004), who states that "music lessons involve long periods of focused attention, daily practice, reading musical notations, memorization of extended musical passages, learning about a variety of musical structures (e.g., intervals, scales, chords, chord progressions), and progressive mastery of technical skills (i.e., fine motor skills). This combination of experiences could have a positive impact on cognition, particularly during the childhood years, when brain development is highly plastic and sensitive to environmental influences" (p. 511).

Catterall, Chapleau, and Iwanaga (1999) were also interested in exploring involvement in music. Their 1999 study for *Champions of Change: The Impact of the Arts on Learning* suggests that certain kinds of musical experiences, especially keyboard training, seem to produce effects on cognitive functioning in children with regard to enhanced mathematical reasoning skills.

Furthermore, researchers such as Butzlaff (2000) and the team of Douglas and Willats (1994) contend that there are several possible reasons to hypothesize that instruction in music may help children acquire *reading skills*. According to Douglas and

Willats (1994), "Skill in reading requires a sensitivity to phonological distinctions and skill in music listening requires a sensitivity to tonal distinctions. Experience in listening to music trains a general kind of auditory sensitivity that is as useful in listening to music as it is in perceiving phonological distinctions." (p. 99). The researchers argue that being exposed to a structured program in music may help children develop a "multi-sensory awareness and response to sounds" (p. 99).

"Music and written text both involve formal written notation which must be read from left to right. In both cases, the written code maps onto a specific sound. Perhaps practice in reading music notations makes the reading of linguistic notation an easier task" (Butzlaff, 2000, p. 167). Butzlaff (2000) conducted a meta-analysis of six experimental and 25 correlational studies that were all designed to test the hypothesis that music study enhances reading improvement. Butzlaff (2000) retained only studies for the meta-analysis that met the following three criteria: a standardized measure of reading ability was used as the dependent variable; a test of reading followed music instruction, and statistical information was sufficient to allow for the calculation of an effect size. Studies that randomly assigned children to music vs. control groups and that assessed reading ability before and after exposure to music were classified as experimental. In all of the correlational studies, reading performance by students with some music experience was compared to reading performance by students without music experience.

Butzlaff (2000) used the Pearson Correlational Coefficient  $r$  as a measure of effect size. In order to account for the non-normal distribution of  $r$ , all of the calculations in the analyses were performed on Fisher transformed  $r$ s which are signified by  $Zr$ . The mean effect in the meta-analysis was reported as  $r = .17$ , with weighted mean  $r = .19$ . The



measure of robustness suggested by Rosenthal (1991) yielded .94. The researcher contends that “this result is highly significant and allows clear rejection of the null hypothesis of no relationship between music and reading. In addition, the *t*-test of the mean *Zr* was significant, with  $t = 4.2$ ,  $df = 23$ ,  $p < .001$ ” (Butzlaff, 2000, p. 169).

### **Characteristics of Drama Education**

Expressive language skills used by students who participate in drama coursework reveal and develop the ability to speculate, imagine, predict, reassure, and evaluate their own learning, in other words, higher order thinking skills. (Critical Links: Learning in the Arts and Student Achievement, 2002). Furthermore, high levels of involvement in theater correlate to high levels of achievement in reading proficiency (Champions of Change, 1999).

Podlozny (2000) conducted a meta-analysis of studies related to the impact of drama on student achievement. Of 200 identified studies, 80 were chosen based on criteria that included having at least one measure of verbal achievement, being experimental in design, and having sufficient information for an effect size to be calculated. Seven verbal outcomes were examined: (1) story understanding (oral measures), (2) story understanding (written measures), (3) reading achievement, (4) reading readiness, (5) oral language development, (6) vocabulary, and (7) writing.

Podlozny states that the following nine hypotheses were tested relating to factors that might be associated with larger vs. smaller effect sizes:

1. *Type of Plot*. It was predicted that studies in which participants act out a structured story would be associated with larger effect size than those using unstructured enactment.

2. *Role of Leader.* The researcher asserts that studies with leaders “in role” should produce larger effect sizes than those with teachers as facilitators or removed.
3. *Degree of Transfer.* It was predicted that studies in which participants were tested on the stories that they acted out (direct outcomes) should be associated with larger effect sizes than stories not enacted (transfer outcomes).
4. *Amount of Drama Instruction.* The hypothesis tested was that the more drama instruction, the stronger the effect.
5. *Age.* Studies with younger children were predicted to have larger effect size, as the belief held by previous researchers was that learning occurring at younger ages may be more easily influenced by drama.
6. *Type of Population.* It was predicted that children from low socioeconomic strata (low SES) or learning disabled populations should be associated with higher effect sizes.
7. *Study Design.* It was hypothesized that pre-experimental and quasi-experimental studies should have larger effect sizes than true experiments.
8. *Publication Status.* It was hypothesized that published studies would have larger effect sizes than unpublished studies.
9. *Publication Date.* The researcher sought to replicate finding of Kardash and Wright (1986), which determined that earlier studies had larger effect sizes than more recent studies (Podlozny, 2000, p. 245).

“The meta-analyses that Podlozny conducted relating to the effects of classroom drama exercises showed positive effects on language development including written and oral story recall, reading achievement, reading readiness, oral language development, and writing” (Critical Links, 2002, p. 47). Podlozny (2000) reports the results of the first meta-analysis (*Oral Measures of Story Understanding/Recall*) as an average effect size of  $r = .24$ ;  $p < .001$ , and  $t$ -test of means  $Zr = 4.99$ , which indicate that the average effect size of studies assessing the relationship between drama instruction and story understanding as determined by oral measures is moderately large with substantial practical implication.

“Perhaps the most important finding is that studies in which students were tested directly on the stories they had enacted had effect sizes larger than studies in which students were tested on new material. The finding that enacting one text makes a new text more comprehensible demonstrates the power of drama to develop text comprehension skills that transfer to new materials” (Podlozny, 2000, p. 248).

In Podlozny (2000) reporting of the results of the second meta-analysis (*Written Measures of Story Understanding/Recall*) the average effect size was  $r = .50$ ;  $p < .001$ , and  $t$ -test of mean  $Zr = 3.91$ . The researcher contends that these results show that the chance of the null hypothesis being true (i.e., that there is no relationship between drama and story understanding) is less than  $p = .001$ ; therefore, a conclusion can be drawn that there is a relationship between drama and story understanding in the form of written measures. “The effect size of studies assessing the relationship between drama instruction and written measures of story understanding was shown to be nearly double of studies assessing the story understanding by oral measures. Why should this be? One possibility

is that written measures are more accurate measures of text comprehension” (Podlozny, 2000, p. 248).

The third meta-analysis, consisting of 20 studies, investigated reading achievement as measured predominantly by standardized tests (including the Metropolitan Achievement, the Iowa Test of Basic Skills, the California Achievement Test, and the Stanford Diagnostic Test) (Podlozny, 2000, p. 252). The participants were never tested on the stories that they directly acted out; instead, they participated in the drama treatment and then took an unrelated test that required transfer of any reading comprehension skills they had gained during the drama instruction. “The reading achievement studies yielded an average effect size  $r = .20$ ,  $p < .001$ , which allowed us to reject the null hypothesis and conclude that there is a relationship between drama instruction and reading achievement” (Podlozny, 2000, p. 252).

A fourth meta-analysis examined 18 studies assessing the affects of drama instruction on reading readiness in young children. For these studies, reading readiness was measured mainly by scores on standardized tests including the following: Metropolitan Readiness Test, the Head Start Measures Battery, Clay’s Concepts About Print, and the Peabody Picture Vocabulary Test (Podlozny, 2000, p. 254). Again, in these studies the children were not tested on stories that they actually acted out, but on new materials, looking for the transfer of skills acquired through drama. The reading readiness studies produced an average effect size of  $r = .25$ ,  $p < .001$ , and  $t$ -test of the mean  $Zr = 4.38$ , thus allowing the researcher to reject the null hypothesis. The researcher also concluded that it is possible that the effect of the length of treatment may vary as a function of age. In other words, “younger children may need the cumulative effect of

drama in order for the treatment to *take* whereas older students may *get it* more quickly, and therefore need less time with drama instruction” (Podlozny, 2000, p. 256).

The fifth meta-analysis investigated studies assessing the effect of drama instruction on oral language development in children ranging in age from pre-K to seventh grade, measured by standardized test or speech samples coded for a wide range of variables. As in the other studies, participants were assessed for degree of transfer of skills to new materials. The researcher reports that in a typical study using standardized tests to measure oral language development, the treatment and control groups both participated in daily reading activities. However, the treatment groups then engaged in critic dramatics, such as storytelling, role-playing puppetry, and discussion, while the control groups did not. After the treatment period, both groups were tested for oral language development through standardized tests. The particular standardized tests used were not identified. The oral language development studies yielded an average effect size of  $r = .30$ ,  $p < .001$  and  $t$ -tests of the mean  $Zr = 5.22$ , which leads the author to conclude that there is a relationship between drama instruction and oral language development. “This analysis indicated that the average effect size of studies assessing the relationship between drama instruction and oral language development is small in size yet still has practical implications. Because drama encourages children to use language in varied ways, it makes sense that drama instruction might lead to improved oral language skills” (Podlozny, 2000, p. 259).

The sixth meta-analysis examined 10 studies assessing the effects of drama instruction on vocabulary achievement as measured by standardized tests and experimenter-designed vocabulary tests. In a typical study, participants in the treatment

group participated in creative drama activities, including role play, pantomime, movement and rhythm activities, and improvised dialogue, while the control group continued with its regular classroom activities. After the treatment period, all students were given standardized tests designed to measure vocabulary achievement. Podlozny (2000) states the results as yielding an average effect size of  $r = .06$ ,  $p = .002$ , and  $t$ -tests of the mean  $Zr = 1.01$ , allowing the researcher to conclude that there is not a reliable relationship between drama instruction and vocabulary development.

The seventh and final meta-analysis explores eight studies assessing the effects of drama instruction on writing achievement as measured primarily by writing samples of children in grades 1-9. Podlozny (2000) states that writing samples were coded by a wide range of variables, including audience awareness, use of beginning-middle-end, organization, structure, and elaboration. In some studies students were asked to write about stories that they had acted out; in other studies, children were asked to write about new materials to assess transfer of skills acquired in drama to material outside of drama. In a typical study, subjects in the drama condition first participated in a discussion on aspects of narrative writing, then engaged in improvisation, pantomime and movement activities, developed story ideas, role-played the ideas, improvised main scenes, and then drafted their stories. The control group also participated in a discussion on narrative writing, but then continued with their regular language arts program. All of the drafts were then analyzed according to a narrative writing scale. The authors of the scale were not mentioned by the researcher. Podlozny (2000) notes that the writing achievement studies yielded an average effect size of  $r = .29$ ,  $p = <.001$ , and  $t$ -tests of the mean  $Zr =$

3.08, which allowed the researcher to reject the null hypothesis and conclude that there is a relationship between drama instruction and writing achievement.

A strength of all of the studies so far described, as well as this study, is that they were based on meta-analyses. In addition, in this study the hypotheses were clearly stated and a high level analysis was presented. A weakness was that validity and reliability of the scales that the researchers employed were not mentioned. In fact, some of the scales were not listed. The meta-analyses does, however, contribute to the literature base about the importance of drama instruction's impact on student achievement and power to foster skills that can transfer to new materials.

### **Theories of Unique Qualities of Arts Education**

*Champions of Change: The Impact of Arts on Learning* (1999) represents an initiative in cooperation with The Arts Education Partnership (an extension of *Goals 2000*) and the President's Committee on the Arts and Humanities. The cumulative report spans over two years of research conducted by seven teams of researchers using both qualitative and quantitative data based on investigating a variety of arts education programs and their impact on student achievement. The teams worked under the auspices of the following: The Imagination Project at the University of California; The Carnegie Foundation for the Advancement of Teaching at Stanford; The Center for Arts Education Research at Teachers' College, Columbia University, and The Chicago Arts Partnership in Education (CAPE). Ultimately, all of the reports came to the conclusion that in addition to enhancing motivation and skills specific to the particular art, the involvement in arts education could play a vital role in students learning *how* to learn, "an essential ability for fostering achievement and growth in their lives" (Preface section, para. 4).

Gardner, in his *Theory of Multiple Intelligence* (1984) formulated a list of seven intelligences that he defines as:

- Logical-Mathematical Intelligence, consisting of the ability to detect patterns, reason deductively, and think logically
- Linguistic Intelligence, which involves having a mastery of language
- Spatial Intelligence, giving one the ability to manipulate and create mental images in order to solve problems
- Musical Intelligence, encompassing the capability to recognize and compose musical pitch, tones, and rhythms
- Bodily-Kinesthetic Intelligence, or the ability to use one's mental abilities to coordinate one's own bodily movements
- Personal Intelligence, including sensitivity to interpersonal feelings and intentions of others and, finally intrapersonal intelligence, the ability to understand one's own feelings and motivations.

Gardner (1984) claims that the seven intelligences very rarely operate independently. Rather, the intelligences are used concurrently, and typically complement one another as individuals develop skills or solve problems. An implication of this theory for educators is that all seven intelligences are needed to productively function in society; thus they should be thought of as equally important. Consequently, teachers should recognize the importance of teaching toward a broader range of talents and skills beyond those involving verbal or mathematical intelligences.

Eisner (2005, 2002, 1998), a colleague of Gardner's at Stanford who has spent a distinguished career contributing to literature on arts education, argues that the arts are



cognitive activities guided by human intelligence. Eisner posits the following support for student involvement in arts education:

In life, no comparable “correct” exists. There is no single answer to an artistic problem—there are many. There is no procedure to tell the student with certainty that his or her solution is correct.... One must depend on that most exquisite of human capacities: judgment. The exercise of judgment in creating artistic images or appreciating all the arts in turn depends on developing the ability to cope with ambiguity, to experience nuance, and to weigh the tradeoffs among alternative courses of action (p. 15).

In the arts classroom, students draw from a range of intelligences and learning styles. In contrast, the focus of traditional academic courses is most predominately based solely on the linguistic and logical-mathematical intelligences (Murfee, 1996, *The Arts Have Potential* section, para. 1).

Because arts education has an emphasis on creative discovery, this is a course of study that naturally stimulates students’ interest and motivation for learning. According to Murfee (1996), this is particularly so for struggling or at-risk students, who often experience success for the first time in an arts program. Murfee (1996) makes the following analogy:

Sometimes the student who is not doing well in traditional academics has an artistic talent that has not yet flowered.... Imagine what might happen to Leonardo da Vinci today if he were placed in the average American public school. This illegitimate son of a poor woman, a left-handed writer who loved to draw and challenge conventional thought, would be labeled an at-risk special education candidate.... Schools with an

integrated arts curriculum might be better able to address the needs of students like da Vinci (p. 12).

Participating in the arts allows students to gain insight into the deeper meaning of culture, their own and that of others. “From an artistic perspective, adolescents can grapple with personal and cultural conflict, interpret emotive and expressive intent, identify common elements in disparate cultural presentations, and locate the self in a complex of world views” (Diket, 2003, p. 174). Study of the arts requires students to make judgments, without the benefit of exact rules. “The exercise of judgment in the absence of rule is one of art’s most demanding challenges” (Eisner, 2005).

Smithrim and Upitis (2005) conducted an empirical study to investigate the relationship between an arts education approach, entitled *Learning through the Arts* (LTTA) and student achievement and attitudes. The sample population included over 6,000 Canadian elementary students, teachers, administrators, and parents in LTTA schools and control schools. The research design was quasi-experimental and the sample consisted of schools recommended by the districts that agreed to allow all students, grades one through six, to participate for the entire three-year study. The independent variable was participation or nonparticipation in the arts education program. The researchers selected a random sample of approximately 650 students per grade level from the 11 schools involved in the study.

Quantitative and qualitative data were gathered both at the onset of the study and after three years. The instrumentation was reported to be standardized achievement tests, writing samples, surveys, one-on-one interviews, and focus group interviews. The researchers reported establishing six research objectives over the three-year period, but

only presented two of those objectives in the study, both of which related to the discovery of evidence relating to the positive change in attitudes and achievement, specifically in mathematics and language in students participating in LTTA schools.

The Smithrim and Upitis (2005) literature review was current and adequately extensive to establish significance for the study. A strength of the study was that the research complemented and expanded prior research on arts education. The use of control schools allowed for comparison between LTTA schools and other schools. Furthermore, the collection of qualitative data reinforced positive outcomes of the quantitative data.

The researchers used SPSS software to analyze the quantitative data, conducting double data entry for 10% of the data to ensure accuracy and consistency in data entry. Analysis of qualitative data, such as transcribed interview field notes and audiotapes, was conducted utilizing ATLAS.ti software. Statistical analysis, such as cross tabulations, *t*-tests, and analyses of means, were used and in cases where significant group differences were found in the means analyses, regression analyses to determine effect sizes were conducted.

An additional strength of the study was the establishment of no baseline differences in socioeconomic status, achievement, attitudes towards school, participation in the arts, or parental values toward the arts in the LTTA and control schools. Smithrim and Upitis concluded that one of the most important findings of the study was that students' involvement in the arts in the LTTA schools did not come at the expense of achievement in mathematics and language. The researchers also concluded that there was a moderate but statistically significant positive effect on student achievement on math tests dealing with computation in the LTTA schools, these gains being attributed to

enhanced ability to stay engaged in a task, which was promoted by involvement in arts education. A noteworthy discovery, however, was that this difference did not occur until after three years of participation in the program. Thus, the effects evolved gradually, not immediately.

Smithrim and Upitis's recommendation for further study is the need for more longitudinal research to determine if the positive changes in math scores for LTTA students were long lasting. Also, they present the proposition that, although no significant differences in language measures between the control schools and LTTA schools were established in this particular study, these differences might also appear over more time.

Lampert (2006) conducted a correlational study for the purpose of investigating the variance in critical thinking dispositions between arts and non-arts college undergraduates. The study, entitled *Critical Thinking Dispositions as an Outcome of Art Education*, utilized the California Critical Thinking Disposition Inventory (CCTD), a quantitative survey instrument, developed by Facione (2000). No research questions or hypotheses are specified.

Lampert's literature review adequately provides significance for the study in the realm of current critical thinking research, yet points out that, while there is an abundance of theoretical discussions on art education, few empirical studies have actually been conducted to test the theories. A strength of the study, therefore, is the attempt to close gaps in the research by lending empirical support to current art education theories. The theoretical basis for the study is found in the work of Dorn (1999), Eisner (1998), and Geahigan (1997).

Data for this study were collected from a convenience sample of 141 undergraduates at a large, urban, public university on the U.S. east coast. The sample consisted of two discipline groups: arts and non-arts undergraduate students and two class rank groups: freshmen and junior/seniors. A two-way ANOVA was utilized to compare CCTDI scores between the two discipline groups and the two class rank groups. Although no statistically significant differences in mean total CCTDI scores were found among the four individual groups, the juniors and seniors were found to have a significantly higher mean score than the freshmen ( $p = .015$ ) and art students scored significantly higher than all non-arts students on three of the subscales of the CCTDI: truth-seeking ( $p = .009$ ), critical thinking maturity ( $p = .002$ ), and open-mindedness ( $p = .032$ ). No measures for reliability or validity were provided.

Lampert states that causality was not an aspect of the study, but concludes that the scores indicate that exposure to the inquiry-based instruction in the arts enhance the disposition to think critically. The author's conclusions correspond with those of other art education research, yet are not adequately supported. A reported limitation of the study is its limited scope and range, and a suggestion that the author makes for further study is the development of a large-scale longitudinal study that compares samples from multiple institutions and correlates results from several measures.

In summary, the strength of this study is that it supports prior research findings relating to inquiry-based arts education's impact on critical thinking. Major weaknesses are the limited sample size, no research questions or hypotheses, and no reference to validity or reliability. A further threat to external validity would be the weakness of generalization to other populations. Further studies would benefit from the development

of measures for reliability and validity; a broader sample population, including secondary school as well undergraduate level students; and replication.

Winner and Hetland (2000) conducted a comprehensive meta-analysis of 188 studies carried out between 1950 and 1999. The studies review systematically what is known about the power of the arts to promote learning in non-arts domains. Each review is based on a comprehensive search of studies, both published and unpublished. The researchers believe that effect size is critical data and assert that meta-analysis is the method of choice for summarizing research and explaining what can and cannot be concluded. The results of this meta-analysis document “potential causal relationships between studying an art form and some area of non-arts achievement” (Winner & Hetland, 2000, What Do We Know section, para. 2).

A study that investigated the possibility that exposure to the arts might lead to overall cognitive growth, consequently leading to higher academic achievement, was conducted by Vaugh and Winner in 2000 and entitled: *SAT scores of Students Who Study the Arts: What We Can and Cannot Conclude about the Association*. The study was prompted by a report of data collected and released by the College Board which maintained that students who study the arts in high school have higher SAT scores than those who do not study the arts. The relationship between arts courses and SAT scores has been documented by the College Board since 1987 and is based on a very broad sample, all students taking the SAT who voluntarily respond to the Student Descriptive Questionnaire (SDQ) as part of the registration process. The College Board reports that between 94% and 95% of all students taking the SAT fill out at least one item on the questionnaire. Item #1 on the questionnaire requires students to fill in ovals relating to

total number of courses (none taken through over 4 taken) in specific subject areas that they have taken in grades 9-12, including a category for “Arts and Music.” The questionnaire lists examples under this category as art, music, art history, and theater.

Vaugh and Winner analyzed 12 years of data, from 1987 to 1998, comparing scores of students who indicated having taken zero, one, two, three, four, or over four years of arts courses on the SDQ. The authors used a one-way ANOVA with levels of arts experiences as the between-subject factor, revealing a significant effect of levels of arts experience ( $F = 93.977$ ,  $MSE = 83.791$ ,  $p < .0001$ ). A contrast analysis revealed scores of students with zero, one, two, or three years of arts experience to be significantly lower than scores of students with four and over four years of arts experience ( $F = 426.544$ ,  $MSE = 83.791$ ,  $p < .0001$ ). Thus, the researchers contend that composite SAT scores increase linearly from zero to three years of arts experience, and then rise sharply. Also concluded, after independent *t*-tests for verbal and math scores were run separately, were that the verbal and math SAT scores of student taking any form of art, irrespective of number of years, was significantly higher than for students who take no art (Vaugh and Winner, 2000). Hence, Vaugh and Winner concluded that: “Our analyses demonstrate that students who take any kind of art course in high school have higher SAT scores (both math and verbal) than students who do not take arts coursework.”

A study conducted in 2008 by the Florida Department of Education (FLDOE) involving the relationship of arts coursework and student achievement confirms national studies, such as Catterall (1999) and Vaughn and Winner (2000): the more arts credits taken aligned with better student achievement on SAT and FCAT and also correlated with a greater likelihood of high school graduation. The FLDOE study data reflected that

for students taking no arts credits, the mean Mathematics scores were 520, which also was the mean for students taking 1-1.5 credits. However, students' mean Mathematics scores jumped to 530 for those taking 2-2.5 credits of arts and rose to 540 for those taking 3-3.5 credits of arts. Finally the Mathematics mean scores for students taking 4 or more credits of arts were 560, a 40 point increase. The relationship between Reading FCAT scores at level three (at grade level) and above increased progressively from 30% for students with no arts credits to 62% for students with four or more arts credits. Finally, the percentage of seniors failing to graduate from a Florida public high school in the 2007-2008 school year decreased progressively from 28% for students with no arts credits to 4% for students with four or more arts credits. (www.faea.org.)

The data drawn from the 2008 cohort of the state of Florida 12<sup>th</sup> graders conducted by FLDOE illustrate the following:

- For the general population, the more music and arts classes taken, the higher student achievement by all measures (SAT, FCAT Reading, Writing, and Mathematics).
- For students on “free and reduced lunch,” an indicator of socioeconomic levels, the more music and arts classes taken the higher the student achievement in all measures (SAT, FCAT Reading, Writing, Math).
- For students divided by ethnicity, the more Music and Visual Arts classes taken, the higher the student achievement in all measures.
- The more Arts classes taken, the less likely a student is to drop out of the cohort group.



“Given these measures (graduation rate, SAT, FCAT Reading, Writing, and Math) are the primary means established by the Department of Education and the Legislature for evaluating student achievement, and given that the arts have a significant, positive impact, we must conclude that the arts are an important element of the curriculum” (Wise & Detert, 2009, p. 1).

A synopsis of the literature on critical thinking and arts education follows. Conclusions were drawn with strengths from which the current study was developed and weaknesses and gaps in the literature that the current study addresses.

### **Synopsis of the Literature**

Empirical research has shown that there is a positive relationship between involvement in arts education and enhanced critical thinking performance (Butzlaff, 2000; Catterall, Chapleau, & Iwanaga, 1999; Douglas & Willets, 1994; Lampert, 2006; Podlozny, 2000; Shaw & Raucher, 1993; Smithrim & Upitis, 2005; Vaughn & Winner, 2000). *Champions of Change: The Impact of Arts on Learning* (1999) represents an initiative in cooperation with The Arts Education Partnership (an extension of *Goals 2000*) and the President’s Committee on the Arts and Humanities. The cumulative report using both qualitative and quantitative data spans over two years of research conducted by seven teams of researchers who investigated a variety of arts education programs and their impact on student achievement. Ultimately, all of the reports came to the conclusion that, in addition to enhancing motivation and skills specific to the particular art, the involvement in arts education played a vital role in students learning *how* to learn, “an essential ability for fostering achievement and growth in their lives” (Preface section, para.

The teams of Shaw and Rauscher (1994) and Catterall, Chapleau, and Iwanaga (1999) explored the impact of music education on student achievement. The research teams found that music instruction dramatically enhanced spatial-temporal reasoning abilities and improved understanding of mathematical concepts. Moreover, Butzlaff (2000) and the team of Douglas and Willats (1994) assert that instruction in music may help children acquire reading skills.

Podlozny (2000) conducted a meta-analysis of studies associated with the impact of drama on student achievement. “The meta-analyses that Podlozny conducted relating to the effects of classroom drama exercises showed positive effects on language development including written and oral story recall, reading achievement, reading readiness, oral language development, and writing” (Critical Links, 2002, p. 47). In all nine of the meta-analysis, the researcher reports that the chance of the null hypothesis being true (i.e., that there is no relationship between drama and story understanding) is less than  $p = .001$ . Therefore, a conclusion can be drawn that there is a positive relationship between drama instruction and language development, both written and oral. Podlozny (2000) contends that “one of the most interesting results of these analyses is that drama not only helps children master text that they enact, but to master new material not enacted” (p. 268). Hence, evidence of strong transfer of skills was demonstrated.

Smithrim and Upitis (2005) conducted an empirical study to investigate the relationship between an arts education approach, entitled *Learning through the Arts* (LTTA) and student achievement among over 6000 Canadian elementary school children. Smithrim and Upitis concluded that one of the most important findings of the study was

that students' involvement in the arts in the LTTA schools did not come at the expense of achievement in mathematics and language. The researchers also concluded that there was a moderate but statistically significant positive effect on student achievement on math tests dealing with computation in the LTTA schools, these gains being attributed to enhanced ability to stay engaged in a task, which was promoted by involvement in arts education. Smithrim and Upitis (2005) recommended that more longitudinal studies involving the impact of arts education on student achievement be conducted, as effects of the treatment appear to evolve gradually, not immediately.

Lampert (2006) conducted a correlational study for the purpose of investigating the variance in critical thinking dispositions between arts and non-arts college undergraduates. The study, entitled *Critical Thinking Dispositions as an Outcome of Art Education*, utilized the CCTDI, a quantitative survey instrument, developed by Facione (2000). This study supports prior research findings relating to inquiry-based arts education's positive impact on critical thinking.

Winner and Hetland (2000) conducted a comprehensive meta-analysis of 188 studies carried out between 1950 and 1999. The studies review systematically what is known about the power of the arts to promote learning in non-arts domains. The results on this study were confirmed in a Vaughn and Winner study (2000) entitled: *SAT Scores of Students Who Study the Arts: What We Can and Cannot Conclude about the Association*. The study was prompted by a report of data collected and released by the College Board which maintained that students who study the arts in high school have higher SAT scores than those who do not study the arts.

A contrast analysis revealed scores of students with zero, one, two, or three years of arts experience to be significantly lower than the scores of students with four and over four years of arts experience ( $F=426.544$ ,  $MSE=83.791$ ,  $p<.0001$ ). Thus, the researchers contend that composite SAT scores increase linearly from zero to three years of arts experience and then rise sharply at four.

To date, no studies have been conducted to analyze the relationships among student demographic characteristics, curriculum characteristics, academic characteristics, and critical thinking performance as measured by the FCAT reading scale scores and FCAT mathematics scale scores. To address this gap in the literature, a non-experimental, quantitative, exploratory (comparative) and explanatory (correlational) secondary data research design was conducted to examine these relationships. The following section provides the theoretical framework to guide this study, which leads to the research questions and hypotheses.

### **Theoretical Framework**

The theoretical framework used to guide this study about the relationship of arts education (i.e., visual arts, music, and drama education) and critical thinking skills is based on a critical analysis of theoretical and empirical literature with respect to both critical thinking and arts education. In this study, a secondary analysis of data was conducted, with a focus on frequency of coursework in the arts disciplines taken by high school seniors and corresponding FCAT Reading and FCAT Mathematics scale scores employed as the measure of critical thinking levels achievement.

Pithers and Soden's (2000) theory of critical thinking development contends that there is a growing global consensus among government and business leadership that

education, no matter what the level or discipline, should enable graduates to exit school equipped with critical thinking skills. Multiple models that describe the identifiable components of critical thinking have been established (Anderson, 2001; Bloom, 1956; Ennis, 1993; Facione, 2000; Krathwohl, 2002; Paul, 1985).

Bloom's (1956) theory on the nature of human thinking served as a foundation for numerous future scientific inquiries concerning critical thinking. Bloom's collaboration with educational colleagues, presented in a handbook commonly referred to as *Bloom's Taxonomy* is one of the most widely applied and most often cited references in education (Krathwohl, 2002). In this tome, Bloom presented a schematic model of cognitive thinking skills organized in distinct hierarchical levels, each requiring more complex intellectual abilities. The theoretical framework identifies six levels of thinking and correlating competencies, ranking from lowest to highest orders of thinking as follows: knowledge, comprehension, application, analysis, synthesis, and evaluation. The categories illustrate degrees of difficulties; thus, the first must be mastered before the next can take place. The highest three tiers of Bloom's taxonomy represent what has since been referred to as "high-order" thinking skills or critical thinking skills.

Many theorists contend the arts education have the unique capacity to develop critical thinking skills (Eisner, 2005, 1998, 1993; Diket, 2003; Murfee, 1996; Paul, 1995). Study of the arts requires students to make judgments, without the benefit of exact rules. "The exercise of judgment in the absence of rule is one of art's most demanding challenges" (Eisner, 2005).

Based on the review of the literature, conclusions, recommendations for future study, and the theoretical framework that was guiding this study, the following research

questions and hypotheses were generated for this study about the relationships among student demographic characteristics, curriculum characteristics, academic characteristics, and critical thinking performance. These are based on the key gaps in the literature, the recommendations of this study, and the theoretical framework that was used to guide this study.

### Research Questions

1. What are the demographic, academic, and curriculum characteristics, as well as critical thinking performance on the FCAT of 12<sup>th</sup> grade students of the Broward County School District?
2. Are there differences in critical thinking performance on the FCAT of 12<sup>th</sup> grade students according to demographic characteristics?
  - a. RQ<sub>2a</sub>: Are there differences in critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade students according to demographic characteristics?
  - b. RQ<sub>2b</sub>: Are there differences in critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students according to demographic characteristics?
3. Are there positive relationships between critical thinking performance on the FCAT of 12<sup>th</sup> grade students and academic characteristics of cumulative GPA in Fine Arts, Language Arts, and Mathematics courses?
  - a. RQ<sub>3a</sub>: Are there positive relationships between critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade and academic characteristics of:
    - i. Cumulative GPA of Fine Arts courses?
    - ii. Cumulative GPA of Language Arts courses?
    - iii. Cumulative GPA of Mathematics courses?
  - b. RQ<sub>3b</sub>: Are there positive relationships between critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students and academic characteristics of:
    - i. Cumulative GPA of Fine Arts courses?
    - ii. Cumulative GPA of Language Arts courses?
    - iii. Cumulative GPA of Mathematics courses?

4. Are there positive relationships between critical thinking performances on the FCAT of 12<sup>th</sup> grade students according to the curriculum characteristics of the frequency of courses taken in the selected fields of study: Fine Arts, Language Arts, and Mathematics?
  - a. RQ<sub>4a</sub>: Are there positive relationships between critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:
    - i. Frequency of Fine Arts courses?
    - ii. Frequency of Language Arts courses?
    - iii. Frequency of Mathematics courses?
  - b. RQ<sub>4b</sub>: Are there positive relationships between critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:
    - i. Frequency of Fine Arts courses?
    - ii. Frequency of Language Arts courses?
    - iii. Frequency of Mathematics courses?
5. Are there positive relationships between critical thinking performance on the *Reading* and *Mathematics* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:
  - a. Frequency of Visual Arts courses?
  - b. Frequency of Music courses?
  - c. Frequency of Drama fine arts courses?
6. Are there positive relationships between critical thinking performance on the *Reading* and *Mathematics* FCAT of 12<sup>th</sup> grade students and the academic characteristics of:
  - a. Cumulative GPAs of Visual Arts courses?
  - b. Cumulative GPAs of Music courses?
  - c. Cumulative GPAs of Drama courses?

### Hypotheses

- H1: The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the frequency of courses taken in the fields of Language Arts and Mathematics.
- H<sub>1a</sub> The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Reading* FCAT than the

- frequency of courses taken in the fields of Language Arts or Mathematics.
- H<sub>1b</sub> The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Mathematics* FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.
- H2: The cumulative GPA of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPA of courses taken in the fields of Language Arts or Mathematics.
- H<sub>2a</sub> The cumulative GPA of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Reading* FCAT than the cumulative GPA of courses taken in the fields of Language Arts or Mathematics.
- H<sub>2b</sub> The cumulative GPA of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Mathematics* FCAT than the cumulative GPA of courses taken in the fields of Language Arts or Mathematics.
- H3: Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the FCAT Reading and FCAT Mathematics.
- H<sub>3a</sub> Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the *Reading* FCAT.
- H<sub>3b</sub> Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the *Mathematics* FCAT.



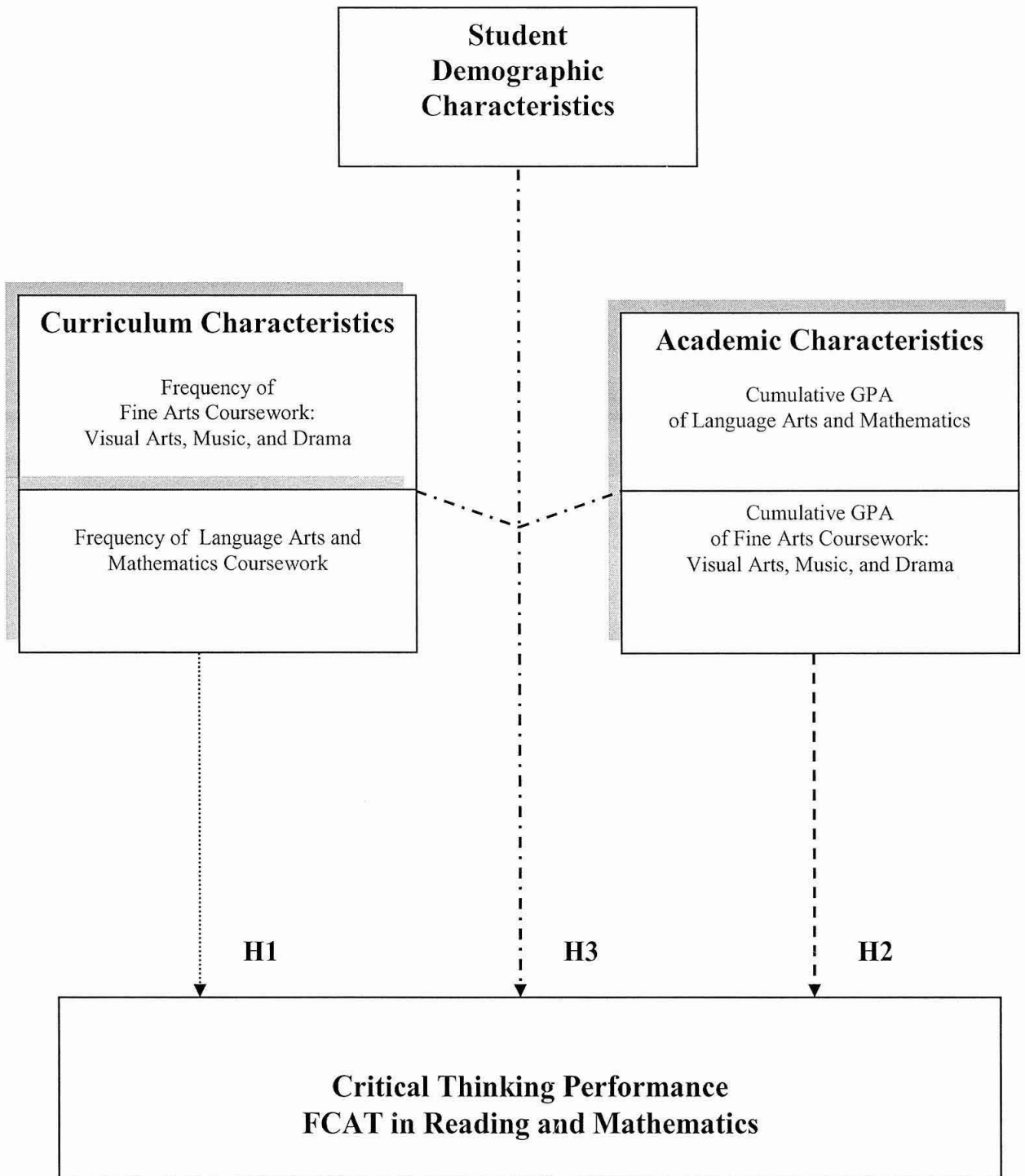


Figure 2-1. Hypothesized model of relationship between fine arts education and critical thinking performance.

Chapter II provided a critical analysis of the literature and related theoretical framework leading to the propositions being tested via hypotheses and research questions to be answered in this study. A hypothesized model and research hypotheses were also presented in this chapter. To guide this study, Chapter III presents the research methods utilized in answering the research questions and testing the hypotheses about the relationships among student demographic characteristics, curriculum characteristics, academic characteristics, and critical thinking performance. Included in Chapter III are a description of the research design, the sampling plan, instrumentation, ethical considerations, and data collection processes along with methods of data analysis and evaluation of research methods.

## **CHAPTER III**

### **RESEARCH METHODS**

Chapter III presents the research methods that were utilized in answering the research questions and testing the hypotheses for this study about relationships among student demographics, academic, and curriculum characteristics (emphasizing arts education), and critical thinking performance on the FCAT of 12<sup>th</sup> grade students. The FCAT, which is the State of Florida's Department of Education measure to assess student achievement was used as the measure of critical thinking performance for this study. The FCAT is used to assess the levels of students' knowledge and critical thinking skills in Reading and Mathematics at grades 3–10. Students have multiple chances to retake the FCAT throughout grades 10–12 and must obtain a passing score in order to graduate from a Florida public high school. The research questions and hypotheses that appear at the end of Chapter II were developed from gaps in the literature and the need to examine the relationship between critical thinking skills and Fine Arts coursework. This chapter begins with a description of the research design and continues with the study's population and sampling plan, instrumentation procedures, ethical considerations, methods of data analysis, and evaluation of research methods.

#### **Research Design**

A non-experimental, quantitative, exploratory (comparative and correlational) and explanatory (correlational) secondary research design was used in this study. Secondary data was collected from the Broward County School's TERMS database. The sample of 504 students was accessed using a proportional probability sampling, based on the systematic selection of every "n<sup>th</sup>" individual senior student's data records from a *low*

performing, *middle* performing, and *high* performing high school (as determined by overall school grade) within each of the county's three geographic areas—North Area, Central Area, and South Area. The data recording instrument for this study included four parts. (See Appendix A.) *Part I: Student Demographic Characteristics*, developed by the researcher, contained six items which measure the demographic variables of area, school, gender, race, age by birth year, and socioeconomic status, as determined by participation in free and reduced lunch programs, (RQ1, RQ2, and H3). *Part II: Curriculum Characteristics*, developed by the researcher, included five items which measured variables of frequency of Visual Arts, Music, and Drama courses, as well as frequencies of Language Arts and Mathematics coursework (RQ1, RQ4, RQ5, and H3). *Part III: Academic Characteristics*, developed by the researcher, included five items that measured variables of cumulative GPA of Language Arts and Mathematics, in addition to cumulative GPA of Fine Arts coursework under the separate categories Visual Arts, Music, and Drama (RQ1, RQ3, and H3, H<sub>3a</sub>, and H<sub>3b</sub>). *Part IV: Critical Thinking Performance FCAT in Reading and Mathematics*, developed by the researcher included ten items that measured critical thinking performance of FCAT results in FCAT Reading and FCAT Mathematics determined by the five scale score levels reflecting the assessments for *both* FCAT Reading and FCAT Mathematics. (RQ1, RQ2, RQ3, RQ4, RQ5, RQ6, H1, H2, and H3).

Six research questions and three hypotheses (and related subhypotheses) were examined in this study. To answer **Research Question 1**, about descriptions of student demographic, academic, curriculum characteristics, and critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade in the Broward County School District, a

descriptive research design including measures of central tendency, frequency distributions, and variability was used.

To answer *Research Question 2* about the differences in critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade in the Broward County School District according to student demographic characteristics, an exploratory research design was used. Independent *t*-tests were conducted to compare two dependent variables, such as gender. Multiple ANOVA tests followed by post hoc comparisons were used when noting significant differences among three or more group comparisons within the headings of academic characteristics and curriculum characteristics.

To answer *Research Question 3*, about the relationships between critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade in the Broward County School District and academic characteristics of cumulative GPA in Fine Arts, Language, Arts, and Mathematics, separate Pearson *r* correlations were used.

To answer *Research Question 4*, about the relationships between critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade in the Broward County School District (the dependent variable), according to curriculum characteristics of frequency of courses taken in Fine Arts, Language, Arts, and Mathematics fields of study, Pearson *r* correlations were used.

To test *Hypothesis 1*, *H<sub>1a</sub>*, *H<sub>1b</sub>* multiple regression analyses using the hierarchical (forward-enter) method were used to examine if the frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade were significantly greater explanatory variables of critical thinking performance on the FCAT (dependent variables) than the frequency of courses taken in the fields of Language Arts or Mathematics.

To test *Hypothesis 2, H<sub>2a</sub>, H<sub>2b</sub>* multiple regression analyses using the hierarchical (forward-enter) method were used to examine if cumulative GPA of Fine Arts courses taken by students completing 12<sup>th</sup> grade was a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPA of courses taken in the fields of Language Arts or Mathematics.

To test *Hypothesis H3, H<sub>3a</sub>, H<sub>3b</sub>* multiple regression analyses using the hierarchical (forward-enter) method were used to examine if demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade were significant explanatory variables of critical thinking performance on the FCAT Reading and Mathematics assessments.

### **Population, Sample, and Setting**

#### **Target Population**

In this study, the target population was all 12<sup>th</sup> grade students enrolled in the Broward County public school system during the 2009–2010 school year. The estimated enrollment of 12<sup>th</sup> grade students in the 31 public high schools that encompassed the Broward County School district in the 2009 -2010 school year was 15,264. All information regarding overall school grades and student populations was public domain and was accessible via Broward County School Board’s website. The researcher selected schools in keeping with proposed methodology based on overall school grades and overall school populations. The enrollment of Broward County high school seniors in accordance with each of the three designated geographical regions: North Area, Central Area, and South Area are presented in Table 3-1.

Table 3-1

*Target Population-High Performing, Middle Performing, and Low Performing High School for Each Geographic Area of County (based on overall 2009 school grade)*

Area	School	2010 School Grade	Total 2010 Students	Total 2010 Seniors
<b>North</b>	School 1	A	2023	453
	School 2	C	1940	453
	School 3	D	2015	455
<b>Central</b>	School 4	B	2111	490
	School 5	C	2018	425
	School 6	D	2122	427
<b>South</b>	School 7	A	2206	506
	School 8	C	1887	442
	School 9	D	2106	490
Totals			18,428	4141

**Accessible population.** This study was based on secondary data analysis collected by Broward County for all public school students. Thus, the accessible population was equivalent to the target population.

**Probability sampling plan.** A probability sampling plan using systematic selection of every “n<sup>th</sup>” individual senior student’s data records from a *low performing*, *middle performing*, and *high performing* high school (as determined by overall school grade) within each of the county’s three demographic areas—North Area, Central Area, and South Area was conducted. The researcher selected low, middle, and high performing schools with respect to designated overall school grades (determined by analysis of schools’ total FCAT scores) in order to ensure that score variability exists. As Florida public high school students have multiple opportunities to take and pass the FCAT, only the *highest* FCAT Reading and Mathematics scores obtained by graduating

12<sup>th</sup> grade student participants were selected for use in the study. The final data producing sample was researcher-selected based on the systematic proportional percentage of student population for each school. The more representative the final data producing sample is based on demographic characteristics of the target population, the stronger the study's external validity.

**Sample size.** Multiple regression analysis was conducted to answer research questions and test hypotheses established by the study. The minimal sample size necessary for multiple regression analysis required that the number of explanatory variables be multiplied by 20 (Garson, 2007). The variables include the following: six student demographic characteristics (area, school, gender, race, age by birth year, and socioeconomic status as determined by participation in free and reduced lunch programs), five curriculum characteristics (frequencies of Visual Arts, Music, and Drama courses, as well as frequencies of Language Arts and Mathematics coursework), five academic characteristics (cumulative in the Fine Arts courses of Visual Arts, Music, and Drama, in addition to cumulative in Language Arts courses and Mathematics courses). Finally, additional variables included a total of 10 measures of critical thinking performance (five for *each* FCAT assessment) determined by the five scale score levels on each of both the FCAT Reading and FCAT Mathematics assessments. Therefore, according to this calculation, the formula would be  $20 \times 26$ , for a total of 520.

An additional method of estimating appropriate sample size when conducting multiple regression analysis is based on the formula of  $n > 50 + 8(m)$ , in which "m" is the number of explanatory variables (Green, 1991). Based on this requirement, the calculation for appropriate sample size would be  $50 + (8 \times 26)$ , and thus an adequate



sample size would be a number above 258. Therefore, to conduct statistical analysis and ensure an adequate sample size, a range of 258 through 520 participants would be necessary. To estimate the sample size needed for population validity, based on a population size of 15,264 Broward County public school seniors in the 2009-2010 school year, according to Gay and Airasian (2000), an adequate sample size would be 400, “but would be even more confident with a sample of 500” (p. 135). The final data-producing sample was analyzed according to the distribution of target population characteristics and contained data from 504 students’ records.

### **Inclusion and Exclusion Criteria**

#### **Inclusion Criteria**

Prospective participants were included in the study if they met the following criteria:

1. Completed 12<sup>th</sup> grade in a Broward County public high school during the 2009-2010 school year.
2. Had taken and received documented scores for the Reading and Mathematics components of the Florida Comprehensive Achievement Test.
3. Were able to read and write in English as determined by the Language Designation recorded in the School Board’s Virtual Counselor records for each student.
4. Were designated as a student in the inclusive general education program.

#### **Exclusion Criteria**

Prospective participants were not included in the study if they met the following criteria:

1. Did not complete 12th grade in the Broward County public high school system during the 2009-2010 school year.
2. Did not have a documented scale level score in both the Reading and Mathematics components of the Florida Comprehensive Achievement Test.
3. Were unable to read and write proficiently in English as determined by the Comprehensive English Language Learning Assessment (CELLA) administered annually to ESOL students, ESOL levels A1 and A2.
4. Were not parts of the inclusive general education population, as determined by the Exceptional Student Education designation recorded in the School Board's Virtual Counselor records for each student.

### **Setting**

The research setting for data collection was in the Data Analysis Specialist's office at Northeast High School, 700 NE 56<sup>th</sup> Street, Oakland Park, Florida, 33334. The data was extracted from both the Virtual Counselor and TERMS master databases.

### **Instrumentation**

In this study, the researcher designed a data recording tool (See Appendix A.) composed of four parts: Part I: Demographic Characteristics, Part II: Curriculum Characteristics, Part III: Academic Characteristics, and Part IV: Critical Thinking Performance FCAT in Reading and FCAT Mathematics. FCAT achievement scale scores range from 1 (*lowest*) to 5 (*highest*). An achievement Level of 1 illustrates that the student has had little success with the challenging content of the Sunshine State Standards (SSS). Level 2 achievement shows that the student has limited success with challenging content of the SSS. A Level 1 or 2 score is deemed to be performance below

grade level. A student performing at Level 3 has partial success with the challenging content of the SSS, but performance is inconsistent. Level 3 students are classified at performing at grade level. A Level 4 achievement confirms that the student has success with the challenging content of the SSS. Level 5 scores indicate that the student has success with the most challenging content of the SSS. Each level of scale score has a numerical range of raw scores, ranging from 100 (*lowest*) to 500 (*highest*), and is illustrated in Table 3-2.

Table 3-2

*FCAT Reading and FCAT Mathematics Achievement Level Scale Scores*

	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>	<b>Level 5</b>
<b>FCAT Reading</b>	100-286	287-326	327-354	355-371	372-500
<b>FCAT Mathematics</b>	100-286	287-314	315-339	340-374	375-500

Broward County School IRB provided the researcher with appropriate passwords to access county data bases (TERMS and Virtual Counselor), which provide student demographics, transcripts, coursework, grades, GPAs, and FCAT scores. Altogether, the measure consists of a total of 26 items. The constructs measured, sources of databases, number of items, and scoring range are illustrated in Table 3-3.

Table 3-3

*Constructs Measured in the Study*

<b>Part</b>	<b>Construct</b>	<b>Source in the Data Base</b>	<b>Type of Measure</b>	<b>Number of Items</b>	<b>Score Range</b>
1.	Student Demographic Characteristics	Broward Schools TERMS master database Virtual Counselor database	Fill in the Blank Multiple Choice	6	5 items measure student demographics: area, school, gender, race, age by birth year, and socioeconomic status.
2.	Curriculum Characteristics Frequency of Fine Arts Coursework within Visual Arts, Music, and Drama Frequency of Language Arts and Mathematics	Broward Schools TERMS master database	Fill in the Blank	5	5 items measure frequency of courses taken: Visual Arts, Music, Drama, Language Arts, and Mathematics.
3.	Academic Characteristics Student Cumulative GPA	Broward Schools TERMS master database	Fill in the Blank	5	5 items measure cumulative GPA in fine arts courses of Visual Arts, Music, and Drama, Language Arts courses, and Mathematic courses.
4.	Critical Thinking Performance	Broward Schools TERMS master database	FCAT scores in Reading, Mathematics, and Science.	10	Five scale score levels (A, B, C, D, and F scores) in both Reading and Mathematics.
	Totals			26	

## **Part I: Student Demographic Characteristics**

*Part I, Student Demographic Characteristics* consists of five items and was designed by the researcher. There were six variables which include area, school gender, race, age by birth year, and socioeconomic status (as determined by participation in free and reduced lunch programs). Race was based on the U.S. Census Bureau (2008) categorization used in 2000 census and beyond. (See Appendix A, *Part I*.)

## **Part II: Curriculum Characteristics**

*Part II, Curriculum Characteristics* of the study was designed by the researcher and contained five items that measure frequency of Fine Arts coursework (total including Visual Arts, Music, and Drama, in addition to frequency of Language Arts and Mathematics coursework. (See Appendix A, *Part II*.)

**Reliability.** Two additional data analysis assistants (both PhDs) worked jointly with the researcher to ensure that all data calculations were reliable. The researcher, along with the two data analysis assistants, determines inter rate data reliability to aim for a 95% agreement for a sample of 504.

**Validity.** The Broward County Schools website ([www.browardschools.org](http://www.browardschools.org)) provides verification that the curriculum characteristics in this study, total Fine Arts coursework (Visual Arts, Music, and Drama), in addition to frequency of Language Arts and Mathematics, were determined by the FLDOE guidelines.

## **Part III: Academic Characteristics**

*Part III, Academic Characteristics* of the study was designed by the researcher and contains five items that measured cumulative GPAs of Language Arts and

Mathematics coursework, in addition to cumulative GPAs of Fine Arts coursework including Visual Arts, Music, and Drama. (See Appendix A, *Part III*.)

**Reliability.** Two additional data analysts work jointly with the researcher to ensure that all data calculations were reliable. The researcher, along with the two data analysts did inter rate data reliability to aim for a 95% agreement for a sample of 504.

**Validity.** The Broward County Schools website ([www.browardschools.org](http://www.browardschools.org)) provided verification that the curriculum characteristics in this study, total Fine Arts coursework (Visual Arts, Music, and Drama), in addition to frequency of Language Arts and Mathematics, are determined by the FLDOE guidelines.

#### **Part IV: Critical Thinking Performance FCAT in Reading and Mathematics**

*Part IV, Critical Thinking Performance FCAT in Reading and FCAT Mathematics*, of the study was designed by the researcher and contains two items that measure critical thinking performance from FCAT scores in Reading and Mathematics. (See Appendix A, *Part IV*.) The FCAT is part of Florida's overall plan to increase student achievement by implementing higher standards and teacher accountability. The FCAT is administered in grades 3 -10 and is based on benchmarks in the Sunshine State Standards (SSS) which identify knowledge and skills students are expected to acquire at each grade level, with an underlying expectation that students also demonstrate *critical thinking* (Florida Department of Education, 2008).

**Reliability.** Internal consistency reliabilities for the FCAT were reported using two methods, Cronbach's alpha and Item Response Theory (IRT) marginal reliabilities (Florida Department of Education, 2007). For the FCAT Reading measure, coefficient alpha reliabilities for 2001-2003 were as follows: 2001, .80; 2002, .80; and 2003, .78.

The FCAT Mathematics coefficient alpha reliabilities for 2006-2008 were 2006, .79; 2007, .77; and 2008, .76 (FLDOE, 2007). With satisfactory FCAT Reading and Mathematics coefficient alphas, the FCAT scores were used to answer the research questions and test the hypotheses using regression analysis.

**Validity.** FCAT technical reports provided evidence that the FCAT Reading and Mathematics had substantial convergent validity (FLDOE, 2008). “The evidence of reliability and validity supports the claim that the FCAT is technically sound and meets or exceeds the professional standards for standardized achievement tests” (FLDOE, 2008, p. 27).

#### **Procedures: Data Collection Methods and Ethical Considerations**

The following section describes the ethical considerations regarding the use of secondary data based research that was taken into account for the protection of all participants. Additionally, each step in data collection, protection of anonymity, and data storage/disposal processes of this study is discussed in sequence.

1. Following a successful proposal defense, the next required step was to obtain approval for the study from the Institution Review Board at Lynn University. (See Appendix D.) Data collection only began after approval was received from Lynn’s Institutional Review Board. The following required forms and the research protocol were submitted to the Lynn University Institutional Review Board for the Protection of Human Subjects for their review and approval:
  - a. IRB Form 1, Application and Research Protocol for Review of Research Involving Human Subjects in a New Project IRB.

- b. IRB Form 3, Request for Expedited Review.
3. Permissions from the Broward County Schools IRB were acquired.  
(See Appendix E.)
4. After IRB approval from Lynn University and the Broward County School Board, data collection commenced.
5. The data were accessed through administrative passwords given to the researcher by the Broward School's research department to enter master databases in Virtual Counselor and TERMS.
6. The data collection process was conducted for no longer than one year after IRB approval.
7. The start date followed the date this study was approved by the IRB.
8. No later than one month following the completion of the data collection, the researcher submitted a Report of Termination of the Project to the Lynn University IRB (Form 8).
9. Data analysis was performed as described in the data analysis section using SPSS version 19.0. Data will be stored electronically in a personal computer with security (requiring a password and identification).
10. Data will be destroyed after five years.



## Methods of Data Analysis

Data collected from Broward County School Board TERMS database and Virtual Counselor database were analyzed with Statistical Package for Social Sciences (SPSS), Version 19.0, to answer research questions, test hypothesis and provide psychometric assessments of the reliability and validity of scales. Exploratory data analysis, descriptive statistics, independent *t*-tests, and one-way ANOVA coefficient alphas as estimates of hierarchical (forward-enter) multiple regression analysis were used to analyze data. The following steps were utilized prior to analyzing the data:

1. Data Coding—Collected data had predetermined coding assigned to each variable in this study. No student names or identifying information were included in the data collection process.
2. Exploratory Data Analysis—Descriptive statistics were examined to verify the parameters used in this study. Variables that did not meet statistical assumptions were identified. Graphs and bar charts were used to display the data for better understanding and to determine what kind of results might be expected. When one or more assumptions were broken, transforming variables were considered.
3. All data analyses were rechecked and verified for accuracy.
4. Independent *t*-tests were used to compare the differences of means in two groups.
5. ANOVAs with post hoc comparisons analysis were used to compare the differences of means in three or more groups.

- Hierarchical multiple regression (stepwise) analyses were used to explain a set of independent and attribute variables and the dependent variables.

### **Research Questions**

Research Question 1 used a descriptive research design to describe the sample. Descriptive statistics such as frequency distributions, measures of central tendency, and variability to describe the demographic, academic, and curriculum characteristics, critical thinking performance on the FCAT of 12<sup>th</sup> grade students of the Broward County School District were included.

Research Question 2 used an exploratory (comparative) research design to identify differences in critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade, according to student demographic characteristics. Independent *t*-tests for two group comparisons and multiple ANOVA tests for three or more group comparisons followed by post hoc comparisons in which there were significant differences were used to determine if there were differences according to demographic characteristics.

Research Question 3 used an exploratory (correlational) research design to identify relationships between critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade and academic characteristics of cumulative GPA in Fine Arts (Visual Arts, Music, and Drama), Language Arts, and Mathematics. Pearson *r* correlations were used to examine these relationships.

Research Question 4 used an exploratory (correlational) research design to identify relationships between critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade and curriculum characteristics of the frequency of courses taken in

Fine Arts (Visual Arts, Music, and Drama), Language Arts, and Mathematics. Pearson  $r$  correlations were used to examine these relationships.

Research Question 5 uses an exploratory (correlational) research design to identify relationships between critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade and curriculum characteristics of frequency of Visual Arts, Music courses, and Drama courses. Pearson  $r$  correlations were used to examine these relationships.

Research Question 6 uses an exploratory (correlational) research design to identify relationships between critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade and academic characteristics of cumulative GPA of Visual Arts, Music courses, and Drama courses. Pearson  $r$  correlations were used to examine these relationships.

### **Hypothesis Testing**

The notation that was used to represent the variables tested in the hypotheses in this study was as follows:

$b_0$  = constant

$b$  = unstandardized coefficient

$\varepsilon_1$  = error

Dependent Variables

Critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade

$Y_1$  = FCAT in Reading

$Y_2$  = FCAT in Mathematics

Student demographic characteristics

$X_1$  = areas

$X_2$  = school

$X_3$  = gender

$X_4$  = race

$X_5$  = age by birth year

$X_6$  = free lunch program

### Curriculum Characteristics

- $X_7$  = Frequency of visual arts courses
- $X_8$  = Frequency of music courses
- $X_9$  = Frequency of drama courses
- $X_{10}$  = Frequency of language courses
- $X_{11}$  = Frequency of mathematics courses

### Academic Characteristics of Cumulative GPA

- $X_{12}$  = GPA in language arts courses
- $X_{13}$  = GPA in mathematics courses
- $X_{14}$  = GPA in visual arts courses
- $X_{15}$  = GPA in music courses
- $X_{16}$  = GPA in drama courses

### Research Hypothesis Testing

Multiple regression analysis using hierarchical (forward-enter) method was used to test Hypothesis 1 to determine whether there is a significantly greater explanatory (correlational) relationship among frequency of Fine Arts courses (Visual Arts, Music, and Drama) taken by students completing 12<sup>th</sup> grade and critical thinking performance on the FCAT, the dependent variable, than the frequency of courses taken in the fields of Language Arts or Mathematics.

Notation to test regression models of this hypothesis is:

Where  $Y$  = Critical thinking performance on the FCAT of students completing 12<sup>th</sup> grade (dependent variables)

$Y_1$  = FCAT in Reading

$Y_2$  = FCAT in Mathematics

Hypothesis 1a:  $Y_1 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + \epsilon_1$

Hypothesis 1b:  $Y_2 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + \epsilon_1$

Where  $Y_1$  = Critical thinking performance on the FCAT in Reading (dependent variable).

$Y_1 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + \epsilon_1$

Where  $Y_2$  = Critical thinking performance on the FCAT in Mathematics  
(dependent variable).

$$Y_2 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + \varepsilon_1$$

Multiple regression analysis using the hierarchical (forward-enter) method was used to test Hypothesis 2 to determine whether there was a significantly greater explanatory (correlational) relationship among academic characteristics of cumulative GPA of Fine Arts courses (Visual Arts, Music, and Drama) and critical thinking performance on the FCAT than the cumulative GPA of courses taken in the fields of Language arts or Mathematics.

Notation to test regression models of this hypothesis was:

Where  $Y$  = Critical thinking performance on the FCAT of 12<sup>th</sup> grade students  
(dependent variables)

$$Y_1 = \text{FCAT in Reading}$$

$$Y_2 = \text{FCAT in Mathematics}$$

$$\text{Hypothesis 2a: } Y_1 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} \\ + b_{14}X_{14} + b_{15}X_{15} + \varepsilon_1$$

Where  $Y_1$  = Critical thinking performance on the FCAT in Reading (dependent variable).

$$Y_1 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} \\ + b_{14}X_{14} + b_{15}X_{15} + \varepsilon_1$$

$$\text{Hypothesis 2b: } Y_2 = b_0 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} \\ + b_{14}X_{14} + b_{15}X_{15} + \varepsilon_1$$

Where  $Y_2$  = Critical thinking performance on the FCAT in Mathematics  
(dependent variable).

$$Y_2 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4 X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + b_{14}X_{14} + b_{15}X_{15} + \varepsilon_1$$

Multiple regression analysis using hierarchical (forward-enter) method was used to test Hypothesis 3 to determine whether there was a significant explanatory (correlational) relationship among demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and critical performance on the FCAT, the dependent variable.

Notation to test regression models of this hypothesis is:

Where Y = Critical thinking performance on the FCAT of 12<sup>th</sup> grade students (dependent variables)

$$Y_1 = \text{FCAT in Reading}$$

$$Y_2 = \text{FCAT in Mathematics}$$

Hypothesis 3a:  $Y_1 = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + b_{14} X_{14} + b_{15} X_{15} + \varepsilon_1$

Where  $Y_1$  = Critical thinking performance on the FCAT in Reading (dependent variable).

$$Y_1 = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + b_{14} X_{14} + b_{15} X_{15} + \varepsilon_1$$

Hypothesis 3b:  $Y_2 = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + b_{14} X_{14} + b_{15} X_{15} + b_{16} X_{16} + b_{17} X_{17} + b_{18} X_{18} + b_{19} X_{19} + \varepsilon_1$

Where  $Y_2$  = Critical thinking performance on the FCAT in Mathematics (dependent variable).

$$Y_2 = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + b_{14} X_{14} + b_{15} X_{15} + \varepsilon_1$$

## **Evaluation of Research Methods**

The research methods used in this study were evaluated for the strengths and weaknesses in internal validity and external validity of the study. Internal validity relates to inferences that can be drawn about causal relationships between attribute or independent variables and dependent variables (Trochim, 2006). External validity of a research study refers to the ability to generalize results or conclusions of the research to settings or populations (Trochim, 2006). Strengths and weaknesses that may have affected internal and external validity were as follows:

### **Internal Validity**

#### **Internal Validity Strengths**

1. The quantitative design of the study had higher internal validity than a qualitative design.
2. The use of correlational (exploratory and explanatory) and causal-comparative (exploratory) research designs was stronger than descriptive designs.
3. A sufficient sample size existed to conduct the data analysis
4. The use of statistical procedures in data analysis (multiple regression) associated with hypotheses testing was rigorous and thus represented strength to the internal validity of the study.
5. Statistical procedures were appropriate to answer research questions.

### **Internal Validity Weaknesses**

1. Internal validity could have been threatened if the sample size was inadequate in order to perform statistical analysis.
2. The use of measures selected by the researcher had no prior estimates of reliability or validity and could possibly pose a potential threat to internal validity.

### **External Validity**

#### **External Validity Strengths**

1. Onwuegbuzie and Leech (2007) argue that inside knowledge adds as much as it detracts from the research validity.
2. Good research demands “skepticism, commitment and detachment” (Norris, 1997), but it also requires comradeship, enthusiasm, and a willingness to actively support the research design.

#### **External Validity Weaknesses**

1. The study was limited to Broward County High Schools.

Chapter III described the research methods that answered research questions and tested hypotheses regarding the relationship among student demographics, curriculum characteristics, academic characteristics, and critical thinking performance as evidenced from FCAT scores in Reading and Mathematics. The chapter also described the research design, population and sampling, instrumentation, data collection procedures that also included ethical considerations and methods of data analysis to answer research questions and test hypothesis. Lastly, the chapter evaluated the research methods in this study. Chapter IV presents the study’s results.



## CHAPTER IV

### RESULTS

Chapter IV presents the findings of the study about the relationships among student demographic characteristics, curriculum characteristics, academic characteristics, and critical thinking as measured by performance on the FCAT for Broward County 12<sup>th</sup> grade students. Secondary analysis of data previously collected by the researcher was used for answering the research questions and testing the hypothesis presented in the study. The data collected was analyzed using the Statistical Program for the Social Sciences (SPSS) version 19.0. Descriptive and inferential statistics were used to answer the research questions. Multiple regression analyses were conducted to test the hypotheses.

#### **Final Data Producing Sample**

The target population for the study was all 12<sup>th</sup> grade students enrolled in the Broward County public school system during the 2009–2010 school year. The estimated enrollment of 12<sup>th</sup> grade students in the 32 public high schools that encompassed the Broward School district in the 2009 – 2010 school year was 17,864. All information regarding overall school grades and student populations is public domain and is accessible via Broward County School Board’s website. In keeping with proposed methodology, the researcher selected schools based on overall school grades and overall school populations. Student data was collected from one *high achieving*, one *middle achieving*, and one *low achieving* public high school (as determined by the 2010 overall school grade) selected from each of the three geographic areas that comprise the Broward

County Public School District: North Area, Central Area, and South Area. These criteria produced data from nine public high schools.

The total population for the study was 504 students, including 168 students from each of the schools selected within each of the three geographical regions of the county. Male students numbered 246 (48.8%) and female students numbered 258 (51.2%)—a comparable representation. The ages of the 12<sup>th</sup> grade students according to birth year were documented at three years: 1991, 1992, and 1993. The overwhelming majority of the students were born in 1992 (52.6%) or 1993 (40.5%), with 6.7% born in 1991. The percentage of students identified as white was 40.1%, followed by Black at 29.4%, and Hispanic at 18.8%. The lowest percentages of students were categorized as Asian at 7.7% and “Mixed” at 4%. Socioeconomic status was measured by the application for and receipt of free or reduced lunch. A majority of students (53.4%) were indicated as applied for and received free and reduced lunch, with 41.3% not applied and 5.4% applied, but did not receive. Demographics of the 12<sup>th</sup> grade students by gender, race, age according to birth year, socioeconomic status according to free lunch program, and Broward County geographic area of the sample population are presented in Table 4-1.

Table 4-1

*Demographics of 12<sup>th</sup> Grade Students by Gender, Race, Age According to Birth Year, Socioeconomic Status According to Free Lunch Program, and Broward County Geographic Area*

Demographic Variables	Frequency	Percentage
<b>Gender</b>	N = 504	N = 100%
Male	246	48.8%
Female	258	51.2%
<b>Race</b>		
White	202	40.1%
Black	147	29.2%
Hispanic	95	18.8%
Asian	40	7.9%
Mixed	20	4%
<b>Birth Year</b>		
1991	34	6.7%
1992	264	52.4%
1993	206	40.9%
<b>Socioeconomic Status</b>		
Did Not Apply	209	41.5%
Applied/Did Not Receive	27	5.4%
Applied/Received	268	53.1%

Table 4 – 1 Continued

Demographic Variables	Frequency	Percentage
<b>County Area</b>		
North	168	33.3%
Central	168	33.3%
South	168	33.3%

### Research Questions

Descriptive statistics were used to answer Research Question 1 in describing the demographic, academic (GPAs), and curriculum (frequency of coursework) of the sample population and the consequent relationship to FCAT Reading and FCAT Mathematics scores. Anovas and *t*-tests were used for Research Question 2 to explore the differences in critical thinking performance as measured on the FCAT Reading and FCAT Mathematics assessment outcomes as related to gender, race, age by birth year, socioeconomic status, county geographical area, and individual schools. Pearson *r* correlations were used to examine the relationships among cumulative GPA's and frequencies of courses for Research Questions 3, 4, 5, and 6.

#### Research Question 1

What are the demographic, academic, and curriculum characteristics, as well as critical thinking performance on the FCAT of 12<sup>th</sup> grade students of the Broward County School District?

**Student demographic characteristics.** Descriptive statistics were used to answer Research Question 1. This included measures of central tendency (the mean),

frequency distributions, and variability to describe the variables of student demographic characteristics and critical thinking performance as measured by the FCAT Reading and FCAT Mathematics scores. The final data producing sample was 504 students. The total sample population of students included 168 students from the three North Area schools, 168 students from the three Central Area schools, and 168 students from the three South Area schools. The researcher randomly selected 56 students from each of the nine schools chosen for the study. The gender of students was an approximate even match, with 246 males (48.8%) and 258 females (51.2%). The largest percentages of students were White (40.1%), followed by Black (29.4%), Hispanic (18.8%), and Asian (7.7%). Students who were identified as “Mixed” represented 4% of the population. The largest age groups according to birth year were born in 1992 and 1993 (52.6% and 40.5% respectively), although 6.7% were born in 1991. Over half of the students in the study had applied for and received free or reduced lunch (53.4%).

The total Fine Arts coursework cumulative GPAs for the students in the study were as follows: “A” (24.2 %), “B+” (23.8%), “B” (16.3%), “C+” (5.8%), “C” (6%), “D+” (1%), “D” (.7%), and “F” (22.2%). The cumulative GPAs for total Language Arts coursework for students in the study were “A” (2.8%), “B+” (20.4%), “B” (26.5%), “C+” (26.5%), “C” (17%), “D+” (6.4%), “D” (1%) and “F” (0). Finally, the total Mathematics coursework GPAs were “A” (9.6%), “B+” (8.2%), “B” (24.6%), “C+” (19.4%), “C” (25.1%), “D+” (10.8%), “D” (2.8%), and “F” (0%).

The total frequencies of Fine Arts coursework under the category of Visual Arts coursework are as follows: 0 credits (33.6 %), 1–3 credits (56.6%), 4–6 credits (8.4%), and 7–9 credits (1.4%). The total frequencies of Fine Arts coursework under the category

of Music coursework was: 0 credits (57.9%), 1-3 credits (38.5%), 4-6 credits (2.8%), and 7- 0 credits (.8%). The total frequencies of Fine Arts coursework under the category of Drama coursework are as follows: 0 credits (80.7%), 1-3 credits (17.5%), and 4-6 credits (1.8%).

The frequencies of total Language Arts coursework taken by students in the study were: 3-5 credits (41.4%), 5.5-7.5 credits (36.3%), 8-10 credits (19.1%), and 10.5-14 credits (3.2%). The frequencies of total Mathematics coursework taken by students in the study was as follows: 2-3.5 credits (12.7%), 4-6 credits (78.2%), 6.5-8 credits (8%), and 8.5-10 credits (1.1%).

The FCAT scale scores range from 100 points to 500 points for each subject area and grade level and are divided into five categories or achievement levels, from 1 (*lowest*) to 5 (*highest*). The Florida Department of Education has designated a score of 3 as critical thinking performance occurring at grade level; a 1 or 2 score is critical thinking below grade level, and a 4 or 5 score signifies critical thinking performance above grade level (FCAT Assessment and Accountability Briefing, 2008). Students in Florida public high schools in grades 10-12 have six opportunities to take and pass the FCAT. The results of FCAT scores for students in this study reflect the *highest* score each student in the study obtained on the FCAT Reading and Mathematics assessments during their tenure in high school. The total percentages of FCAT Reading scores were as follows: a score of "1" (7.7%), a score of "2" (26%), a score of "3" (31.7%), a score of "4" (17.9%), and a score of "5" (16.7%). Additionally, the total percentages of FCAT Mathematics scores were "1" (2.2%), "2" (11.7%), "3" (31%), "4" (41.9%), and a score of "5"

(13.3%). The frequency distributions of 12<sup>th</sup> grade students in the 2009-2010 school year demographic characteristics are shown in Table 4-2.

Table 4-2  
*Demographics, Academic Characteristics, Curriculum Characteristics, and Critical Thinking Performance as Measured by the FCAT of 12<sup>th</sup> Grade Students*

Variables	Frequency	Percentage	Mean
<b>Gender</b>	N = 504	N = 100%	
Male	246	48.8%	
Female	258	51.2%	
<b>Race</b>			
White	202	40.1%	
Black	147	29.2%	
Hispanic	95	18.8%	
Asian	40	7.9%	
Mixed	20	4%	
<b>Birth Year</b>			
1991	34	6.7%	
1992	264	52.4%	
1993	206	40.9%	
<b>Socioeconomic Status</b>			
Did Not Apply	209	41.5%	
Applied/Did Not Receive	27	5.4%	

Table 4 - 2 Continued

<b>Demographic Variable</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Mean</b>
<b>County Area</b>			
North	168	33.3%	
Central	168	33.3%	
South	168	33.3%	
<b>Academic Characteristics (GPA's)</b>			
<b>Fine Arts GPA's</b>			
A	122	24.2%	
B+	120	23.8%	
B	82	16.3%	
C+	29	5.8%	
C	30	6%	
D+	5	1%	
D	4	.7%	
F	112	22.2%	
<b>Language Arts GPA's</b>			
A	14	2.8%	
B+	102	20.4%	
B	133	26.5%	
C+	133	26.5%	
C	85	17%	
D	5	1%	
F	0	0%	



Table 4 – 2 Continued

Variables	Frequency	Percentage	Mean
<b>Mathematics GPAs</b>			
A	0		
B	124	24.6%	
C+	97	19.4%	
C	126	25.1%	
D+	54	10.8%	
D	14	2.8%	
F	0	0%	
<b>Curriculum Characteristics</b>			
Frequencies of Fine Arts			
Visual Arts			1.5
0 credits	170	33.7%	
1 - 3 credits	285	56.6%	
4 – 6 credits	42	8.4%	
7 – 9 credits	7	1.4%	
Music			.76
0 credits	292	57.9%	
1 - 3 credits	194	38.5%	
4 – 6 credits	14	2.8%	
7 – 9 credits	4	.8%	
Drama			.30
0 credits	407	80.7%	
1 - 3 credits	88	17.5%	
4 - 6	9	1.8%	

Table 4 – 2 Continued

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Mean</b>
<b>Frequency of Language Arts</b>			
3 – 5 credits	209	41.4%	
5.5 – 7.5 credits	183	36.3%	
8 – 10 credits	96	19.1%	
10.5 – 14 credits	16	3.2%	
<b>Frequencies of Mathematics</b>			<b>4.8</b>
2 – 3.5 credits	64	12.7%	
4 – 6 credits	394	78.2%	
6.5 – 8 credits	40	8%	
8.5 – 10 credits	6	1.1%	
<b>Critical Thinking Performance (FCAT scores)</b>			
<b>Reading</b>			<b>3.10</b>
1	39	7.7%	
2	131	26%	
3	160	31.7%	
4	90	17.9%	
5	84	16.7%	<b>3.52</b>
<b>Math</b>			
1	11	2.2%	
2	59	11.7%	
3	156	31%	
4	211	41.9%	
5	67	13.3%	

## Research Question 2

Are there differences in critical thinking performance on the FCAT of 12<sup>th</sup> grade students according to demographic characteristics?

- a. RQ<sub>2a</sub>: Are there differences in critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade students according to demographic characteristics?
- b. RQ<sub>2b</sub>: Are there differences in critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students according to demographic characteristics?

Differences in critical thinking performance as measures by the FCAT Reading scores and FCAT Mathematics scores of 12<sup>th</sup> grade students in the 2009-2010 school year according to demographic characteristics were analyzed by *t*-tests and ANOVAs. Gender was determined by independent *t*-tests. Multiple ANOVA tests followed by post hoc comparisons were performed for race, age by birth year, socioeconomic level, county area, and individual schools. Tukey's tests were used as post hoc comparisons when significant *F* values resulted from ANOVA analyses. This provided a comparison control for Type I errors by correcting the level of significance for each test (Field, 2005). According to Field (2005) a Type I error, also known as a false positive, "occurs when we believe that there is a genuine effect in our population" (p. 748), when in reality none exists. Tukey's test compares the largest mean with the smallest mean, and then continues to compare the largest mean to the next smallest mean until no significant differences are found.

**Differences in FCAT scores according to gender.** As discussed in Chapter III and illustrated in Table 3-2 (p. 93), The FCAT Reading and Mathematics scores range from level 1 through level 5. There was not a significant difference between males and

females in FCAT Reading scores ( $t = 1.208, p = .227$ ) and FCAT Mathematics scores ( $t = 1.916, p = .160$ ). The results of independent  $t$ -tests of FCAT reading scores and FCAT Mathematics scores according to gender are presented in Table 4-3.

Table 4-3  
*Comparison of Student Gender and FCAT Reading Scores and FCAT Math Scores: Independent t-tests.*

Variable and Gender	N	Mean	Mean Difference	t-value	p-value
<b>FCAT Reading Scores</b>			.128	1.208	.227
Males	246	3.16			
Females	258	3.03			
<b>FCAT Mathematics Scores</b>			.160	1.916	.056
Males	246	3.61			
Females	258	3.45			

**Differences in FCAT reading scores according to race, age by birth year, socioeconomic status, area, and school.**

For comparison of FCAT Reading scores according to race, age by birth year, socioeconomic status, area, and school, multiple ANOVA tests were performed. The variables for race were recoded into five categories so that the different races could be compared. Post hoc tests were performed because at least one group had more than two cases. There was a significant outcome in comparison of race on the FCAT Reading scores ( $p = .000$ ), with Tukey's post hoc comparisons showing that FCAT Reading scores were significantly higher for white students ( $M = 3.44$ ) than Black ( $M = 2.84$ ), Hispanic ( $M = 2.91$ ), or Asian ( $M = 2.83$ ). The relationship of age by the birth year (1991, 1992, and 1993) shows a significant correlation between FCAT Reading scores and age by birth year ( $p = .002$ ). FCAT reading scores were significantly different in age by birth year, with students born in 1992 ( $M = 3.11$ ) or 1993 ( $M = 3.19$ ) outperforming students born in 1991 ( $M = 2.41$ ).

A comparison of socioeconomic status illustrated a significant difference between students who applied for and received free or reduced lunch and those who did not ( $p = .000$ ). Students who did not apply for free or reduced lunch ( $M = 3.35$ ) outperformed those who did apply for and receive free or reduced lunch ( $M = 2.95$ ). In addition, as pertained to the three geographical areas, there was a significant relationship between FCAT reading scores and county areas ( $p = .029$ ). The South area schools ( $M = 3.21$ ) performed slightly higher as a whole than the North Area schools ( $M = 2.90$ ).

Finally, as would be expected, there was a significant difference in FCAT Reading scores according to individual schools ( $p = .000$ ). Students in the designated *high performing* schools for all three areas (schools 4, 5, and 7) outperformed students designated in the *low performing* schools in all three areas (schools 3, 6, and 9). Table 4-4 shows the results of ANOVA comparison of student FCAT reading scores according to race, age by birth year, socioeconomic status, county area, and schools.

Table 4-4

*Comparison of FCAT Reading Scores according to Race, Age by Birth Year, Socioeconomic Status, Area, and School: ANOVAs and post hoc comparisons*

Variables	N	Mean	Mean Difference	df	F	p	Tukey's Post Hoc Comparison
<b>FCAT Reading Race</b>				4	7.392	.000	
White	202	3.44					
Black	147	2.84					
Hispanic	95	2.91					
Asian	40	2.83					
Mixed	20	3.05					
White>Black			.599				.000
White>Hispanic			.530				.002
White>Asian			.611				.020
<b>Birth Year</b>				2	6.456	.002	
1991	34	2.41					
1992	264	3.11					
1993	206	3.19					
1992>1991			.702				.003
1993>1991			.778				.001
<b>Socioeconomic Status</b>				2	9.488	.000	
Did Not Apply	209	3.35					
Applied/Did Not Receive	27	2.59					
Applied/Received	268	2.95					
Did Not Apply>Applied Received			.398				.001

Table 4 -4 Continued

<b>County Area</b>			2	3.576	.029
North	168	2.90			
Central	168	3.18			
South	168	3.21			
South Area>North Area			.310		<b>.044</b>
<b>Schools</b>			8	6.695	.000
School 1	56	3.02			
School 2	56	3.13			
School 3	56	2.55			
School 4	56	3.45			
School 5	56	3.46			
School 6	56	2.64			
School 7	56	3.66			
School 8	56	3.23			
School 9	56	2.73			
School 4>School 3			.893		<b>.001</b>
School 4>School 6			.804		<b>.006</b>
School 4>School 9			.714		<b>.026</b>
School 5> School 3			.911		<b>.001</b>
School 5> School 6			.821		<b>.005</b>
School 5> School 9			.732		<b>.020</b>
School 7> School 3			1.107		<b>.000</b>
School 7> School 6			1.018		<b>.000</b>
School 7> School 9			.929		<b>.001</b>

As used in the comparison of FCAT Reading scores, multiple ANOVA tests were performed to compare FCAT Mathematics scores according to race, age by birth year, socioeconomic status, area, and school. Again, the variables for race were recoded into five categories so that the different races could be compared and subsequently post hoc tests were done. There was a significant outcome in comparison of race on the FCAT Mathematics scores ( $p = .000$ ), with Tukey's post hoc comparisons showing that FCAT Mathematics scores were significantly higher for white students ( $M = 3.75$ ) than Black ( $M = 3.23$ ). However, the relationship of age by the birth year (1991, 1992, and 1993) illustrated only a minor significant effect of FCAT Mathematics scores and age by birth year ( $p = .05$ ). Students born in 1993 ( $M = 3.56$ ) slightly outperformed students born in 1991 ( $M = 3.15$ ).

A comparison of socioeconomic status illustrated a significant difference between students who applied for and received free or reduced lunch and those who did not ( $p = .013$ ). Students who did not apply for free or reduced lunch ( $M = 3.67$ ) outperformed those who did apply for and receive free or reduced lunch ( $M = 3.42$ ). Yet no significant relationship was shown between FCAT Mathematics scores and county geographical areas.

As evidenced in the relationship between FCAT Reading scores and individual schools, there also were significant differences in FCAT Mathematics scores and individual schools ( $p = .000$ ). Students in *high performing* schools, such as schools 4 and 7 outperformed students designated in the *low performing* schools in all three areas (schools 3, 6, and 9). However, School 5, a designated high performing school, only



outperformed school 6, one designated low performing school. Results of ANOVA comparison of student FCAT mathematics scores according to race, age by birth year, socioeconomic status, county area, and schools are presented in Table 4-5.

Table 4-5

*Comparison of FCAT Mathematics Scores according to Race, Age by Birth Year, Socioeconomic Status, Area, and School: ANOVAs and post hoc comparisons*

Variables	N	Mean	Mean Difference	df	F	p	Tukey's Post Hoc Comparison
<b>FCAT Mathematics</b>							
<b>Race</b>				4	7.136	.000	
White	202	3.75					
Black	147	3.23					
Hispanic	95	3.46					
Asian	40	3.63					
Mixed	20	3.45					
White>Black			.521				<b>.000</b>
<b>Birth Year</b>				2	2.987	.051	
1991	34	3.15					
1992	264	3.54					
1993	206	3.56					
1993>1991			.416				<b>.044</b>
<b>Socioeconomic Status</b>				2	4.378	.013	
Did Not Apply	209	3.67					
Applied/Did Not Receive	27	3.41					
Applied/Received	268	3.42					
Did Not Apply> Applied Received			.248				<b>.011</b>

Table 4 – 5 Continued

Variables	N	Mean	Mean Difference	df	F	p	Tukey's Post Hoc Comparison
<b>County Area</b>				2	1.671	.189	
North	168	2.393					
Central	168	2.32					
South	168	2.49					
<b>Schools</b>				8	6.873	.000	
School 1	56	3.46					
School 2	56	3.61					
School 3	56	2.30					
School 4	56	3.86					
School 5	56	3.59					
School 6	56	3.00					
School 7	56	4.02					
School 8	56	3.64					
School 9	56	3.23					
School 4>School 3			.554				.032
School 4>School 6			.857				.000
School 4>School 9			.625				.008
School 5> School 6			.589				.016
School 7> School 3			.714				.001
School 7> School 6			.1.018				.000
School 7>School 9			.786				.000

### Research Question 3

Are there positive relationships between critical thinking performance on the FCAT of 12<sup>th</sup> grade students and academic characteristics of cumulative GPA in Fine Arts, Language arts, and Mathematics courses?

- a. RQ<sub>3a</sub>: Are there positive relationships between critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade and academic characteristics of:
- i. Cumulative GPA of Fine Arts courses?
  - ii. Cumulative GPA of Language Arts courses?
  - iii. Cumulative GPA of Mathematics courses?

- b. RQ<sub>3b</sub>: Are there positive relationships between critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students and academic characteristics of:

- i. Cumulative GPA of Fine Arts courses?
- ii. Cumulative GPA of Language Arts courses?
- iii. Cumulative GPA of Mathematics courses?

#### **Relationships between FCAT reading scores and cumulative GPA's in fine arts, language arts, and mathematics.**

To answer research question 3a, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the Reading FCAT scores of 12<sup>th</sup> grade students and academic characteristics of cumulative GPAs in Fine Arts, Language Arts, and Mathematics. The Pearson  $r$  correlation is one of the most common statistics that describes the degree and direction of the linear relationship between variables (Trochim, 2006). The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Reading scores and of Fine Arts coursework ( $r = .348, p = .000$ ); GPAs of Language Arts coursework ( $r = .326, p = .000$ ), and GPAs of Mathematics coursework ( $r = .130, p = .004$ ). Hence, students who scored higher GPAs in all three areas analyzed in the study (Fine Arts, Language Arts, and Mathematics) consequently scored higher on FCAT Reading assessments. Table 4-6

reports the results of Pearson  $r$  correlations of FCAT Reading scores and GPAs of Fine Arts coursework, Language Arts coursework, and Mathematics coursework.

Table 4-6  
*Pearson  $r$  Correlations of FCAT Reading Scores and of Fine Arts, Language Arts, and Mathematics Coursework*

Variables	FCAT Reading Scores	GPA Fine Arts Coursework	GPA Language Arts Coursework	GPA Mathematics Coursework
	$r$	$r$	$r$	$r$
	$p$	$p$	$p$	$p$
<b>FCAT Reading Score</b>				
<b>GPA Fine Arts Coursework</b>	.348			
	.000			
<b>GPA Language Arts Coursework</b>	.326	.280		
	.000	.000		
<b>GPA Mathematics Coursework</b>	.130	.183	.563	
	.004	.000	.000	

**Relationships between FCAT mathematics scores and cumulative GPAs in fine arts, language arts, and mathematics.**

To answer research question 3<sub>b</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Mathematics scores of 12<sup>th</sup> grade students and academic characteristics of cumulative GPAs in Fine Arts, Language Arts, and Mathematics. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Mathematics scores and of Fine arts coursework ( $r = .431, p = .000$ ); of Language Arts coursework ( $r = .267, p = .000$ ), and

GPA of Mathematics coursework ( $r = .232, p = .004$ ). Thus, just as with comparisons of FCAT Reading scores and student GPA's, students who scored higher GPA's in all three areas analyzed in the study (Fine Arts, Language Arts, and Mathematics) consequently scored higher on FCAT Mathematics assessments. The results of Pearson  $r$  correlations of FCAT Mathematics scores and GPA's of Fine Arts coursework, Language Arts coursework, and Mathematics coursework are presented in Table 4-7.

Table 4-7  
*Pearson  $r$  Correlations of FCAT Mathematics Scores and GPA's of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	FCAT Mathematics Scores	GPA Fine Arts Coursework	GPA Language Arts Coursework	GPA Mathematics Coursework
	$r$ $p$	$r$ $p$	$r$ $p$	$r$ $p$
<b>FCAT Mathematics Score</b>				
<b>GPA Fine Arts Coursework</b>	.431 .000			
<b>GPA Language Arts Coursework</b>	.267 .000	.280 .000		
<b>GPA Mathematics Coursework</b>	.232 .004	.183 .000	.563 .000	

#### Research Question 4

Are there positive relationships between critical thinking performances on the FCAT of 12<sup>th</sup> grade students according to the curriculum characteristics of the frequency of courses taken in the selected fields of study: Fine Arts, Language Arts, and Mathematics?

- a. RQ<sub>4a</sub>: Are there positive relationships between critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:
  - i. Frequency of Fine arts courses?
  - ii. Frequency of Language Arts courses?
  - iii. Frequency of Mathematics courses?
  
- b. RQ<sub>4b</sub>: Are there positive relationships between critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:
  - i. Frequency of Fine Arts courses?
  - ii. Frequency of Language Arts courses?
  - iii. Frequency of Mathematics courses?

#### **Relationships between FCAT reading scores and frequency of coursework in fine arts, language arts, and mathematics.**

To answer research question 4<sub>a</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Reading scores of 12<sup>th</sup> grade students and the curriculum characteristics of frequencies of Fine Arts coursework, Language Arts coursework, and Mathematics coursework. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Reading scores and the frequencies of Fine Arts coursework ( $r = .456, p = .000$ ). However, the FCAT Reading scores were significantly, yet negatively related to the frequencies of Language Arts courses ( $r = -.188, p = .000$ ). No significant correlation was demonstrated between the FCAT reading scores and frequencies of Mathematics coursework. The results of Pearson  $r$  correlations of FCAT Reading scores and frequencies of Fine Arts

coursework, Language Arts coursework, and Mathematics coursework are presented in Table 4-8.

Table 4-8  
*Pearson  $r$  Correlations of FCAT Reading Scores and Frequencies of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	FCAT Reading Scores	Frequencies Fine Arts Coursework	Frequencies Language Arts Coursework	Frequencies Mathematics Coursework
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
FCAT Reading Score				
Frequencies Fine Arts Coursework	.456			
	.000			
Frequencies Language Arts Coursework	-.188	-.198		
	.000	.000		
Frequencies Mathematics Coursework	-.061	-.117	.327	
	.173	.009	.000	

**Relationships between FCAT mathematics scores and frequency of coursework in fine arts, language arts, and mathematics.**

To answer research question 4<sub>a</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Mathematics scores of 12<sup>th</sup> grade students and the curriculum characteristics of frequencies of Fine Arts coursework, Language Arts coursework, and Mathematics coursework. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT

Mathematics scores and the frequencies of Fine Arts coursework ( $r = .460, p = .000$ ). A significant but slightly negative correlation was reported in the relationship of FCAT Mathematics scores and frequencies of Language Arts coursework ( $r = -.162, p = .000$ ). No significant correlation was shown between FCAT Mathematics scores and frequencies of Mathematics coursework ( $r = 1.084, p = .061$ ). Table 4-9 presents the results of Pearson  $r$  correlations of FCAT Mathematics scores and frequencies of Fine Arts coursework, Language Arts coursework, and Mathematics coursework.

Table 4-9  
*Pearson  $r$  Correlations of FCAT Mathematics Scores and Frequencies of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	Mathematics FCAT scores	Frequencies of Fine Arts Coursework	Frequencies of Language Arts Coursework	Frequencies of Mathematics Coursework
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
<b>Mathematics FCAT scores</b>				
<b>Frequencies of Fine Arts Coursework</b>	.460			
	.000			
<b>Frequencies of Language Arts Coursework</b>	-.162	-.198		
	.000	.000		
<b>Frequencies of Mathematics Coursework</b>	1.084	-.117	.327	
	.061	.009	.000	



### Research Question 5

Are there positive relationships between critical thinking performance on the FCAT of 12<sup>th</sup> grade students and the curriculum characteristics:

RQ<sub>5a</sub>: Are there positive relationships between critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:

- i. Frequency of Fine Arts courses?
- ii. Frequency of Language Arts courses?
- iii. Frequency of Mathematics courses?

RQ<sub>5b</sub>: Are there positive relationships between critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students and the curriculum characteristics of:

- i. Frequency of Fine Arts courses?
- ii. Frequency of Language Arts courses?
- iii. Frequency of Mathematics courses?

#### **Relationships between FCAT reading scores and frequency of coursework in visual arts, music, and drama.**

To answer Research Question 5<sub>a</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Reading scores of 12<sup>th</sup> grade students and the curriculum characteristics of frequencies of Visual Arts coursework, Music coursework, and Drama coursework. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Reading scores and the frequencies of Visual Arts coursework ( $r = .539, p = .000$ ) and Music coursework ( $r = .097, p = .030$ ). No significant correlation was found between FCAT Reading scores and the frequencies of Drama coursework. The results of Pearson  $r$  correlations of FCAT Reading scores and frequencies of Visual Arts coursework, Music coursework, and Drama coursework are presented in Table 4-10.

Table 4-10

*Pearson  $r$  Correlations of FCAT Reading Scores and Frequencies of Visual Arts Coursework, Music Coursework, and Drama Coursework*

Variables	FCAT Reading Scores	Frequencies Visual Arts Coursework	Frequencies Music Coursework	Frequencies Drama Coursework
	$r$	$r$	$r$	$r$
	$p$	$p$	$p$	$p$
<b>FCAT Reading Score</b>				
<b>Frequencies Visual Arts Coursework</b>	.539			
	.000			
<b>Frequencies Music Coursework</b>	.097	-.104		
	.030	.019		
<b>Frequencies Drama Coursework</b>	-.044	-.082	-.058	
	.330	.066	.195	

**Relationships between FCAT mathematics scores and frequency of coursework in visual arts, music, and drama.**

To answer Research Question 5<sub>b</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Mathematics scores of 12<sup>th</sup> grade students and the curriculum characteristics of frequencies of Visual Arts coursework, Music coursework, and Drama coursework. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Mathematics scores and the frequencies of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). No significant correlation was found between FCAT Mathematics scores

and the frequencies of Drama coursework. Table 4-11 shows the results of Pearson  $r$  correlations of FCAT Mathematics scores and frequencies of Visual Arts coursework, Music coursework, and Drama coursework.

Table 4-11

*Pearson  $r$  Correlations of FCAT Mathematics Scores and Frequencies of Visual Arts Coursework, Music Coursework, and Drama Coursework*

Variables	FCAT Mathematics Scores	Frequencies Visual Arts Coursework	Frequencies Music Coursework	Frequencies Drama Coursework
	$r$	$r$	$r$	$r$
	$p$	$p$	$p$	$p$
<b>FCAT Mathematics Score</b>				
<b>Frequencies Visual Arts Coursework</b>	.458			
	.000			
<b>Frequencies Music Coursework</b>	.202	-.104		
	.000	.019		
<b>Frequencies Drama Coursework</b>	-.028	-.082	-.058	
	.533	.066	.195	

## Research Question 6

Are there positive relationships between critical thinking performance on the FCAT of 12<sup>th</sup> grade students and the academic characteristics:

a. RQ<sub>6a</sub>: Are there positive relationships between critical thinking performance on the *Reading* FCAT of 12<sup>th</sup> grade and academic characteristics of:

- i. Cumulative GPAs of Visual Arts courses?
- ii. Cumulative GPAs of Music courses?
- iii. Cumulative GPAs of Drama courses?

b. RQ<sub>6b</sub>: Are there positive relationships between critical thinking performance on the *Mathematics* FCAT of 12<sup>th</sup> grade students and academic characteristics of:

- i. Cumulative GPAs of Visual Arts courses?
- ii. Cumulative GPAs of Music courses?
- iii. Cumulative GPAs of Drama courses?

### **Relationships between FCAT reading scores and GPA's of coursework in visual arts, music, and drama.**

To answer Research Question 6<sub>a</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Reading scores of 12<sup>th</sup> grade students and the academic characteristics of cumulative GPA's of Visual Arts coursework, Music coursework, and Drama coursework. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Reading scores and the cumulative GPAs of Visual Arts coursework ( $r = .515$ ,  $p = .000$ ). No significant correlation was found between FCAT Reading scores and the cumulative GPA's of Music or Drama coursework. Table 4-12 shows the correlations of FCAT Reading scores and cumulative GPAs of Visual Arts coursework, Music coursework, and Drama coursework.

Table 4-12

*Pearson  $r$  Correlations of FCAT Reading Scores and of Visual Arts Coursework, Music Coursework, and Drama Coursework*

Variables	FCAT Reading Scores	GPA Visual Arts Coursework	GPA Music Coursework	GPA Drama Coursework
	$r$ $p$	$r$ $p$	$r$ $p$	$r$ $p$
<b>FCAT Reading Score</b>				
<b>GPA Visual Arts Coursework</b>	.515 .000			
<b>GPA Music Coursework</b>	.072 .107	.039 .000		
<b>GPA Drama Coursework</b>	-.008 .004	-.076 .088	.020 .653	

**Relationships between FCAT mathematics scores and GPAs of coursework in visual arts, music, and drama.**

To answer Research Question 6<sub>b</sub>, Pearson  $r$  correlations were used to examine relationships among critical thinking performance on the FCAT Mathematics scores of 12<sup>th</sup> grade students and academic characteristics of cumulative GPAs in Visual Arts, Music, and Drama. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Mathematics scores and GPAs of Visual Arts coursework ( $r = .480$ ,  $p = .000$ ) and Music coursework ( $r = .197$ ,  $p = .000$ ). No correlation was reported between FCAT Mathematics scores and the cumulative GPAs of

Drama coursework. The results of Pearson  $r$  correlations of FCAT Mathematics scores and GPAs of Visual Arts coursework, Music coursework, and Drama coursework are presented in Table 4-13.

Table 4-13  
*Pearson  $r$  Correlations of FCAT Mathematics Scores and of Visual Arts Coursework, Music Coursework, and Drama Coursework*

Variables	FCAT Mathematics Scores	GPA Visual Arts Coursework	GPA Music Coursework	GPA Drama Coursework
	$r$	$r$	$r$	$r$
	$p$	$p$	$p$	$p$
<b>FCAT Mathematics Score</b>				
<b>GPA Visual Arts Coursework</b>	.480			
	.000			
<b>GPA Music Coursework</b>	.197	.039		
	.000	.382		
<b>GPA Drama Coursework</b>	.017	-.076	.020	
	.696	.088	.653	

## Results of Hypotheses Testing

### Research Hypothesis 1

H1: The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the frequency of courses taken in the fields of Language Arts and Mathematics.

To test Hypothesis 1, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the frequency of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 1 had two separate hypotheses. Research Hypothesis 1<sub>a</sub> tested the explanatory relationship of frequency of Fine Arts courses and the FCAT *Reading* scores and Hypothesis 1<sub>b</sub> tested the explanatory relationship of frequency of Fine Arts courses and FCAT *Mathematics* scores.

H<sub>1a</sub> The frequency of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Reading* FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.

To test Hypothesis 1<sub>a</sub>, Pearson *r* correlations and multiple regression analyses using the hierarchical (forward-enter) method were conducted to determine whether there was a significantly greater explanatory (correlational) relationship among frequency of Fine Arts courses taken by students reaching 12<sup>th</sup> grade and critical thinking performance on the FCAT Reading, the dependent variable, than the frequency of courses taken in the fields of Language Arts or Mathematics.

First, Pearson *r* correlation analyses were conducted to determine the order in which to enter the independent variables into the regression model. Pearson *r* correlations showed a significant positive correlation between the FCAT Reading scores

and the frequency of Visual Arts coursework ( $r = .539, p = .000$ ) and Music coursework ( $r = .097, p = .030$ ). A significant inverse relationship was reported between FCAT Reading scores and frequency of Language Arts coursework. No significant correlation was found between FCAT Reading scores and frequency of Mathematics coursework ( $r = -.061, p = .173$ ) or Drama coursework ( $r = -.044, p = .330$ ). Pearson  $r$  correlations of FCAT Reading scores and frequencies of Fine Arts coursework, Language Arts coursework, and Mathematics coursework are presented in Table 4-14.

Table 4-14  
*Pearson  $r$  Correlations of FCAT Reading Scores and Frequencies of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	Pearson $r$	$p$ -value
Frequency of Fine Arts coursework		
Frequency of Visual Arts coursework	.539	.000
Frequency of Music coursework	.097	.030
Frequency of Drama coursework	-.044	.330
Frequency of Language Arts coursework	-.188	.000
Frequency of Mathematics coursework	-.061	.173

The five variables of frequency of Visual Arts, Music, Drama, Language Arts, and Mathematics were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  correlation to the weakest. The highest level of measurement was used for each variable. Collinearity statistics were examined. The VIF is a predictor of strong linear relationships with other predictors and may be a concern if over 10, while tolerance should be greater than .10 (Field, 2005). For the three models produced, the Variance Inflation Factor (VIF) ranged from 1.002 to 1.021, while the tolerance ranged from 1.000 to .979. These results were well within the recommended guidelines, suggesting multicollinearity was not a problem.



Three different models were produced from the hierarchical regression. Each model had significant  $F$  values, which is the significance of the regression model as a whole. Model 1 had significant  $F$  values ( $p = .000$ ), as well as Model 2 ( $p = .000$ ) and Model 3 ( $p = .000$ ). The *Adjusted R<sup>2</sup>* increased steadily from Model 1 (28.9%), to Model 2 (31.1%), to Model 3 (32.2%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores. The explanatory model found was:

$$\text{FCAT Reading scores} = 2.80 \text{ (constant)} + .406 \text{ (Frequency of Visual Arts)} \\ + .138 \text{ (Frequency of Music)} - .07 \text{ (Frequency of Language Arts)} + e$$

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Reading scores. The standardized beta coefficient ( $\beta$ ) for each of the three predictors indicated its relative importance in explaining critical thinking as measured by the FCAT *Reading* scores. Frequency of *Visual Arts* courses was the most important predictor ( $t = 14.5$ ,  $p = .000$ ,  $\beta = .540$ ) in the model. A positive relationship was reported between frequency of visual art courses and critical thinking as measured by the FCAT *Reading* scores. As a result, higher frequencies of Visual Arts courses correlated with higher FCAT Reading scores.

Frequency of *Music* courses ( $t = 3.95$ ,  $p = .000$ ,  $\beta = .146$ ) was the second most important predictor in the model. A positive relationship was also reported between the frequency of Music courses and critical thinking as measured by the FCAT *Reading* scores. Higher frequencies of Music courses correlated with higher FCAT Reading scores.

Lastly, frequency of Language Arts courses was the third most important predictor ( $t = -3.03$ ,  $p = .003$ ,  $\beta = -.112$ ) in the model. The inverse  $\beta$  value of frequency of Language Arts courses had a negative relationship with critical thinking as measured by the FCAT *Reading* scores, thus higher frequencies of language arts courses resulted in lower scores on the Reading FCAT.

According to the findings, Hypothesis 1<sub>a</sub> was partially supported. The frequencies of Visual Arts and Music courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. An inverse negative relationship was determined between frequencies of Language Arts courses and FCAT Reading scores. No significant relationship, either positive or negative, was demonstrated between the relationship of frequency of Drama courses or Mathematics courses and critical thinking as measured by the FCAT *Reading* scores. The hierarchical (forward) multiple regression results for H1<sub>a</sub> are summarized in Table 4-15.

Table 4-15

*Hierarchical (Forward) Multiple Regression Analysis of FCAT Reading scores and Frequency of Fine Arts, Language Arts, and Mathematic Coursework*

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 1</b>	205.4	1	.00						.290	.289
(Constant)				2.5	.061					
Frequency of Visual Arts				.405	.028	.539	14.3	.000		
<b>Model 2</b>	114.7	2	.00						.314	.311
(Constant)				2.4	.068					
Frequency of Visual Art				.41	.028	.555	14.9	.000		
Frequency of Music				.15	.035	.155	4.2	.000		
<b>Model 3</b>	80.8	3	.00						.326	.322
(Constant)				2.80	.157					
Frequency of Visual Art				.406	.028	.540	14.5	.000		
Frequency of Music				.138	.035	.146	3.95	.000		
Frequency of Language Arts				-.07	.022	-.112	-3.03	.000		

H<sub>1b</sub> The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Mathematics* FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.

To test Hypothesis 1<sub>b</sub>, Pearson *r* correlations and multiple regression analyses using the hierarchical (forward-enter) method were conducted to determine whether there was a significantly greater explanatory (correlational) relationship among frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade and critical thinking performance on the FCAT Mathematics, the dependent variable, than the frequency of courses taken in the fields of Language Arts or Mathematics.

First, Pearson  $r$  correlation analyses were conducted to determine the order in which to enter the independent variables into the regression model. Pearson  $r$  correlations showed a significant positive correlation between the FCAT Mathematics scores and the frequency of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .030$ ). An inverse relationship was found between FCAT Mathematics scores and frequency of Language Arts coursework ( $r = -.162, p = .000$ ). No significant correlation was found between FCAT Mathematics scores and frequency of Mathematics coursework ( $r = -.084, p = .061$ ) or Drama coursework ( $r = -.028, p = .533$ ). Pearson  $r$  correlations of FCAT Mathematic scores and frequencies of Fine Arts coursework, Language Arts coursework, and Mathematics coursework are presented in Table 4-16.

Table 4-16

*Pearson  $r$  Correlations of FCAT Mathematics Scores and Frequencies of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	Pearson $r$	$p$ -value
Frequency of Fine Arts coursework		
Frequency of Visual Arts coursework	.458	.000
Frequency of Music coursework	.202	.000
Frequency of Drama coursework	-.028	.533
Frequency of Language Arts coursework	-.162	.000
Frequency of Mathematics coursework	-.084	.061

The variables of frequency of Visual Arts, Music, Drama, Language Arts, and Mathematics were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  correlation to the weakest. The highest level of measurement was used for each variable. Collinearity statistics were examined. For the three models produced, the Variance Inflation Factor (VIF) ranged from 1.000 to 1.021, while the tolerance ranged from .976 to 1.000. Three different models were produced from the

hierarchical regression. Each model had significant  $F$  values. Model 1 had significant  $F$  values ( $p = .000$ ), as did Model 2 ( $p = .000$ ) and Model 3 ( $p = .000$ ). The *Adjusted R<sup>2</sup>* increased steadily from Model 1 (20.8%), to Model 2 (27%), to Model 3 (27.6%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores. The explanatory model found was:

$$\text{FCAT Mathematics scores} = 3.22 \text{ (constant)} + .280 \text{ (Frequency of Visual Arts)} + .184 \text{ (Frequency of Music)} - .041 \text{ (Frequency of Language Arts)} + e$$

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT *Mathematics* scores. The standardized beta coefficient ( $\beta$ ) for each of the three predictors indicated its relative importance in explaining critical thinking as measured by the FCAT *Mathematics* scores. Frequency of *Visual Arts* courses was the most important predictor ( $t = 12.30$ ,  $p = .000$ ,  $\beta = .473$ ) in the model. A positive relationship was reported between frequency of *Visual Arts* courses and critical thinking as measured by the FCAT *Mathematics* scores. Higher frequencies of *Visual Arts* courses correlated with higher FCAT *Mathematics* scores.

Frequency of *Music* courses ( $t = 6.43$ ,  $p = .000$ ,  $\beta = .246$ ) was the second most important predictor in the model. A positive relationship was also reported between the frequency of *Music* courses and critical thinking as measured by the FCAT *Mathematics* scores. Higher frequencies of *Music* courses correlated with higher FCAT *Mathematics* scores.

Finally, frequency of *Language Arts* courses was the third most important predictor ( $t = -2.31$ ,  $p = .022$ ,  $\beta = -.088$ ) in the model. The inverse  $\beta$  value of frequency

of Language Arts courses had a negative relationship with critical thinking as measured by the FCAT *Mathematics* scores, thus higher frequencies of Language Arts courses resulted in lower scores on the FCAT Mathematics.

According to the findings, Hypothesis 1<sub>b</sub> was partially supported. The frequency of Visual Arts and Music courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Mathematics* scores. An inverse negative relationship was determined between frequencies of Language Arts courses and FCAT Mathematics scores. No significant relationship was demonstrated between the relationship of frequency of Drama courses or Mathematics courses and critical thinking as measured by the FCAT *Mathematics* scores. The hierarchical (forward) multiple regression results for H1<sub>a</sub> are summarized in Table 4-17.

Table 4-17

*Hierarchical (Forward) Multiple Regression Analysis of FCAT Mathematics scores and Frequency of Fine Arts, Language Arts, and Mathematic Coursework*

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 1</b>	133.3	1	.00						.210	.208
(Constant)				3.12	.051					
Frequency of Visual Arts				.272	.024	.458	11.55	.000		
<b>Model 2</b>	94.06	2	.00						.273	.270
(Constant)				2.96	.056					
Frequency of Visual Art				.287	.023	.484	12.65	.000		
Frequency of Music				.189	.029	.253	6.595	.000		

Table 4 – 17 Continued

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 3</b>	65.01	3	.00						.281	.276
(Constant)				3.221	.128					
Frequency of Visual Art				.280	.023	.473	12.29	.000		
Frequency of Music				.184	.029	.246	6.429	.000		
Frequency of Language Arts				-.041	.018	-.088	-2.31	.022		

## Research Hypothesis 2

H2: The cumulative GPAs of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPAs of courses taken in the fields of Language Arts or Mathematics.

To test Hypothesis 2, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the cumulative GPAs of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 2 had two separate hypotheses. Research Hypothesis 2<sub>a</sub> tested the explanatory relationship of cumulative GPAs of Fine Arts courses and the FCAT *Reading* scores and Hypothesis 2<sub>b</sub> tested the explanatory relationship of cumulative GPAs of Fine Arts courses and FCAT *Mathematics* scores.

H<sub>2a</sub> The cumulative GPAs of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Reading* FCAT than the cumulative GPAs of courses taken in the fields of Language Arts or Mathematics.

Pearson  $r$  correlations were performed initially to determine the order in which to enter the independent variables into the regression model. Pearson  $r$  correlations indicated a significant positive correlation between the FCAT Reading scores and cumulative GPAs of Visual Arts coursework ( $r = .515, p = .000$ ), the cumulative GPAs of Language Arts coursework ( $r = .326, p = .000$ ), and the cumulative GPAs of Mathematics coursework ( $r = .136, p = .002$ ). No significant correlation was found between FCAT Reading scores and cumulative GPAs of Music or Drama coursework. Pearson  $r$  correlations of FCAT Reading scores and the cumulative GPAs of Fine Arts coursework, Language Arts coursework, and Mathematics coursework are shown in Table 4-18.

Table 4-18  
*Pearson  $r$  Correlations of FCAT Reading Scores and Cumulative GPAs of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	Pearson $r$	$p$ -value
Cumulative GPAs of Fine Arts coursework		
Cumulative GPAs of Visual Arts coursework	.515	.000
Cumulative GPAs of Music coursework	.072	.107
Cumulative GPAs of Drama coursework	-.008	.865
Cumulative GPAs of Language Arts coursework	.326	.000
Cumulative GPAs of Mathematics coursework	.136	.002

The five variables of cumulative GPAs of Visual Arts coursework, Music coursework, Drama coursework, Language Arts coursework, and Mathematics coursework were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  correlation to the weakest. For the three models produced, the VIF ranged from 1.000 to 1.486, while the tolerance ranged from .673 to 1.000. The  $F$  values for Model 1 ( $p = .000$ ), Model 2 ( $p = .000$ ), Model 3 ( $p = .000$ ) were all significant for an explanatory relationship. The *Adjusted  $R^2$*  increased steadily from Model 1 (26.4%), to



Model 2 (30%), to Model 3 (30.6%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores. The explanatory model found was:

$$\begin{aligned} \text{FCAT Reading scores} = & 1.421 \text{ (constant)} + .321 \text{ (Cumulative GPAs of} \\ & \text{Visual Arts)} + .470 \text{ (Cumulative GPAs of Language Arts)} - .162 \text{ (Cumulative} \\ & \text{GPAs of Mathematics)} + e \end{aligned}$$

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Reading scores. The standardized beta coefficient ( $\beta$ ) for each of the three predictors indicated its relative importance in explaining critical thinking as measured by the FCAT *Reading* scores. The cumulative GPAs of *Visual Arts* courses had the greatest impact on the model ( $t = 12.04$ ,  $p = .000$ ,  $\beta = .466$ ). A positive relationship was reported between the GPAs of Visual Arts courses and critical thinking as measured by the FCAT *Reading* scores. As a result, higher GPAs of Visual Arts courses correlated with higher FCAT Reading scores.

Cumulative GPAs of *Language Arts* courses ( $t = 5.64$ ,  $p = .000$ ,  $\beta = .260$ ), was the second most important predictor in the model. Additionally, a positive relationship was reported between the cumulative GPAs of Language Arts courses and critical thinking as measured by the FCAT *Reading* scores. Higher GPAs of Language Arts courses correlated with higher FCAT Reading scores.

Lastly, frequency of Mathematics courses was the third most important predictor ( $t = -2.34$ ,  $p = .019$ ,  $\beta = -.106$ ) in the model. The  $\beta$  value of cumulative GPA of Mathematics courses symbolized an inverse relationship with critical thinking as

measured by the FCAT *Reading* scores, thus higher GPA's of Mathematics courses correlated with lower scores on the Reading FCAT.

Hypothesis 2<sub>a</sub> was partially supported by these findings. The cumulative GPAs of Visual Arts courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. Also, a significant positive relationship was established between cumulative GPA's in Language Arts coursework and FCAT Reading scores. No significant relationship was demonstrated between the cumulative GPAs of Music or Drama courses and FCAT Reading scores. However, an inverse negative relationship was determined between cumulative GPAs of Mathematics coursework and critical thinking as measured by the FCAT *Reading* scores. The hierarchical (forward) multiple regression results of H2<sub>a</sub> are presented in Table 4-19.

Table 4-19  
*Hierarchical (Forward) Multiple Regression Analysis of FCAT Reading scores and Cumulative of Fine Arts, Language Arts, and Mathematics Coursework*

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 1</b>	181.2	1	.00						.265	.264
(Constant)				2.83	.076					
Cumulative GPAs of Visual Arts				.356	.026	.515	13.46	.000		
<b>Model 2</b>	108.7	2	.00						.303	.300
(Constant)				1.34	.196					
Cumulative GPAs of Visual Arts				.318	.027	.460	11.86	.000		
Cumulative GPAs of Language Arts				.363	.070	.201	5.180	.000		

Table 4-19 Continued

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	Adjusted <i>R</i> <sup>2</sup>
<b>Model 3</b>	74.92	3	.00						.310	.306
(Constant)				1.42	.198					
Cumulative of Visual Arts				.321	.027	.466	12.04	.000		
Cumulative of Language Arts				.470	.083	.260	5.639	.000		
Cumulative of Mathematics				-.162	.069	-.106	-2.34	.019		

H<sub>2b</sub> The cumulative GPAs of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the *Mathematics* FCAT than the cumulative GPAs of courses taken in the fields of Language Arts or Mathematics.

Pearson *r* correlations were performed initially to determine the order in which to enter the independent variables into the regression model. Pearson *r* correlations indicated a significant positive correlation between the FCAT Mathematics scores and cumulative GPAs of Visual Arts coursework ( $r = .480, p = .000$ ), the cumulative GPAs of Language Arts coursework ( $r = .267, p = .000$ ), and the cumulative GPAs of Mathematics coursework ( $r = .237, p = .000$ ), and the cumulative GPAs of Music coursework ( $r = .197, p = .000$ ) No significant correlation was found between FCAT Mathematics scores and cumulative GPAs of Drama coursework. Pearson *r* correlations of FCAT Mathematics scores and the cumulative GPAs of Fine Arts coursework, Language Arts coursework, and Mathematics coursework are shown in Table 4-20.

Table 4-20

*Pearson r Correlations of FCAT Mathematics Scores and Cumulative GPAs of Fine Arts Coursework, Language Arts Coursework, and Mathematics Coursework*

Variables	Pearson <i>r</i>	<i>p</i> -value
Cumulative GPA of Fine Arts coursework		
Cumulative GPA of Visual Arts coursework	.480	.000
Cumulative GPA of Music coursework	.197	.000
Cumulative GPA of Drama coursework	.017	.696
Cumulative GPA of Language Arts coursework	.267	.000
Cumulative GPA of Mathematics coursework	.237	.000

The variables of cumulative GPAs of Visual Arts coursework, Music coursework, Drama coursework, Language Arts coursework, and Mathematics coursework were entered into a hierarchical forward linear regression model from the strongest Pearson *r* correlation to the weakest. For the three models produced, the VIF ranged from 1.000 to 1.043, while the tolerance ranged from .959 to 1.000. The *F* values for Model 1 (*p* = .000), Model 2 (*p* = .000), Model 3 (*p* = .000) were all significant for an explanatory relationship. The *Adjusted R*<sup>2</sup> increased steadily from Model 1 (22.9%), to Model 2 (26%), to Model 3 (27.8%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores. The explanatory model found was:

$$\begin{aligned} \text{FCAT Mathematics scores} = & 2.421 \text{ (constant)} + .242 \text{ (Cumulative GPA of} \\ & \text{Visual Arts)} + .173 \text{ (Cumulative GPAs of Mathematics)} + .095 \text{ (Cumulative} \\ & \text{GPAs of Music)} + e \end{aligned}$$

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT *Mathematics* scores. The standardized beta coefficient ( $\beta$ ) for

each of the three predictors indicated its relative importance in explaining critical thinking as measured by the FCAT *Mathematics* scores. The Cumulative GPAs of *Visual Arts* courses had the greatest impact on the model ( $t = 11.484, p = .000, \beta = .445$ ). A positive relationship was reported between the GPAs of Visual Arts courses and critical thinking as measured by the FCAT *Mathematics* scores. Consequently, higher GPAs of Visual Arts courses correlated with higher FCAT Mathematics scores.

Cumulative GPAs of *Music* courses ( $t = 4.66, p = .000, \beta = .177$ ), was the second most important predictor in the model. Additionally, a positive relationship was reported between the cumulative GPAs of Music courses and critical thinking as measured by the FCAT *Mathematics* scores. Hence, higher GPAs of Music courses correlated with higher FCAT Mathematics scores.

Finally, the cumulative GPAs of Mathematics courses was the third most important predictor ( $t = 3.695, p = .000, \beta = .143$ ) in the model. The  $\beta$  value of cumulative GPAs of Mathematics courses also demonstrated a positive relationship with critical thinking as measured by the FCAT *Mathematics* scores; therefore, higher GPAs of Mathematics courses correlated with higher scores on the Mathematics FCAT.

According to the findings, Hypothesis 2<sub>b</sub> was partially supported. A significant positive relationship between the cumulative GPAs of Visual Arts coursework, Music coursework, and Mathematics coursework and critical thinking as measured by the FCAT *Mathematics* scores was determined. The hierarchical (forward) multiple regression results of H2<sub>b</sub> are presented in Table 4-21.

Table 4-21

*Hierarchical (Forward) Multiple Regression Analysis of FCAT Mathematics scores and Cumulative GPAs of Fine Arts, Language Arts, and Mathematic Coursework*

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 1</b>	150.7	1	.00						.480	.229
(Constant)				2.93	.061					
Cumulative GPAs of Visual Arts				.262	.021	.480	12.26	.000		
<b>Model 2</b>	89.32	2	.00						.513	.260
(Constant)				2.796	.066					
Cumulative GPAs of Visual Arts				.258	.021	.474	12.34	.000		
Cumulative GPAs of Music				.097	.021	.179	4.66	.000		
<b>Model 3</b>	65.60	3	.00						.531	.278
(Constant)				2.421	.121					
Cumulative GPAs of Visual Arts				.242	.021	.445	11.48	.000		
Cumulative GPAs of Music				.095	.020	.177	4.66	.000		
Cumulative GPAs of Mathematics				.173	.047	.143	3.695	.000		

### Research Hypothesis 3

H3: Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the FCAT Reading and FCAT Mathematics.

To test Hypothesis 3, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 3 had two separate hypotheses. Research Hypothesis 3<sub>a</sub> tested the explanatory relationship of the

demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and the FCAT *Reading* scores and Hypothesis 3<sub>b</sub> tested the explanatory relationship of the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and FCAT *Mathematics* scores.

H<sub>3a</sub> Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the *Reading* FCAT.

First, Pearson *r* correlation analyses were conducted to determine the order in which to enter the independent variables into the regression model. Under the category of *demographic* characteristics of students, Pearson *r* correlations showed a significant positive correlation between the FCAT Reading scores and birth year ( $r = .118, p = .000$ ) and county area ( $r = .107, p = .017$ ). A significant inverse, thus negative, relationship was reported between FCAT Reading scores and race and FCAT Reading scores and student socioeconomic status. No significant correlation was found between FCAT Reading scores and gender ( $r = -.054, p = .173$ ) or individual schools ( $r = .021, p = .632$ ).

Within the category of *curriculum* characteristics (frequency of coursework), Pearson *r* correlations showed a significant positive correlation between the FCAT Reading scores and frequency of Visual Arts coursework ( $r = .539, p = .000$ ) and Music coursework ( $r = .539, p = .000$ ). A significant inverse relationship was reported between FCAT Reading scores and frequency of Language Arts coursework ( $r = -.188, p = .000$ ). No significant correlation was found between FCAT Reading scores and frequency of Drama Coursework ( $r = -.054, p = .173$ ) or Mathematics coursework ( $r = .051, p = .170$ ).

Under the category of *academic* characteristics (cumulative GPAs), Pearson *r* correlations showed a significant positive correlation between the FCAT Reading scores

and cumulative GPAs of Visual Arts coursework ( $r = .515, p = .000$ ), cumulative GPAs of Language Arts coursework ( $r = .326, p = .000$ ), and cumulative GPAs of Mathematics coursework ( $r = .136, p = .002$ ). No significant correlation was found between FCAT Reading scores and cumulative GPAs of Music or Drama coursework. Pearson  $r$  correlations of FCAT Reading scores and demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are presented in Table 4-22.

Table 4-22  
*Pearson  $r$  Correlations of FCAT Reading Scores and Students' Demographic, Academic, and Curriculum Characteristics*

Variables	Pearson $r$	$p$ -value
Demographic Characteristics		
Gender	-.054	.227
Race	-.168	.000
Socioeconomic Status	-.159	.000
Area	.107	.017
School	.021	.632
Curriculum Characteristics		
Frequency of Visual Art	.539	.000
Frequency of Music	.097	.030
Frequency of Drama	-.044	.330
Frequency of Language Arts	-.188	.000
Frequency of Mathematics	.051	.170
Academic Characteristics		
GPA of Visual Art	.515	.000
GPA of Music	.072	.107
GPA of Drama	-.008	.865
GPA of Language Arts	.326	.000
GPA of Mathematics	.136	.002

The six demographic characteristics (gender, race, birth year, socioeconomic status, area, and school); the five curriculum characteristics (frequency of Visual Arts coursework, frequency of Music coursework, frequency of Drama coursework, frequency of Language Arts coursework, and frequency of Mathematics coursework); as well as the five academic characteristics (cumulative GPAs of Visual Arts coursework, cumulative GPAs of Music coursework, cumulative GPAs of Drama coursework, cumulative GPAs



of Language Arts coursework, and cumulative GPAs of Mathematics coursework) were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  to the weakest. The highest level of measurement was used for each level. The VIF ranged from 1.000 to 1.005 and the tolerance ranged from .995 to 1.000.

Six different models were produced from the hierarchal regression. All models had significant  $F$  values, including Model 1 through Model 6 ( $p = .000$ ). The *Adjusted R<sup>2</sup>* increased steadily from Model 1 (28.9%), to Model 2 (32.4%), to Model 3 (35%) to Model 4 (36.8%), to Model 5 (38.1), to Model 6 (39.3%). Therefore, Model 6 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores. The explanatory model found was:

$$\begin{aligned} \text{FCAT Reading scores} = & 1.395 \text{ (constant)} \ .261 \text{ (Frequency of Visual Arts)} \\ & .151 \text{ (Cumulative GPAs of Visual Arts)} \ .292 \text{ (Cumulative GPAs of} \\ & \text{Language Arts)} \ -1.32 \text{ (Race)} \ .123 \text{ (Frequency of Music)} \ .163 \text{ (County} \\ & \text{Area)} + e \end{aligned}$$

Analysis of individual predictors in Model 6 indicated six significant explanatory relationships between the six predictors and critical thinking skills as measured by the FCAT Reading scores. The standardized beta coefficient ( $\beta$ ) for each of the six predictors indicated its relative importance in explaining critical thinking as measured by the FCAT *Reading* scores. The frequency of *Visual Arts* courses was the most important predictor of the model ( $t = 6.93$ ,  $p = .000$ ,  $\beta = .347$ ). A positive relationship was reported between the frequency of Visual Arts courses and critical thinking as measured by the FCAT *Reading* scores. Accordingly, higher frequencies of Visual Arts courses correlated with higher FCAT Reading scores.

The cumulative GPAs of *Visual Arts* courses ( $t = 4.41, p = .000, \beta = .219$ ) was the second most important predictor in the model. A positive relationship was shown between the cumulative GPAs of Visual Arts courses and critical thinking as measured by the FCAT Reading scores. A higher cumulative GPA in Visual Arts coursework was associated with higher FCAT Reading scores. The cumulative GPAs of *Language Arts* coursework was the third most important predictor ( $t = 4.43, p = .000, \beta = .162$ ) in the model. A higher cumulative GPA in Language Arts correlated with higher FCAT Reading scores.

The *race* of the student was the fourth most significant predictor ( $t = 3.68, p = .000, \beta = -.134$ ) in the model. The inverse  $\beta$  value of race had a negative relationship with critical thinking as measured by the FCAT Reading scores. The multiple ANOVA tests, followed by Tukey's post hoc comparisons presented in Research Question 2 (Table 4-4) show that FCAT Reading scores were significantly higher for white students ( $M = 3.44$ ) than Hispanic ( $M = 2.91$ ), Black ( $M = 2.84$ ), or Asian ( $M = 2.83$ ) students.

The frequency of *Music* courses ( $t = 3.68, p = .000, \beta = .130$ ) was the fifth most important predictor in the model, which showed a positive relationship between the frequencies of Music coursework and FCAT Reading scores. Higher frequencies of Music coursework correlated with higher FCAT Reading scores. Finally, the *county area* ( $t = 3.22, p = .001, \beta = .112$ ) was also a significant predictor in the model. The multiple ANOVA tests, followed by Tukey's post hoc comparisons presented in Research Question 2 (Table 4-4) show that FCAT Reading scores were higher for the South area schools ( $M = 3.21$ ) than the North area schools ( $M = 2.90$ ).

According to the findings Hypothesis 3<sub>a</sub> was partially supported. Some demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on FCAT Reading scores. The *demographic* characteristics of birth year and county area in which the student attended school were found to be significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. The  $\beta$  value of race and socioeconomic status symbolized an inverse relationship with critical thinking as measured by the FCAT Reading scores. No significant relationship was established between the demographic characteristics of gender or individual schools in the study that students attended.

The *curriculum* characteristics of frequency of Visual Arts coursework and Music coursework were found to be significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. No significant relationship was demonstrated between the frequencies of Drama coursework or Mathematics coursework and critical thinking performance in Reading. However, an inverse negative relationship was shown between the frequency of Language Arts coursework and critical thinking as measured by the FCAT *Reading* scores.

Finally, a significant positive explanatory relationship was established between the *academic* characteristics of cumulative GPAs of Visual Arts coursework, cumulative GPAs of Language Arts coursework, and cumulative GPAs of Mathematics coursework and critical thinking as measured by the FCAT *Reading* scores. No significant relationship was shown between the cumulative GPAs of Music or Drama coursework

and critical thinking as measured by the FCAT *Reading* scores. The hierarchical (forward) multiple regression results of H<sub>3a</sub> are presented in Table 4-23.

Table 4-23  
*Hierarchical (Forward) Multiple Regression Analysis of FCAT Reading Scores and Students' Demographic, Academic, and Curriculum Characteristics*

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 1</b>	205.4	1	.00						.290	.289
(Constant)				2.5	.061		40.77			
Frequency of Visual Arts				.4	.028	.539	14.33	.000		
<b>Model 2</b>	121.3	2	.00						.326	.324
(Constant)				2.283	.073		31.49			
Frequency of Visual Arts				.262	.039	.349	6.736	.000		
Cumulative GPAs of Visual Arts				.185	.036	.268	5.163	.000		
<b>Model 3</b>	91.21	3	.00						.354	.350
(Constant)				1.472	.190		7.756	.000		
Frequency of Visual Arts				.242	.038	.322	6.291	.000		
Cumulative of Visual Arts				.166	.035	.240	4.683	.000		
Cumulative of Language Arts				.313	.068	.174	4.612	.000		
<b>Model 4</b>	74.11	4	.00						.373	.368
Constant				1.758	.201		8.742	.000		
Frequency of Visual Arts				.237	.038	.316	6.252	.000		
Cumulative of Visual Arts				.163	.035	.237	4.683	.000		
Cumulative of Language Arts				.318	.067	.176	4.742	.000		
Race				-.136	.035	-.138	-3.89	.000		

Table 4 – 23 Continued

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	Adjusted <i>R</i> <sup>2</sup>
<b>Model 5</b>	62.98	5	.00						.387	.381
Constant				1.718	.199		8.62	.000		
Frequency of Visual Arts				.257	.038	.342	6.77	.000		
Cumulative of Visual Arts				.153	.035	.222	4.43	.000		
Cumulative of Language Arts				.298	.067	.165	4.47	.000		
Race				-.135	.035	-.137	-3.89	.000		
<b>Model 6</b>	55.20	6	.00						.400	.3939
Constant				1.395	.221		6.305	.000		
Frequency of Visual Arts				.261	.038	.347	6.934	.000		
Cumulative of Visual Arts				.151	.034	.219	4.409	.000		
Cumulative of Language Arts				.292	.066	.162	4.428	.000		
Race				-.132	.034	-.134	-3.86	.000		
Frequency of Music				.123	.033	.130	3.675	.000		
Area				.163	.051	.112	3.224	.000		

H<sub>3b</sub> Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the *Mathematics* FCAT.

Pearson *r* correlations were initially conducted to determine the order in which to enter the independent variables into the regression model. Within the *demographic* characteristics, only one variable, socioeconomic status, was found to illustrate a significant correlation with FCAT Mathematics scores and was reported as an inverse, or negative correlation ( $r = -.125, p = .005$ ). No significant correlations were found between FCAT Mathematics scores and the demographic characteristics of gender, race, birth year, county area, or individual school attended by students in the study.

Within the category of *curriculum* characteristics (frequency of coursework), Pearson *r* correlations showed a significant positive correlation between the FCAT

Mathematics scores and frequency of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). A significant inverse relationship was reported between FCAT Mathematics scores and frequency of Language Arts coursework ( $r = -.162, p = .000$ ). No significant correlation was found between FCAT Mathematics scores and the frequency of Drama coursework or Mathematics coursework.

Under the category of *academic* characteristics (cumulative GPA's), Pearson  $r$  correlations showed a significant positive correlation between the FCAT Mathematics scores and cumulative GPAs of Visual Arts coursework ( $r = .480, p = .000$ ) and Music coursework ( $r = .197, p = .000$ ). A significant positive correlation between the FCAT Mathematics scores and cumulative GPAs of Language Arts coursework ( $r = .267, p = .000$ ), and cumulative GPAs of Mathematics coursework ( $r = .237, p = .000$ ) was also established. No significant correlation was found between FCAT Mathematics scores and cumulative GPAs of Drama coursework. Pearson  $r$  correlations of FCAT Mathematics scores and demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are presented in Table 4-24.

Table 4-24

*Pearson  $r$  Correlations of FCAT Mathematics Scores and Students' Demographic, Academic, and Curriculum Characteristics*

Variables	<i>Pearson <math>r</math></i>	<i>p-value</i>
Demographic Characteristics		
Gender	-.083	.062
Race	-.075	.091
Birth year	.076	.087
Socioeconomic Status	-.125	.005
Area	.073	.103
School	-.013	.769
Curriculum Characteristics		
Frequency of Visual Art	.458	.000
Frequency of Music	.202	.000
Frequency of Drama	-.028	.533
Frequency of Language Arts	-.162	.000
Frequency of Mathematics	-.084	.061
Academic Characteristics		
GPA Art	.480	.000
GPA Music	.197	.000
GPA Drama	.017	.696
GPA Language Arts	.267	.000
GPA Mathematics	.237	.000

The six demographic characteristics (gender, race, birth year, socioeconomic status, area, and school); the five curriculum characteristics (frequency of Visual Arts coursework, frequency of Music coursework, frequency of Drama coursework, frequency of Language Arts coursework, and frequency of Mathematics coursework); as well as the five academic characteristics (cumulative GPAs of Visual Arts coursework, cumulative GPAs of Music coursework, cumulative GPAs of Drama coursework, cumulative GPAs of Language Arts coursework, and cumulative GPAs of Mathematics coursework) were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  to the weakest. The highest level of measurement was used for each level. For the three models produced, the VIF ranged from 1.000 to 1.045 and the tolerance ranged from .957 to 1.000.

The  $F$  values for Model 1 ( $p = .000$ ), Model 2 ( $p = .000$ ), Model 3 ( $p = .000$ ) were all significant for an explanatory relationship. The *Adjusted R*<sup>2</sup> increased steadily from Model 1 (23.1%), to Model 2 (27.3%), to Model 3 (29.1%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores. The explanatory model found was:

$$\text{FCAT Mathematics scores} = 2.451 \text{ (constant)} + .248 \text{ (Cumulative GPAs of Visual Arts)} + .149 \text{ (Frequency of Music)} + .095 \text{ (Cumulative GPAs of Mathematics)} + e$$

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT *Mathematics* scores. The Cumulative GPAs of *Visual Arts* courses ( $t = 11.81$ ,  $p = .000$ ,  $\beta = .454$ ) was the most important indicator of the model. A positive relationship was reported between the GPAs of *Visual Arts* courses and critical thinking as measured by the FCAT *Mathematics* scores. Consequently, higher GPAs of *Visual Arts* courses correlated with higher FCAT *Mathematics* scores.

The frequency of *Music* courses ( $t = 5.29$ ,  $p = .000$ ,  $\beta = .199$ ), was the second most important predictor in the model. Additionally, a positive relationship was reported between the frequency of *Music* courses and critical thinking as measured by the FCAT *Mathematics* scores. Hence, higher frequencies of *Music* courses correlated with higher FCAT *Mathematics* scores.

Finally, the cumulative GPAs of *Mathematics* courses was the third most important predictor ( $t = 3.54$ ,  $p = .000$ ,  $\beta = .136$ ) in the model. The  $\beta$  value of cumulative GPA of *Mathematics* courses also demonstrated a positive relationship with critical



thinking as measured by the FCAT *Mathematics* scores, therefore higher GPAs of Mathematics courses correlated with higher scores on the Mathematics FCAT.

According to the findings, Hypothesis 3<sub>b</sub> was partially supported. A significant positive relationship between the cumulative GPAs of Visual Arts and Mathematics coursework, the frequencies of Music coursework, and critical thinking as measured by the FCAT *Mathematics* scores was determined. The hierarchical (forward) multiple regression results of H3<sub>b</sub> are presented in Table 4-25.

Table 4-25  
*Hierarchical (Forward) Multiple Regression Analysis of FCAT Mathematics Scores and Students' Demographic, Academic, and Curriculum Characteristics*

Variable	<i>F</i>	<i>df</i>	<i>p</i>	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>R</i> <sup>2</sup>	<i>Adjusted R</i> <sup>2</sup>
<b>Model 1</b>	150.7	1	.00						.231	.229
(Constant)				2.925	.061		47.87	.000		
GPA of Visual Arts				.262	.021	.480	12.28	.000		
<b>Model 2</b>	94.16	2	.00						.273	.270
(Constant)				2.806	.063		44.24	.000		
GPA of Visual Arts				.263	.021	.482	12.66	.000		
Frequency of Music				.154	.028	.206	5.401	.000		
<b>Model 3</b>	68.40	3	.00						.291	.287
(Constant)				2.451	.118		20.70	.000		
GPA of Visual Arts				.248	.021	.454	11.81	.000		
Frequency of Music				.149	.028	.199	5.29	.000		
GPA of Mathematics				.165	.046	.136	3.54	.000		

Chapter IV presented a description of the final data-producing sample and the psychometric analyses of the FCAT assessment tool. Results of answering the research questions and hypotheses testing were also presented. All data analyses were rechecked

and verified for accuracy. Chapter V presents a summary and discusses the interpretations of findings, limitations, conclusions, practical implications, and recommendations for future studies on critical thinking skills and arts education.

## CHAPTER V

### DISCUSSION

The ability to think critically has been established as an important prerequisite for success, not only in school, but in the workplace-and in life. Many studies have been conducted on the development of critical thinking skills, and more specifically, the unique capacity of arts education to teach students to think critically. However, this is the first study conducted to examine the relationship among demographic, academic, and curriculum characteristics, with an emphasis on arts education, and the level of critical thinking skills in 12<sup>th</sup> grade high school students. A non-experimental, quantitative, exploratory (comparative and correlational) and explanatory (correlational) secondary research design was used in this study. Chapter V presents a summary and interpretations of the findings, followed by the practical implications, conclusions, limitations, and recommendations for future study.

#### Summary and Interpretations

##### **Data-Producing Sample and the Target Population of Students Completing 12<sup>th</sup> Grade in the 2009-2010 School Year**

The data collection process was performed by the researcher using a researcher-designed data collection tool and secondary data derived from student transcripts accessed from the Broward County Schools' master TERMS database. The sample of 504 students was accessed using a proportional probability sampling based on the systematic selection of every "n<sup>th</sup>" individual senior student's data records from a *low* performing, *middle* performing, and *high* performing high school (as determined by overall school grade) within each of the county's three geographic areas: North Area,

Central Area, and South Area. The design of the study allowed for the final data-producing sample to closely represent the distribution of the target population of the entire county, thus providing support for the external validity of the study.

### **Psychometric Evaluation of Measures**

The data recording instrument for this study included four parts (See Appendix A). *Part I: Student Demographic Characteristics* developed by the researcher contained six items that measured the demographic variables of area, school, gender, race, age by birth year, and socioeconomic status (as determined by participation in free and reduced lunch programs). *Part II: Curriculum Characteristics*, developed by the researcher, included five items that measured variables of frequency of Visual Arts, Music, and Drama courses, as well as frequencies of Language Arts and Mathematics coursework. *Part III: Academic Characteristics* developed by the researcher includes five items that measured variables of cumulative GPAs of Language Arts and Mathematics, in addition to cumulative GPAs of Fine Arts coursework under the separate categories of Visual Arts, Music, and Drama. *Part IV: Critical Thinking Performance FCAT in Reading and Mathematics*, developed by the researcher, includes ten items that measure critical thinking performance of FCAT results in FCAT Reading and FCAT Mathematics determined by the five-scale score levels reflecting the assessments for *both* FCAT Reading and FCAT Mathematics. This 26-item scale was used to answer the research questions and hypotheses for the study.

In this study, critical thinking performance was measured by the Florida Comprehensive Achievement Test (FCAT) scores in Reading and Mathematics found in student scores that were recorded in the TERMS database. The FCAT is part of Florida's

overall plan to increase student achievement by implementing higher standards and teacher accountability. The FCAT is administered in grades 3-10 and is based on benchmarks in the Sunshine State Standards (SSS) which identify knowledge and skills students are expected to acquire at each grade level, with an underlying expectation that students also demonstrate *critical thinking* (Florida Department of Education, 2008). Florida high school students have at least six additional opportunities to take and pass the FCAT in grades 10–12. For the purposes of this study, the researcher used only the *highest* score that each participant obtained, if retakes were recorded in the database.

Internal consistency reliabilities for the FCAT were reported using two methods, Cronbach's alpha and Item Response Theory (IRT) marginal reliabilities (Florida Department of Education, 2008). For the FCAT Reading measure, coefficient alpha reliabilities for 2006-2008 were as follows: 2006, .80; 2007, .80; and 2008, .78. The FCAT Mathematics coefficient alpha reliabilities for 2006-2008 were: 2006, .79; 2007, .77; and 2008, .76 (FLDOE, 2008). With satisfactory FCAT Reading and Mathematics coefficient alphas, the FCAT scores were used to answer the research questions and test the hypotheses relating to critical thinking performance.

FCAT technical reports conducted by the Florida Department of Education (FLDOE) provided evidence that the FCAT Reading and Mathematics had substantial convergent validity (FLDOE, 2008). "The evidence of reliability and validity supports the claim that the FCAT is technically sound and meets or exceeds the professional standards for standardized achievement tests" (FLDOE, 2008, p. 27).

A study conducted in 2008 by the Florida Department of Education (FLDOE) involving the relationship of arts coursework and student achievement confirms national

studies, such as Catterall (1999) and Vaughn and Winner (2000): the more arts credits achieved, the better student achievement on SAT and FCAT and a greater likelihood of high school graduation. The data drawn from the 2008 cohort of the state of Florida 12<sup>th</sup> graders conducted by FLDOE illustrate the following:

- For the general population, the more music and arts classes taken, the higher student achievement by all measures (SAT, FCAT Reading, Writing, and Mathematics).
- For students on “free and reduced lunch,” an indicator of socioeconomic levels, the more music and arts classes taken, the higher the student achievement in all measures (SAT, FCAT Reading, Writing, Mathematics).
- For students divided by ethnicity, the more music and arts classes taken, the higher the student achievement in all measures.
- The more Fine Arts classes taken, the less likely a student is to drop out of the cohort group.

Hence, previous studies found the FCAT to meet the criteria of a good scale to measure critical thinking performance and corroborated its use as a measure in this study.

## **Research Questions**

### **Research Question 1 - Descriptive Analysis**

**Descriptive analysis of student demographic characteristics.** Descriptive statistics were used to answer Research Question 1. This included measures of central tendency (the mean), frequency distributions, and variability to describe the variables of student demographic characteristics and critical thinking performance as measured by the

FCAT Reading and FCAT Mathematics scores. The final data-producing sample was 504 students. The total sample population of students included 168 students from the three North Area schools, 168 students from the three Central Area schools, and 168 students from the three South Area schools. The researcher randomly selected 56 students from each of the nine schools chosen for the study. The gender of students was an approximate even match, with 246 males (48.8%) and 258 females (51.2%). The largest percentages of students were white (40.1%), followed by Black (29.4%), Hispanic (18.8%), and Asian (7.7%). Students who were identified as “Mixed” represented 4% of the population. The largest age groups according to birth year were born in 1992 and 1993 (52.6% and 40.5% respectively), although 6.7% were born in 1991. Over half of the students in the study had applied for and received free or reduced lunch (53.4%).

The total Fine Arts coursework cumulative GPAs for the students in the study were as follows: “A” (24.2 %), “B+” (23.8%), “B” (16.3%), “C+” (5.8%), “C” (6%), “D+” (1%), “D” (.7%), and “F” (22.2%). The cumulative GPAs for total Language Arts coursework for students in the study were “A” (2.8%), “B+” (20.4%), “B” (26.5%), “C+” (26.5%), “C” (17%), “D+” (6.4%), “D” (1%) and “F” (0). Finally, the total Mathematics coursework GPAs were “A” (9.6%), “B+” (8.2%), “B” (24.6%), “C+” (19.4%), “C” (25.1%), “D+” (10.8%), “D” (2.8%), and “F” (0%).

The total frequencies of Fine Arts coursework under the category of Visual Arts coursework are as follows: 0 credits (33.6.0%), 1 – 3 credits (56.6%), 4 – 6 credits (8.4%), and 7 – 9 courses (1.4%). The total frequencies of Fine Arts coursework under the category of Music coursework were: 0 credits (57.9%), 1 – 3 credits (38.5%), 4 – 6 credits (2.8%), and 7 – 10 credits (.8%). The total frequencies of Fine Arts coursework

under the category of Drama coursework were as follows: 0 credits (80.7%), 1 – 3 credits (17.5%), 4 – 6 credits (1.8%).

The frequencies of total Language Arts coursework taken by students in the study were: 3 – 5 credits (41.4%), 5.5 – 7.5 credits (36.3%), 8 – 10 credits (19.1%), and 10.5 – 14 credits (3.2%). The frequencies of total Mathematics coursework taken by students in the study were as follows: 2 – 3.5 credits (12.7%), 4 – 6 credits (78.2%), 6.5 – 8 credits (8%), and 8.5 – 10 credits (1.1%).

The FCAT scale scores range from 100 points to 500 points for each subject area and grade level and are divided into five categories, or achievement levels, from 1 (*lowest*) to 5 (*highest*). The Florida Department of Education has designated a score of 3 as critical thinking performance occurring at grade level; a 1 or 2 score is critical thinking below grade level, and a 4 or 5 score signifies critical thinking performance above grade level (FCAT Assessment and Accountability Briefing, 2008). Students in Florida public high schools in grades 10–12 have six opportunities to take and pass the FCAT. The results of FCAT scores for students in this study reflect the *highest* score each student in the study obtained on the FCAT Reading and Mathematics assessments during his/her tenure in high school. The total percentage of FCAT Reading scores were as follows: a score of “1” (7.7%), a score of “2” (26%), a score of “3” (31.7%), a score of “4” (17.9%), and a score of “5” (16.7%). Additionally, the total percentage of FCAT Mathematics scores were: “1” (2.2%), “2” (11.7%), “3” (31%), “4” (41.9%), and a score of “5” (13.3%).



## **Research Question 2 - Analyzing the Differences in Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students According to Demographic Characteristics**

Research Question 2 examined the differences in critical thinking performance as measures by the FCAT Reading scores and FCAT Mathematics scores of 12<sup>th</sup> grade students in the 2009-2010 school year according to demographic characteristics. The relationships were analyzed by *t*-tests and ANOVAs. Gender was determined by independent *t*-tests. Multiple ANOVA tests followed by post hoc comparisons were performed for race, age by birth year, socioeconomic level, county area, and individual schools. Tukey's tests were used as post hoc comparisons when significant *F* values resulted from ANOVA analyses.

**Differences in FCAT scores according to gender.** As discussed in Chapter III and illustrated in Table 3-2 (p. 92), the FCAT Reading and Mathematics scores range from level 1 through level 5. In this study, no significant differences between males and females in FCAT Reading scores ( $t = 1.208, p = .227$ ) and FCAT Mathematics scores ( $t = 1.916, p = .160$ ) were found.

**Differences in FCAT reading scores according to race, age by birth year, socioeconomic status, area and school.** For comparison of FCAT Reading scores according to race, age by birth year, socioeconomic status, area, and school, multiple ANOVA tests were performed. The variables for race were recoded into five categories so that the different races could be compared. Post hoc tests were performed because at least one group had more than two cases. There was a significant outcome in comparison of race on the FCAT Reading scores ( $p = .000$ ), with Tukey's post hoc comparisons showing that FCAT reading scores were significantly higher for white students ( $M = 3.44$ )

than Hispanic ( $M = 2.91$ ), Black ( $M = 2.84$ ), or Asian ( $M = 2.83$ ). The relationship of age by the birth year (1991, 1992, and 1993) shows a significant effect of FCAT reading scores and age by birth year ( $p = .002$ ). FCAT reading scores were significantly different in age by birth year, with students born in 1992 ( $M = 3.11$ ) or 1993 ( $M = 3.19$ ) outperforming students born in 1991 ( $M = 2.41$ ).

A comparison of socioeconomic status illustrated a significant difference between students who applied for and received free or reduced lunch and those who did not ( $p = .000$ ). Students who did not apply for free or reduced lunch ( $M = 3.35$ ) outperformed those who did apply for and receive free or reduced lunch ( $M = 2.95$ ). In addition, as pertained to the three geographical areas, there was a significant relationship between FCAT reading scores and county areas ( $p = .029$ ). The South Area schools ( $M = 3.21$ ) performed slightly higher as a whole than the North Area schools ( $M = 2.90$ ).

In this study, there was a significant difference in FCAT Reading scores according to individual schools ( $p = .000$ ). Students in the designated *high performing* schools for all three areas (schools 4, 5, and 7) outperformed students designated in the *low performing* schools in all three areas (schools 3, 6, and 9). Teachers in low performing schools are certainly under more pressure to increase student performance on FCAT scores, or pay the price of heavy sanctions and consequences such as being removed from their positions (Duran, 2005). Perhaps this may mean that so much time is allotted to remedial work to improve failing scores, that not enough classroom instructional time can be used for the types of teaching that promotes critical thinking skills. This would be consistent with the theories of Bacon (1605), Dewey (1934), Ennis (1962), and Paul (1993), who contend that critical or high level thinking must be

systematically cultivated and requires a much longer process than teaching lower level thinking skills. This also supports what Dedman (2003) referred to as a teacher gap, where students in low achieving schools are often subject to being taught by teachers who do not possess the qualifications or the knowledge needed to be effective.

**Research Question 3 - Analysis of Relationships Between Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students and Academic Characteristics of Cumulative GPA in Fine Arts, Language Arts, and Mathematics courses**

**Relationships between FCAT reading scores and cumulative GPAs in fine arts, language arts, and mathematics.** Research Question 3 examined the relationships among critical thinking performance on the Reading FCAT scores and Mathematics FCAT scores of 12<sup>th</sup> grade students and academic characteristics of cumulative GPAs in Fine Arts, Language Arts, and Mathematics. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Reading scores and GPAs of Fine arts coursework ( $r = .348, p = .000$ ); GPAs of Language Arts coursework ( $r = .326, p = .000$ ), and GPAs of Mathematics coursework ( $r = .130, p = .004$ ). Hence, students who scored higher GPAs in all three areas analyzed in the study (Fine Arts, Language Arts, and Mathematics) consequently scored higher on FCAT Reading assessments.

**Relationships between FCAT mathematics scores and cumulative GPAs in fine arts, language arts, and mathematics.** The results of the analysis also showed a positive significant relationship for FCAT Mathematics scores and GPAs of Fine arts coursework ( $r = .431, p = .000$ ); GPAs of Language Arts coursework ( $r = .267, p = .000$ ), and GPAs of Mathematics coursework ( $r = .232, p = .004$ ). Thus, just as with comparisons of FCAT Reading scores and student GPAs, students in this study who

scored higher GPAs in all three areas analyzed (Fine Arts, Language Arts, and Mathematics) consequently scored higher on FCAT Mathematics assessments. As the FCAT scale scores (1–5) reflect the requirement for increasingly higher levels of critical thinking (FCAT Assessment and Accountability Briefing, 2008), it stands to reason that students who have shown mastery of this ability in their coursework, as demonstrated by their cumulative GPAs, might also be able to employ the same type of reflective thought measured on standardized assessment tools such as the FCAT Reading and FCAT Mathematics. Van Gelder posits the following about critical thinking:

1. Critical Thinking is Hard - Critical thinking is a complex activity built up out of other skills that are simpler and easier to acquire.
2. Practice Makes Perfect - Everyone knows that that mastering a skill takes practice, and plenty of it. The skills of critical thinking are no exception.
3. Practice for Transfer - Students must practice the art of transferring the skills from one situation to another. If they can master that higher-order skill of transfer, then they do not have a problem of transfer of the primary skill.

**Research Question 4 - Analysis to Determine if a Positive Relationship Between Critical Thinking Performances on the FCAT of 12<sup>th</sup> Grade Students Exists According to the Curriculum Characteristics of the Frequency of Courses Taken in the Selected Fields of Study: Fine Arts, Language Arts, and Mathematics**

**Relationships between FCAT reading scores and frequency of coursework in fine arts, language arts, and mathematics.**

The results of the analyses showed a positive significant relationship for FCAT Reading scores and the frequencies of Fine Arts coursework ( $r = .456, p = .000$ ). This is supportive of the study conducted by the Florida Department of Education in 2008. That study reported evidence of the impact of arts education on standardized national and state level assessments and concluded that there was a strong correlation between the frequency of Visual Arts and Music coursework and higher FCAT and SAT test scores.

However, results showed the FCAT Reading scores were significantly, yet *negatively* related to the frequencies of Language Arts courses ( $r = -.188, p = .000$ ). In this study, according to the data collected by the researcher, the transcripts reflected that typically students with more credits in the Language Arts category had taken one or more remedial reading courses. This would indicate that they were not reading sufficiently at grade level, which would designate them as “struggling” readers. As expected, this would impact their FCAT Reading scores negatively. No significant correlation was demonstrated between the FCAT Reading scores and frequencies of Mathematics coursework.

#### **Research Question 5 – Analysis of Relationships Between Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students and the Curriculum Characteristics of Frequency of Coursework Specifically in Visual Arts, Music, and Drama Classes**

**Relationship between critical thinking performance and the frequency of visual arts coursework.** The results of the analyses showed a positive significant relationship for FCAT Reading scores and the frequencies of Visual Arts coursework ( $r = .539, p = .000$ ) and Music coursework ( $r = .097, p = .030$ ). Additionally, the analyses

showed a positive significant relationship for FCAT Mathematics scores and the frequencies of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). Again, as in Research Question 4, the findings of this study were consistent with the study exploring the impact of arts education conducted by the Florida Department of Education (2008).

Since 2004, the FCAT assessment has been based on a model of critical thinking levels developed by Webb in 1999 and referred to as Webb's Depth-of-Knowledge model or DOK (FCAT Assessment and Accountability Briefing, 2008). Similar to the Bloom Taxonomy levels (1956) that the FCAT developers initially used, the DOK measures rigor, or complexity of thinking. Each level describes and shows a progression of the *rigor* of what is being taught and learned (Webb, 1999). Level one, referred to as *Recall Level*, requires simple knowledge such as verbatim recall or rote response and correlates with a scale score of 1. Some examples of level one performance in the Reading assessment are using a dictionary to find the meaning of words or identifying figurative language in a reading passage. There is little comprehension involved at this level, as it requires only very basic surface knowledge of the material.

Level two or the *Skill/Concept Level*, involves more comprehension of material than level one and includes the engagement of some mental processing beyond recalling. At this level, students begin to apply skills and process concepts, making simple decisions about how to approach a problem. Some examples that represent a level two performance of reading skills are:

- Use context cues to identify the meaning of unfamiliar words.
- Predict a logical outcome based on information in a reading selection.

- Identify and summarize the major events in a narrative.

An FCAT score of a 2 would reflect Webb's level two thinking skills. FCAT scores that show students is thinking at or above grade level (3, 4, and 5) indicate more understanding of DOK levels 3 and 4. Deep knowledge actually becomes more of a focus at the level three of the DOK - *Strategic Thinking Level*. At this level, students are capable of demonstrating such things as analyzing, evaluating, reasoning, and planning. Students must also be able to support their thinking, as well as deal with abstractions and open-ended conclusions. Some examples that represent DOK level three thinking in the FCAT Reading are:

- Determine the author's purpose and describe how it affects the interpretation of a reading.
- Summarize information from multiple sources to address a specific topic.
- Analyze and describe the characteristics of various types of literature.

Several examples of level three (Strategic Thinking) mathematical operations would be activities that require students to draw conclusions from observations, cite evidence and develop logical arguments, and explain phenomena in terms of concepts, all while providing justification for reasoning.

Higher order thinking is central and knowledge is deep at level four, referred to as the *Extended Thinking Level*. Students must have learned the basics at level one, applied them at level two, and strategically thought about them at level three before they can extend their thinking by completing much deeper and complex tasks at level four. The assessment item at this level could likely require extended time or activity, but does not necessarily have to do so. According to Webb (1999), higher-level thinking is absolutely

central to level four. At this level, students are required to successfully do such things as synthesize, hypothesize, evaluate, and analyze. Examples of some level four reading requirements are:

- Analyze and synthesize information from multiple sources.
- Examine and explain alternative perspectives across a variety of sources.
- Describe and illustrate how common themes are found across texts from different cultures.

Webb's Depth-of-Knowledge model is presented in this study in Figure 2-3 (p. 34).

The findings in this study support Oddleifson (1994) who provides the following description of visual art education: "The arts are cognitive domains that trigger multiple forms of learning by engaging students in long-term, open-ended projects that integrate production of original works with perception of the work of others" (p. 450) and Murfee (1996) who posits that "art education is an intellectual discipline of substance because it involves the use of complex symbols to communicate, similar to language or mathematics" (Murfee, 1996, The Arts are Rigorous section, para. 2).

**Relationship between critical thinking performance and the frequency of music coursework.** The results of the analyses showed a positive significant relationship for FCAT Reading scores and the frequencies of Music coursework ( $r = .097$ ,  $p = .030$ ). Also, a significant result was illustrated between FCAT Mathematics scores and the frequency of Music coursework ( $r = .202$ ,  $p = .000$ ). The findings in this study support the research team of Shaw and Rauscher (1994), who conducted an experimental study involving groups of children who received piano/keyboard lessons; a



group receiving computer lessons, and finally a group receiving no training. That study showed that the children who received piano/keyboard training performed 34% higher on tests measuring spatial-temporal ability than the other groups. Thus, the researchers asserted that music training is far superior to computer instruction in dramatically enhancing children's spatial-reasoning abilities, as well as generating neural connections that are used for abstract reasoning, particularly those necessary for understanding mathematical concepts. Additionally, Shaw authored a book, *Keeping Mozart in Mind*, (1999) that reiterated his 25 years of research relating to the study of music and the subsequent impact on higher brain functioning such as spatial-reasoning abilities. Spatial-temporal agility is an important component of mathematical ability and aptitude (Hetland, 2000; Shaw & Raucher, 1993; Shaw, 1999).

The team of Catterall, Chapleau, and Iwanaga (1999) explored the impact of music classes in their 1999 study for *Champions of Change: The Impact of the Arts on Learning*. Findings support the results of the researchers who suggested that certain kinds of musical experiences, especially keyboard training, seem to produce effects on cognitive functioning in children with regard to enhanced mathematical reasoning skills. Furthermore, researchers such as Butzlaff (2000) and the team of Douglas and Willats (1994) contend that there are several possible reasons to hypothesize that instruction in music may help children acquire *reading skills*. The findings of this study were consistent with Butzlaff (2000), who conducted a meta-analysis of six experimental and 25 correlational studies which were all designed to test the hypothesis that music study enhances reading improvement. "Music and written text both involve formal written notation which must be read from left to right. In both cases, the written code maps onto

a specific sound. Perhaps practice in reading music notations makes the reading of linguistic notation an easier task.” (Butzlaff, 2000, p. 167).

**Relationship between critical thinking performance and the frequency of drama coursework.** In this study, no significant correlation was found between FCAT Reading or Mathematics scores and the frequencies of Drama coursework. The results of this study are in contradiction to a meta-analysis conducted by Podlozny (2006), including 80 studies relating to the impact of drama coursework on student achievement. “The meta-analyses that Podlozny conducted relating to the effects of classroom drama exercises showed positive effects on language development including written and oral story recall, reading achievement, reading readiness, oral language development, and writing” (Critical Links, 2002, p. 47). In this study, there was a predominance of students not taking any drama (80.7%). Therefore, this may mean that the sample was not sufficient to support a positive relationship between drama coursework and the performance on critical thinking assessments such as the FCAT.

#### **Research Question 6 – Analysis of Relationships Between Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students and the Academic Characteristics of Cumulative GPAs of Coursework Specifically in Visual Arts, Music, and Drama Classes**

**Relationship between critical thinking performance and cumulative GPAs of visual arts coursework.** The results of the analyses showed a positive significant relationship existed between cumulative GPAs of Visual Arts coursework ( $r = .515, p = .000$ ) and FCAT Reading scores. Also, a positive significant relationship for FCAT Mathematics scores and GPAs of Visual Arts coursework ( $r = .480, p = .000$ ) was

illustrated. The findings of this study support the data analysis by Vaughn and Winner (2000), which showed that for the 13 years preceding their national study, students involved in the arts outscored their peers on the SAT by an average of more than 90 points. This also confirms studies by Fiske (1999), who contends that study in the arts provide educational implications such as development of broader ways of thinking as represented in the multiple intelligences reported by Gardner.

**Relationship between critical thinking performance and cumulative GPAs of music coursework.** The results of the analyses showed no relationship between cumulative GPAs of Music coursework and FCAT Reading scores. However, a positive significant relationship existed between cumulative GPAs of Music coursework and FCAT Mathematics scores ( $r = .197, p = .000$ ). The findings of this study support those in a study by Shaw and Rauscher (1993), focusing on the link between music instruction and spatial reasoning abilities. That study determined that music training enhanced students' spatial reasoning abilities as well as generated neural connections that were used for abstract reasoning, particularly those necessary for understanding mathematical concepts.

**Relationship between critical thinking performance and cumulative GPAs of drama coursework.** The results of the analyses reported no correlation between cumulative GPAs of Drama coursework and FCAT Reading or FCAT Mathematics scores. Again, the results of this study are in contradiction to a meta-analysis conducted by Podlozny (2000), including 80 studies relating to the impact of drama coursework on student achievement. "The meta-analyses that Podlozny conducted relating to the effects of classroom drama exercises showed positive effects on language development including

written and oral story recall, reading achievement, reading readiness, oral language development, and writing” (Critical Links, 2002, p. 47).

### **Summary and Interpretations of Hypotheses Testing**

#### **Summary Results of Hypotheses Testing**

To test the hypotheses in this study, hierarchical (forward) multiple regression analyses were used in SPSS version 19 to find the best explanatory models for respective hypotheses. First Pearson  $r$  correlations were performed on the variables, and then they were entered into hierarchical regression based on the order of the strongest significant or Pearson  $r$  correlations to the weakest Pearson  $r$  correlation to find the best explanatory model with the highest  $R^2$ . Table 5-1 presents a summary of the results of the research hypotheses testing and the percent of variance explained by the model.

Table 5 – 1

*Summary of Research Hypotheses and Results*

Research Hypotheses	Results	Hypothesis Testing Percent of Variance Explained (Adjusted $R^2$ - $R^2$ .)
<p>H1 The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the frequency of courses taken in the fields of Language Arts and Mathematics.</p>	Partially Supported	
<p>H<sub>1a</sub> The frequency of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Reading</i> FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.</p>	Partially Supported	28.9%-29%
<p>H<sub>1b</sub> The frequency of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Mathematics</i> FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.</p>	Partially Supported	20.8%-21%

Table 5 – 1 Continued

Research Hypotheses	Results	Hypothesis Testing Percent of Variance Explained (Adjusted $R^2$ - $R^2$ )
<p>H2: The cumulative GPAs of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPAs of courses taken in the fields of Language Arts or Mathematics.</p>	<p>Partially Supported</p>	
<p>H<sub>2a</sub> The cumulative GPAs of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Reading</i> FCAT than the cumulative GPA's of courses taken in the fields of Language Arts or Mathematics.</p>	<p>Partially Supported</p>	<p>26.4%-26.5%</p>
<p>H<sub>2b</sub> The cumulative GPA of fine arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Mathematics</i> FCAT than the cumulative GPA of courses taken in the fields of language arts or mathematics.</p>	<p>Partially Supported</p>	<p>22.9%-23%</p>

Table 5 – 1 Continued

Research Hypotheses	Results	Hypothesis Testing Percent of Variance Explained (Adjusted $R^2$ - $R^2$ )
H3: Demographic, academic, and curriculum characteristics of students completing 12 <sup>th</sup> grade are significant explanatory variables of critical thinking performance on the FCAT Reading and FCAT Mathematics.	Partially Supported	
H <sub>3a</sub> Demographic, academic, and curriculum characteristics of students completing 12 <sup>th</sup> grade are significant explanatory variables of critical thinking performance on the <i>Reading</i> FCAT.	Partially Supported	28.9%-29%
H <sub>3b</sub> Demographic, academic, and curriculum characteristics of students reaching 12 <sup>th</sup> grade are significant explanatory variables of critical thinking performance on the <i>Mathematics</i> FCAT.	Partially Supported	22.9%-23.1% <sup>s</sup>

**Hypothesis 1: The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the frequency of courses taken in the fields of Language Arts and Mathematics.** To test Hypothesis 1, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the frequency of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 1 had two separate hypotheses. Research Hypothesis 1<sub>a</sub> tested the explanatory relationship of frequency of Fine Arts courses and the FCAT *Reading* scores and Hypothesis 1<sub>b</sub> tested the explanatory relationship of frequency of Fine Arts courses and FCAT *Mathematics* scores. The results of the

regression analysis partially supported each of the sub-hypotheses. These findings correlate with studies conducted by Vaughn and Winner (2000), who concluded that students involved in arts coursework outperformed their peers on standardized tests such as the SAT. Other empirical literature reviewed also proposed that coursework in the arts has the unique capacity to enhance critical thinking (Gullat, 2007; Lampert, 2006; Smithrim & Uptis, 2005; Winner & Hetland, 2000). The analysis of the sub-hypotheses follows:

***Research Hypothesis 1<sub>a</sub>: The frequency of fine arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the reading FCAT than the frequency of courses taken in the fields of language arts or mathematics.*** Three different models were produced from the hierarchical regression. Each model had significant *F* values, which is the significance of the regression model as a whole. Model 1 had significant *F* values ( $p = .000$ ), as well as Model 2 ( $p = .000$ ) and Model 3 ( $p = .000$ ). The *Adjusted R*<sup>2</sup> increased steadily from Model 1 (28.9%), to Model 2 (31.1%), to Model 3 (32.2%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores.

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Reading scores. Frequency of *Visual Arts* courses was the most important predictor ( $t = 14.5$ ,  $p = .000$ ,  $\beta = .540$ ) in the model. A positive relationship was reported between frequency of Visual Arts courses and critical thinking as measured



by the FCAT *Reading* scores. As a result, higher frequencies of Visual Arts courses correlated with higher FCAT Reading scores.

Frequency of *Music* courses ( $t = 3.95, p = .000, \beta = .146$ ), was the second most important predictor in the model. A positive relationship was also reported between the frequency of Music courses and critical thinking as measured by the FCAT *Reading* scores. Higher frequencies of Music courses correlated with higher FCAT Reading scores.

Finally, frequency of Language Arts courses was the third most important predictor ( $t = -3.03, p = .003, \beta = -.112$ ) in the model. The inverse  $\beta$  value of frequency of Language Arts courses had a negative relationship with critical thinking as measured by the FCAT *Reading* scores; thus, higher frequencies of Language Arts courses resulted in lower scores on the Reading. This may be a result of the data showing students with more Language Arts credits also taking remedial reading coursework.

According to the findings, Hypothesis 1<sub>a</sub> was partially supported. The frequencies of Visual Arts and Music courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. An inverse negative relationship was determined between frequencies of Language Arts courses and FCAT Reading scores. No significant relationship, either positive or negative, was demonstrated between the relationship of frequency of Drama courses or Mathematics courses and critical thinking as measured by the FCAT *Reading* scores.

***Research Hypothesis 1<sub>b</sub>: The frequency of fine arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the mathematics FCAT than the frequency of courses taken in the***

*fields of language arts or mathematics.* The variables of frequency of Visual Arts, Music, Drama, Language Arts, and Mathematics were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  correlation to the weakest. The highest level of measurement was used for each variable. Three different models were produced from the hierarchical regression. Each model had significant  $F$  values. Model 1 had significant  $F$  values ( $p = .000$ ), as well as Model 2 ( $p = .000$ ) and Model 3 ( $p = .000$ ). The *Adjusted R<sup>2</sup>* increased steadily from Model 1 (20.8%), to Model 2 (27%), to Model 3 (27.6%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores.

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT *Mathematics* scores. Frequency of *Visual Arts* courses was the most important predictor ( $t = 12.30$ ,  $p = .000$ ,  $\beta = .473$ ) in the model. A positive relationship was reported between frequency of Visual Arts courses and critical thinking as measured by the FCAT *Mathematics* scores. Higher frequencies of Visual Arts courses correlated with higher FCAT *Mathematics* scores.

Frequency of *Music* courses ( $t = 6.43$ ,  $p = .000$ ,  $\beta = .246$ ) was the second most important predictor in the model. A positive relationship was also reported between the frequency of Music courses and critical thinking as measured by the FCAT *Mathematics* scores. Higher frequencies of Music courses correlated with higher FCAT *Mathematics* scores.

Finally, frequency of Language Arts courses was the third most important predictor ( $t = -2.31$ ,  $p = .022$ ,  $\beta = -.088$ ) in the model. The inverse  $\beta$  value of frequency

of Language Arts courses had a negative relationship with critical thinking as measured by the FCAT *Mathematics* scores; thus, higher frequencies of Language Arts courses resulted in lower scores on the FCAT Mathematics.

According to the findings, Hypothesis 1<sub>b</sub> was partially supported. The frequencies of Visual Arts and Music courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Mathematics* scores. An inverse negative relationship was determined between frequencies of Language Arts courses and FCAT Mathematics scores. No significant relationship was demonstrated between the relationship of frequency of Drama courses or Mathematics courses and critical thinking as measured by the FCAT *Mathematics* scores.

**Hypothesis 2: The cumulative GPAs of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPAs of courses taken in the fields of Language Arts and Mathematics.** To test Hypothesis 2, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the cumulative GPA of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 2 had two separate hypotheses. Research Hypothesis 2<sub>a</sub> tested the explanatory relationship of cumulative GPA of Fine Arts courses and the FCAT *Reading* scores and Hypothesis 2<sub>b</sub> tested the explanatory relationship of cumulative GPA of Fine Arts courses and FCAT *Mathematics* scores. The results of the regression analysis partially supported each of the sub hypotheses.

*Research Hypothesis 2<sub>a</sub> : The cumulative GPA's of fine arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the reading FCAT than the cumulative GPAs of courses taken in the fields of language arts or mathematics.* Three different models were produced from the hierarchical regression. Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores. Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Reading scores. The Cumulative GPAs of *Visual Arts* courses had the greatest impact on the model ( $t = 12.04$ ,  $p = .000$ ,  $\beta = .466$ ). A positive relationship was reported between the GPAs of Visual Arts courses and critical thinking as measured by the FCAT *Reading* scores. As a result, higher GPAs of Visual Arts courses correlated with higher FCAT Reading scores.

The cumulative GPAs of *Language Arts* courses ( $t = 5.64$ ,  $p = .000$ ,  $\beta = .260$ ), was the second most important predictor in the model. Additionally, a positive relationship was reported between the cumulative GPAs of Language Arts courses and critical thinking as measured by the FCAT *Reading* scores. Higher GPAs of Language Arts courses correlated with higher FCAT Reading scores.

Lastly, frequency of Mathematics courses was the third most important predictor ( $t = -2.34$ ,  $p = .019$ ,  $\beta = -.106$ ) in the model. The  $\beta$  value of cumulative GPAs of Mathematics courses symbolized an inverse relationship with critical thinking as measured by the FCAT *Reading* scores; thus, higher GPAs of Mathematics courses correlated with lower scores on the Reading FCAT.

Hypothesis 2<sub>a</sub> was partially supported by these findings. The cumulative GPAs of Visual Arts courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. Also, a significant positive relationship was established between cumulative GPAs in Language Arts coursework and FCAT Reading scores. No significant relationship was demonstrated between the cumulative GPAs of Music or Drama courses and FCAT Reading scores. However, an inverse negative relationship was determined between cumulative GPAs of Mathematics coursework and critical thinking as measured by the FCAT *Reading* scores.

*Research Hypothesis 2<sub>b</sub>: The cumulative GPAs of fine arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the mathematics FCAT than the cumulative GPAs of courses taken in the fields of language arts or mathematics.* The hierarchical regression produced three different models. Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores. Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Mathematics scores. The Cumulative GPAs of *Visual Arts* courses had the greatest impact on the model ( $t = 11.484$ ,  $p = .000$ ,  $\beta = .445$ ). A positive relationship was reported between the GPAs of Visual Art courses and critical thinking as measured by the FCAT *Mathematics* scores. Consequently, higher GPAs of Visual Arts courses correlated with higher FCAT Mathematics scores.

Cumulative GPAs of *Music* courses ( $t = 4.66$ ,  $p = .000$ ,  $\beta = .177$ ) was the second most important predictor in the model. Additionally, a positive relationship was reported

between the cumulative GPAs of Music courses and critical thinking as measured by the FCAT *Mathematics* scores. Hence, higher GPAs of Music courses correlated with higher FCAT Mathematics scores.

Finally, the cumulative GPA of Mathematics courses was the third most important predictor ( $t = 3.695$ ,  $p = .000$ ,  $\beta = .143$ ) in the model. The  $\beta$  value of cumulative GPAs of Mathematics courses also demonstrated a positive relationship with critical thinking as measured by the FCAT *Mathematics* scores, therefore higher GPAs of Mathematics courses correlated with higher scores on the Mathematics FCAT. According to the findings, Hypothesis 2<sub>b</sub> was partially supported. A significant positive relationship between the cumulative GPAs of Visual Arts coursework, Music coursework, and Mathematics coursework and critical thinking as measured by the FCAT *Mathematics* scores was determined.

**Hypothesis 3: Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the FCAT Reading and FCAT Mathematics.** To test Hypothesis 3, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 3 had two separate hypotheses. Research Hypothesis 3<sub>a</sub> tested the explanatory relationship of the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and the FCAT *Reading* scores and Hypothesis 3<sub>b</sub> tested the explanatory relationship of the demographic, academic, and

curriculum characteristics of students completing 12<sup>th</sup> grade and FCAT *Mathematics* scores.

***Research Hypothesis 3<sub>a</sub>: demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the reading FCAT.***

The six demographic characteristics (gender, race, birth year, socioeconomic status, area, and school), the five curriculum characteristics (frequency of Visual Arts coursework, frequency of Music coursework, frequency of Drama coursework, frequency of Language Arts coursework, and frequency of Mathematics coursework), as well as the five academic characteristics (cumulative GPAs of Visual Arts coursework, cumulative GPAs of Music coursework, cumulative GPAs of Drama coursework, cumulative GPAs of Language Arts coursework, and cumulative GPAs of Mathematics coursework) were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  to the weakest. Six different models were produced from the hierarchical regression. All models had significant  $F$  values, including Model 1 through Model 6 ( $p = .000$ ). The *Adjusted R*<sup>2</sup> increased steadily from Model 1 (28.9%), to Model 2 (32.4%), to Model 3 (35%) to Model 4 (36.8%), to Model 5 (38.1), to Model 6 (39.3%). Therefore, Model 6 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores.

Analysis of individual predictors in Model 6 indicated six significant explanatory relationships between the six predictors and critical thinking skills as measured by the FCAT Reading scores. The standardized beta coefficient ( $\beta$ ) for each of the six predictors indicated its relative importance in explaining critical thinking as measured by the FCAT

*Reading* scores. The frequency of *Visual Arts* courses was the most important predictor of the model ( $t = 6.93, p = .000, \beta = .347$ ). A positive relationship was reported between the frequency of Visual Arts courses and critical thinking as measured by the FCAT *Reading* scores. Accordingly, higher frequencies of Visual Arts courses correlated with higher FCAT Reading scores.

The cumulative GPAs of *Visual Arts* courses ( $t = 4.41, p = .000, \beta = .219$ ) were the second most important predictor in the model. A positive relationship was shown between the cumulative GPAs of Visual Arts courses and critical thinking as measured by the FCAT Reading scores. A higher cumulative GPA in Visual Arts coursework was associated with higher FCAT Reading scores. The cumulative GPAs of *Language Arts* coursework were the third most important predictor ( $t = 4.43, p = .000, \beta = .162$ ) in the model. A higher cumulative GPA in Language Arts correlated with higher FCAT Reading scores.

The *race* of the student was the fourth most significant predictor ( $t = 3.68, p = .000, \beta = -.134$ ) in the model. The inverse  $\beta$  value of race had a negative relationship with critical thinking as measured by the FCAT Reading scores. The multiple ANOVA tests, followed by Tukey's post hoc comparisons presented in Research Question 2 (Table 4-4) show that FCAT Reading scores were significantly higher for white students ( $M = 3.44$ ) than Hispanic ( $M = 2.91$ ), Black ( $M = 2.84$ ), or Asian ( $M = 2.83$ ) students.

The frequency of *Music* courses ( $t = 3.68, p = .000, \beta = .130$ ) was the fifth most important predictor in the model, which showed a positive relationship between the frequencies of Music coursework and FCAT Reading scores. Higher frequencies of music coursework correlated with higher FCAT Reading scores. Finally, the *county area*



( $t = 3.22$ ,  $p = .001$ ,  $\beta = .112$ ) was also a significant predictor in the model. The multiple ANOVA tests, followed by Tukey's post hoc comparisons presented in Research Question 2 (Table 4-4) show that FCAT Reading scores were higher for the South area schools ( $M = 3.21$ ) than the North area schools ( $M = 2.90$ ).

According to the findings, Hypothesis 3<sub>a</sub> was partially supported. Some demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on FCAT Reading scores. The *demographic* characteristics of birth year and county area in which the student attended school were found to be significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. The  $\beta$  value of race and socioeconomic status symbolized an inverse relationship with critical thinking as measured by the FCAT Reading scores. No significant relationship was established between the demographic characteristics of gender or individual schools in the study that students attended.

The *curriculum* characteristics of frequency of Visual Arts coursework and Music coursework were found to be significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. No significant relationship was demonstrated between the frequencies of Drama coursework or Mathematics coursework and critical thinking performance in Reading. However, an inverse negative relationship was shown between the frequency of Language Arts coursework and critical thinking as measured by the FCAT *Reading* scores.

Finally, a significant positive explanatory relationship was established between the *academic* characteristics of cumulative GPAs of Visual Arts coursework, cumulative

GPA of Language Arts coursework, and cumulative GPA of Mathematics coursework and critical thinking as measured by the FCAT *Reading* scores. No significant relationship was shown between the cumulative GPA of Music or Drama coursework and critical thinking as measured by the FCAT *Reading* scores.

***Research Hypothesis 3b: demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the mathematics FCAT.*** Within the category of *curriculum* characteristics (frequency of coursework), Pearson *r* correlations showed a significant positive correlation between the FCAT Mathematics scores and frequency of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). A significant inverse relationship was reported between FCAT Mathematics scores and frequency of Language Arts coursework ( $r = -.162, p = .000$ ). No significant correlation was found between FCAT Mathematics scores and the frequency of Drama coursework or Mathematics coursework.

Under the category of *academic* characteristics (cumulative GPAs), Pearson *r* correlations showed a significant positive correlation between the FCAT Mathematics scores and cumulative GPAs of Visual Arts coursework ( $r = .480, p = .000$ ) and Music coursework ( $r = .197, p = .000$ ). A significant positive correlation between the FCAT Mathematics scores and cumulative GPAs of Language Arts coursework ( $r = .267, p = .000$ ), and cumulative GPAs of Mathematics coursework ( $r = .237, p = .000$ ) was also established. No significant correlation was found between FCAT Mathematics scores and cumulative GPAs of Drama coursework.

## CHAPTER V DISCUSSION

The ability to think critically has been established as an important prerequisite for success, not only in school, but in the workplace. Many studies have been conducted on the development of critical thinking skills, and more specifically, the unique capacity of arts education to teach students to think critically. However, this is the first study conducted to examine the relationship among demographic, academic, and curriculum characteristics—with an emphasis on arts education—and the level of critical thinking skills in 12<sup>th</sup> grade high school students. A non-experimental, quantitative, exploratory (comparative and correlational) and explanatory (correlational) secondary research design was used in this study. Chapter V presents a summary and interpretations of the findings, followed by the practical implications, conclusions, limitations, and recommendations for future study.

### Summary and Interpretations

#### **Data Producing Sample and the Target Population of Students Completing 12<sup>th</sup> Grade in the 2009-2010 School Year**

The data-collection process was performed by the researcher using a researcher-designed data collection tool and secondary data derived from student transcripts accessed from the Broward County Schools' master TERMS database. The sample of 504 was accessed using a proportional probability sampling, based on the systematic selection of every "n<sup>th</sup>" individual senior student's data records from a *low* performing, *middle* performing, and *high* performing high school (as determined by overall school grade) within each of the county's three geographic areas: North Area, Central Area, and South Area. The design of the study allowed for the final data-producing sample to

closely represent the distribution of the target population of the entire county, thus providing support for the external validity of the study.

### **Psychometric Evaluation of Measures**

The data-recording instrument for this study included four parts (See Appendix A). *Part I: Student Demographic Characteristics*, developed by the researcher, contained six items that measured the demographic variables of area, school, gender, race, age by birth year, and socioeconomic status (as determined by participation in free and reduced lunch programs). *Part II: Curriculum Characteristics*, developed by the researcher, included five items that measured variables of frequency of Visual Arts, Music, and Drama courses, as well as frequencies of Language Arts and Mathematics coursework. *Part III: Academic Characteristics*, developed by the researcher, includes five items that measured variables of cumulative GPAs of Language Arts and Mathematics, in addition to cumulative GPAs of Fine Arts coursework under the separate categories Visual Arts, Music, and Drama. *Part IV: Critical Thinking Performance FCAT in Reading and Mathematics*, developed by the researcher, includes 10 items which measure critical thinking performance of FCAT results in FCAT Reading and FCAT Mathematics determined by the five scale score levels reflecting the assessments for *both* FCAT Reading and FCAT Mathematics. This 26-item scale was used to answer the research questions and hypotheses for the study.

In this study, critical thinking performance was measured by the Florida Comprehensive Achievement Test (FCAT) scores in Reading and Mathematics found in student scores that were recorded in the TERMS database. The FCAT is part of Florida's overall plan to increase student achievement by implementing higher standards and

teacher accountability. The FCAT is administered in grades 3-10 and is based on benchmarks in the Sunshine State Standards (SSS) which identify knowledge and skills students are expected to acquire at each grade level, with an underlying expectation that students also demonstrate *critical thinking* (Florida Department of Education, 2008). Florida high school students have at least six additional opportunities to take and pass the FCAT in grades 10–12. For the purposes of this study, the researcher used only the *highest* score that each participant obtained, if retakes were recorded in the database.

Internal consistency reliabilities for the FCAT were reported using two methods, Cronbach's alpha and Item Response Theory (IRT) marginal reliabilities (Florida Department of Education, 2008). For the FCAT Reading measure, coefficient alpha reliabilities for 2006-2008 were as follows: 2006, .80; 2007, .80; and 2008, .78. The FCAT Mathematics coefficient alpha reliabilities for 2006-2008 were 2006, .79; 2007, .77; and 2008, .76 (FLDOE, 2008). With satisfactory FCAT Reading and Mathematics coefficient alphas, the FCAT scores were used to answer the research questions and test the hypotheses relating to critical thinking performance.

FCAT technical reports conducted by the Florida Department of Education (FLDOE) provided evidence that the FCAT Reading and Mathematics had substantial convergent validity (FLDOE, 2008). "The evidence of reliability and validity supports the claim that the FCAT is technically sound and meets or exceeds the professional standards for standardized achievement tests" (FLDOE, 2008, p. 27).

A study conducted in 2008 by the Florida Department of Education (FLDOE) involving the relationship of arts coursework and student achievement confirms national studies, such as Catterall (1999) and Vaughn and Winner (2000): the more arts credits

achieved, the better student achievement on SAT and FCAT and the greater likelihood of high school graduation. The data drawn from the 2008 cohort of the state of Florida 12<sup>th</sup> graders conducted by FLDOE illustrate the following:

- For the general population, the more music and arts classes taken, the higher student achievement by all measures (SAT, FCAT Reading, Writing, and Math).
- For students on free and reduced lunch, an indicator of socioeconomic levels, the more music and arts classes taken, the higher the student achievement in all measures (SAT, FCAT Reading, Writing, and Math).
- For students divided by ethnicity, the more music and arts classes taken, the higher student achievement in all measures (SAT, FCAT Reading, Writing, and Math).
- The more arts classes taken, the less likely a student is to drop out of the cohort group.

Hence, previous studies found the FCAT to meet the criteria of a good scale to measure critical thinking performance and corroborated its use as a measure in this study.

## **Research Questions**

### **Research Question 1 - Descriptive Analysis**

**Descriptive analysis of student demographic characteristics.** Descriptive statistics were used to answer Research Question 1. This included measures of central tendency (the mean), frequency distributions, and variability to describe the variables of student demographic characteristics and critical thinking performance as measured by the FCAT Reading and FCAT mathematics scores. The final data-producing sample was

504 students. The total sample population of students included 168 students from the three North Area schools, 168 students from the three Central Area schools, and 168 students from the three South Area schools. The researcher randomly selected 56 students from each of the nine schools chosen for the study. The gender of students was an approximate even match, with 246 males (48.8%) and 258 females (51.2%). The largest percentages of students were white (40.1%), followed by Black (29.4%), Hispanic (18.8%), and Asian (7.7%). Students who were identified as “Mixed” represented 4% of the population. The largest age groups according to birth year were born in 1992 and 1993 (52.6% and 40.5% respectively), although 6.7% were born in 1991. Over half of the students in the study had applied for and received free or reduced lunch (53.4%).

The total Fine Arts coursework cumulative for the students in the study were as follows: “A” (24.2 %), “B+” (23.8%), “B” (16.3%), “C+” (5.8%), “C” (6%), “D+” (1%), “D” (.7%), and “F” (22.2%). The cumulative for total Language Arts coursework for students in the study were “A” (2.8%), “B+” (20.4%), “B” (26.5%), “C+” (26.5%), “C” (17%), “D+” (6.4%), “D” (1%) and “F” (0). Finally, the total Mathematics coursework were “A” (9.6%), “B+” (8.2%), “B” (24.6%), “C+” (19.4%), “C” (25.1%), “D+” (10.8%), “D” (2.8%), and “F” (0%).

The total frequencies of Fine Arts coursework under the category of Visual Arts coursework were as follows: 0 credits (33.6.0%), 1 – 3 credits (56.6%), 4 – 6 credits (8.4%), and 7 – 9 courses (1.4%). The total frequencies of Fine Arts coursework under the category of Music coursework were: 0 credits (57.9%), 1 – 3 credits (38.5%), 4 – 6 credits (2.8%), and 7 – 10 credits (.8%). The total frequencies of Fine Arts coursework

under the category of Drama coursework were as follows: 0 credits (80.7%), 1 – 3 credits (17.5%), and 4 – 6 credits (1.8%)

The frequencies of total Language Arts coursework taken by students in the study were: 3 – 5 credits (41.4%), 5.5 – 7.5 credits (36.3%), 8 – 10 credits (19.1%), and 10.5 – 14 credits (3.2%). The frequencies of total Mathematics coursework taken by students in the study were as follows: 2 – 3.5 credits (12.7%), 4 – 6 credits (78.2%), 6.5 – 8 credits (8%), and 8.5 – 10 credits (1.1%).

The FCAT scale scores range from 100 points to 500 points for each subject area and grade level and are divided into five categories, or achievement levels, from 1 (*lowest*) to 5 (*highest*). The Florida Department of Education has designated a score of 3 as critical thinking performance occurring at grade level; a 1 or 2 score is critical thinking below grade level, and a 4 or 5 score signifies critical thinking performance above grade level (FCAT Assessment and Accountability Briefing, 2008). Students in Florida public high schools in grades 10 – 12 have six opportunities to take and pass the FCAT. The results of FCAT scores for students in this study reflect the *highest* score each student in the study obtained on the FCAT Reading and Mathematics assessments during their tenure in high school. The total percentages of FCAT Reading scores were as follows: a score of “1” (7.7%), a score of “2” (26%), a score of “3” (31.7%), a score of “4” (17.9%), and a score of “5” (16.7%). Additionally, the total percentages of FCAT Mathematics scores were: “1” (2.2%), “2” (11.7%), “3” (31%), “4” (41.9%), and a score of “5” (13.3%).



## **Research Question 2 - Analyzing the Differences in Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students According to Demographic Characteristics**

Research Question 2 examined the differences in critical thinking performance as measured by the FCAT reading scores and FCAT Mathematics scores of 12<sup>th</sup> grade students in the 2009-2010 school year according to demographic characteristics. The relationships were analyzed by *t*-tests and ANOVAs. Gender was determined by independent *t*-tests. Multiple ANOVA tests followed by post hoc comparisons were performed for race, age by birth year, socioeconomic level, county area, and individual schools. Tukey's tests were used as post hoc comparisons when significant *F* values resulted from ANOVA analyses.

**Differences in FCAT scores according to gender.** As discussed in Chapter III and illustrated in Table 3-2 (p. 92), The FCAT Reading and Mathematics scores range from level 1 through level 5. In this study, no significant differences between males and females in FCAT Reading scores ( $t = 1.208, p = .227$ ) and FCAT Mathematics scores ( $t = 1.916, p = .160$ ) were found.

**Differences in FCAT reading scores according to race, age by birth year, socioeconomic status, area and school.** For comparison of FCAT Reading scores according to race, age by birth year, socioeconomic status, area, and school, multiple ANOVA tests were performed. The variables for race were recoded into five categories so that the different races could be compared. Post hoc tests were performed because at least one group had more than two cases.

There was a significant outcome in comparison of race on the FCAT Reading scores ( $p = .000$ ), with Tukey's post hoc comparisons showing that FCAT reading scores

were significantly higher for white students ( $M = 3.44$ ) than Hispanic ( $M = 2.91$ ), Black ( $M = 2.84$ ), or Asian ( $M = 2.83$ ). The relationship of age by the birth year (1991, 1992, and 1993) shows a significant relationship between FCAT reading scores and age by birth year ( $p = .002$ ). FCAT reading scores were significantly different in age by birth year, with students born in 1992 ( $M = 3.11$ ) or 1993 ( $M = 3.19$ ) outperforming students born in 1991 ( $M = 2.41$ ).

A comparison of socioeconomic status illustrated a significant difference between students who applied for and received free or reduced lunch and those who did not ( $p = .000$ ). Students who did not apply for free or reduced lunch ( $M = 3.35$ ) outperformed those who did apply for and receive free or reduced lunch ( $M = 2.95$ ). In addition, as pertained to the three geographical areas, there was a significant relationship between FCAT reading scores and county areas ( $p = .029$ ). The South area schools ( $M = 3.21$ ) performed slightly higher as a whole than the North area schools ( $M = 2.90$ ).

In this study, there was a significant difference in FCAT Reading scores according to individual schools ( $p = .000$ ). Students in the designated *high performing* schools for all three areas (schools 4, 5, and 7) outperformed students designated in the *low performing* schools in all three areas (schools 3, 6, and 9). Teachers in low performing schools are certainly under more pressure to increase student performance on FCAT scores, or pay the price of heavy sanctions and consequences such as being removed from their positions (Duran, 2005). Perhaps this may mean that so much time is allotted to remedial work to improve failing scores that not enough classroom instructional time can be used for the types of teaching that promotes critical thinking skills. This would be consistent with the theories of Bacon (1605), Dewey (1934), Ennis

(1962), and Paul (1993), who contend that critical or high-level thinking must be systematically cultivated and requires a much longer process than teaching lower-level thinking skills. This also supports what Dedman (2003) referred to as a teacher gap, where students in low achieving schools are often subject to being taught by teachers who do not possess the qualifications or the knowledge needed to be effective.

### **Research Question 3 - Analysis of Relationships Between Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students and Academic Characteristics of Cumulative GPAs in Fine Arts, Language Arts, and Mathematics courses**

**Relationships between FCAT reading scores and cumulative GPAs in fine arts, language arts, and mathematics.** Research Question 3 examined the relationships among critical thinking performance on the Reading FCAT scores and Mathematics FCAT scores of 12<sup>th</sup> grade students and academic characteristics of cumulative in Fine Arts, Language Arts, and Mathematics. The results of the Pearson  $r$  correlation showed a positive significant relationship for FCAT Reading scores and of Fine arts coursework ( $r = .348, p = .000$ ); of Language Arts coursework ( $r = .326, p = .000$ ), and GPA of Mathematics coursework ( $r = .130, p = .004$ ). Hence, students who scored higher in all three areas analyzed in the study (Fine Arts, Language Arts, and Mathematics) consequently scored higher on FCAT Reading assessments.

**Relationships between FCAT mathematics scores and cumulative GPAs in fine arts, language arts, and mathematics.** The results of the analysis also showed a positive significant relationship for FCAT Mathematics scores and of Fine Arts coursework ( $r = .431, p = .000$ ); of Language Arts coursework ( $r = .267, p = .000$ ), and GPAs of Mathematics coursework ( $r = .232, p = .004$ ). Thus, just as with comparisons of

FCAT Reading scores and student , students in this study who scored higher in all three areas analyzed (Fine Arts, Language Arts, and Mathematics) consequently scored higher on FCAT Mathematics assessments. As the FCAT scale scores (1–5) reflect the requirement for increasingly higher levels of critical thinking (FCAT Assessment and Accountability Briefing, 2008), it stands to reason that students who have attained mastery of this ability in their coursework, as demonstrated by their cumulative GPAs, might also be able to employ the same type of reflective thought measured on standardized assessment tools such as the FCAT Reading and FCAT Mathematics. Van Gelder posits the following about critical thinking:

- Critical Thinking is Hard - Critical thinking is a complex activity built up out of other skills that are simpler and easier to acquire.
- Practice Makes Perfect - Everyone knows that mastering a skill takes practice, and plenty of it. The skills of critical thinking are no exception.
- Practice for Transfer - Students must practice the art of transferring the skills from one situation to another. If they can master that higher-order skill of transfer, then they do not have a problem of transfer of the primary skill.

**Research Question 4 - Analysis to Determine if a Positive Relationship Between Critical Thinking Performances on the FCAT of 12<sup>th</sup> Grade Students Exists According to the Curriculum Characteristics of the Frequency of Courses Taken in the Selected Fields of Study: Fine Arts, Language Arts, and Mathematics**

**Relationships between FCAT reading scores and frequency of coursework in fine arts, language arts, and mathematics.**

The results of the analyses showed a positive significant relationship for FCAT Reading scores and the frequencies of Fine Arts coursework ( $r = .456, p = .000$ ). This is supportive of the study conducted by the Florida Department of Education in 2008. That study reported evidence of the impact of arts education on standardized national and state level assessments and concluded that there was a strong correlation between the frequency of Visual Arts and Music coursework and higher FCAT and SAT test scores.

However, results showed the FCAT Reading scores were significantly, yet *negatively* related to the frequencies of Language Arts courses ( $r = -.188, p = .000$ ). In this study, according to the data collected by the researcher, the transcripts reflected that typically students with more credits in the Language Arts category had taken one or more remedial reading courses. This would indicate that they were not reading sufficiently at grade level, which would designate them as “struggling” readers. As expected, this would impact their FCAT Reading scores negatively. No significant correlation was demonstrated between the FCAT reading scores and frequencies of Mathematics coursework.

#### **Research Question 5 – Analysis of Relationships Between Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students and the Curriculum Characteristics of Frequency of Coursework Specifically in Visual Arts, Music, and Drama Classes**

**Relationship between critical thinking performance and the frequency of visual arts coursework.** The results of the analyses showed a positive significant relationship for FCAT Reading scores and the frequencies of Visual Arts coursework ( $r = .539, p = .000$ ) and Music coursework ( $r = .097, p = .030$ ). Additionally, the analyses

showed a positive significant relationship for FCAT Mathematics scores and the frequencies of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). Again, as in Research Question 4, the findings of this study were consistent with the study exploring the impact of arts education conducted by the Florida Department of Education (2008).

Since 2004, the FCAT assessment has been based on a model of critical thinking levels developed by Webb in 1999 and referred to as Webb's Depth-of- Knowledge model or DOK (FCAT Assessment and Accountability Briefing, 2008). Similar to the Bloom Taxonomy levels (1956) that the FCAT developers initially used, the DOK measures rigor, or complexity of thinking. Each level describes and shows a progression of the *rigor* of what is being taught and learned (Webb, 1999). Level one, referred to as *Recall Level*, requires simple knowledge such as verbatim recall or rote response and correlates with a scale score of 1. Some examples of level one performance in the Reading assessment are using a dictionary to find the meaning of words or identifying figurative language in a reading passage. There is little comprehension involved at this level, as it requires only very basic surface knowledge of the material.

Level two or the *Skill/Concept Level*, involves more comprehension of material than level one and includes the engagement of some mental processing beyond recalling. At this level, students begin to apply skills and process concepts, making simple decisions about how to approach a problem. Some examples that represent a level two performance of reading skills are as follows:

- Use context cues to identify the meaning of unfamiliar words.
- Predict a logical outcome based on information in a reading selection.

- Identify and summarize the major events in a narrative.

An FCAT score of a 2 would reflect Webb's level two thinking skills. FCAT scores that show a student is thinking at or above grade level (3, 4, and 5) requires more understanding of DOK levels 3 and 4. Deep knowledge actually becomes more of a focus at the level three of the DOK: *Strategic Thinking Level*. At this level, students are capable of demonstrating abilities such as analyzing, evaluating, reasoning, and planning. Students must also be able to support their thinking, as well as deal with abstractions and open-ended conclusions. Some examples that represent DOK level three thinking in the FCAT Reading are:

- Determine the author's purpose and describe how it affects the interpretation of a reading.
- Summarize information from multiple sources to address a specific topic.
- Analyze and describe the characteristics of various types of literature.

Several examples of level three (Strategic Thinking) mathematical operations would be activities that require students to draw conclusions from observations, cite evidence and develop logical arguments, explain phenomena in terms of concepts, all while providing justification for reasoning.

Higher order thinking is central and knowledge is deep at level four, referred to as the *Extended Thinking Level*. Students must have learned the basics at level one, applied them at level two, and strategically thought about them at level three before they can extend their thinking by completing much deeper and more complex tasks at level four. The assessment item at this level could likely require extended time or activity, but does not necessarily have to do so. According to Webb (1999), higher-level thinking is

absolutely central to level four. At this level, students are required to successfully do such things as synthesizing, hypothesizing, evaluating, and analyzing. Examples of some level four reading requirements are:

- Analyze and synthesize information from multiple sources.
- Examine and explain alternative perspectives across a variety of sources.
- Describe and illustrate how common themes are found across texts from different cultures.

Webb's Depth-of-Knowledge model is presented in this study in Figure 2-3 (p. 34).

The findings in this study support Oddleifson (1994), who provides the following description of visual art education: "The arts are cognitive domains that trigger multiple forms of learning by engaging students in long-term, open-ended projects that integrate production of original works with perception of the work of others" (p. 450) and Murfee (1996), who posits that "art education is an intellectual discipline of substance because it involves the use of complex symbols to communicate, similar to language or mathematics (Murfee, 1996, The Arts are Rigorous section, para. 2).

**The relationship between critical thinking performance and the frequency of music coursework.** The results of the analyses showed a positive significant relationship between FCAT Reading scores and the frequencies of Music coursework ( $r = .097$ ,  $p = .030$ ). Also a significant result was illustrated between FCAT Mathematics scores and the frequency of Music coursework ( $r = .202$ ,  $p = .000$ ). The findings in this study support the findings of the research team of Shaw and Rauscher (1994), who conducted an experimental study involving groups of children who received



piano/keyboard lessons; a group receiving computer lessons, and finally a group receiving no training. That study showed that the children who received piano/keyboard training performed 34% higher on tests measuring spatial-temporal ability than the other groups. Thus, the researchers asserted that music training is far superior to computer instruction in dramatically enhancing children's spatial-reasoning abilities, as well as generating neural connections that are used for abstract reasoning, particularly those necessary for understanding mathematical concepts. Additionally, Shaw authored a book, *Keeping Mozart in Mind*, (1999) that reiterated his 25 years of research relating to the study of music and the subsequent impact on higher brain functioning such as spatial-reasoning abilities. Spatial-temporal agility is an important component of mathematical ability and aptitude (Hetland, 2000; Shaw & Raucher, 1993; Shaw, 1999).

The team of Catterall, Chapleau, and Iwanaga (1999) also explored the impact of music classes in their 1999 study for *Champions of Change: The Impact of the Arts on Learning*. Findings of this study support the results of the researchers who suggested that certain kinds of musical experiences, especially keyboard training, seem to produce effects on cognitive functioning in children with regard to enhanced mathematical reasoning skills. Furthermore, researchers such as Butzlaff (2000) and the team of Douglas and Willats (1994) contend that there are several possible reasons to hypothesize that instruction in music may help children acquire *reading skills*. The findings of this study were consistent with Butzlaff (2000), who conducted a meta-analysis of six experimental and 25 correlational studies which were all designed to test the hypothesis that music study enhances reading improvement. "Music and written text both involve formal written notation which must be read from left to right. In both cases,

the written code maps onto a specific sound. Perhaps practice in reading music notations makes the reading of linguistic notation an easier task.” (Butzlaff, 2000, p. 167).

**The relationship between critical thinking performance and the frequency of drama coursework.** In this study, no significant correlation was found between FCAT Reading or Mathematics scores and the frequencies of Drama coursework. The results of this study are in contradiction to a meta-analysis conducted by Podlozny (2000), including 80 studies relating to the impact of drama coursework on student achievement. “The meta-analyses that Podlozny conducted relating to the effects of classroom drama exercises showed positive effects on language development including written and oral story recall, reading achievement, reading readiness, oral language development, and writing” (Critical Links, 2002, p. 47). In this study, because there was a predominance of students not taking any drama (80.7%); therefore, this may mean that the sample was not sufficient to support a positive relationship between drama coursework and the performance on critical thinking assessments such as the FCAT.

#### **Research Question 6 – Analysis of Relationships Between Critical Thinking Performance on the FCAT of 12<sup>th</sup> Grade Students and the Academic Characteristics of Cumulative GPAs of Coursework Specifically in Visual Arts, Music, and Drama Classes**

**Relationship between critical thinking performance and cumulative GPAs of visual arts coursework.** The results of the analyses showed a positive significant relationship existed between cumulative of Visual Arts coursework ( $r = .515, p = .000$ ) and for FCAT Reading scores Also, a positive significant relationship for FCAT Mathematics scores and of Visual Arts coursework ( $r = .480, p = .000$ ) was illustrated.

The findings of this study support the data analysis by Vaughn and Winner (2000), which showed that for the 13 years preceding their national study, students involved in the arts outscored their peers on the SAT by an average of more than 90 points. This also confirms studies by Fiske (1999) who contends that study in the arts provide educational implications such as development of broader ways of thinking as represented in the multiple intelligences reported by Gardner.

**Relationship between critical thinking performance and cumulative GPAs of music coursework.** The results of the analyses showed no relationship between cumulative GPAs of Music coursework and FCAT Reading scores. However, a positive significant relationship existed between cumulative GPAs of Music coursework and FCAT Mathematics scores ( $r = .197, p = .000$ ). The findings of this study support those in a study by Shaw and Rauscher (1993), focusing on the link between music instruction and spatial reasoning abilities. That study determined that music training enhanced students' spatial reasoning abilities as well as generated neural connections that were used for abstract reasoning – particularly those necessary for understanding mathematical concepts.

**Relationship between critical thinking performance and cumulative GPAs of drama coursework.** The results of the analyses reported no correlation between cumulative of Drama coursework and FCAT Reading or FCAT Mathematics scores. Again, the results of this study are in contradiction to a meta-analysis conducted by Podlozny (2000), including 80 studies relating to the impact of drama coursework on student achievement. “The meta-analyses that Podlozny conducted relating to the effects of classroom drama exercises showed positive effects on language development including

written and oral story recall, reading achievement, reading readiness, oral language development, and writing” (Critical Links, 2002, p. 47).

### **Summary and Interpretations of Hypotheses Testing**

#### **Summary Results of Hypotheses Testing**

To test the hypotheses in this study, hierarchical (forward) multiple regression analyses were used in SPSS to find the best explanatory models for respective hypotheses. First Pearson  $r$  correlations were performed on the variables, and then they were entered into hierarchical regression based on the order of the strongest significant or Pearson  $r$  correlations to the weakest Pearson  $r$  correlation to find the best explanatory model with the highest  $R^2$ . Table 5-1 presents a summary of the results of the research hypotheses testing and the percent of variance explained by the model.

Table 5 – 1

*Summary of Research Hypotheses and Results*

Research Hypotheses	Results	Hypothesis Testing Percent of Variance Explained (Adjusted $R.^2$ - $R.^2$ )
<p>H1 The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the frequency of courses taken in the fields of Language Arts and Mathematics.</p>	Partially Supported	
<p>H<sub>1a</sub> The frequency of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Reading</i> FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.</p>	Partially Supported	28.9%-29%
<p>H<sub>1b</sub> The frequency of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Mathematics</i> FCAT than the frequency of courses taken in the fields of Language Arts or Mathematics.</p>	Partially Supported	20.8%-21%

Table 5 – 1 Continued

Research Hypotheses	Results	Hypothesis Testing Percent of Variance Explained (Adjusted $R^2$ - $R^2$ )
<p>H2: The cumulative GPA of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPA of courses taken in the fields of Language Arts or Mathematics.</p>	<p>Partially Supported</p>	
<p>H<sub>2a</sub> The cumulative GPA of Fine Arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Reading</i> FCAT than the cumulative GPA of courses taken in the fields of Language Arts or Mathematics.</p>	<p>Partially Supported</p>	<p>26.4%-26.5%</p>
<p>H<sub>2b</sub> The cumulative GPA of fine arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the <i>Mathematics</i> FCAT than the cumulative GPA of courses taken in the fields of language arts or mathematics.</p>	<p>Partially Supported</p>	<p>27.8%-28.2%</p>

Table 5 – 1 Continued

Research Hypotheses	Results	Hypothesis Testing Percent of Variance Explained (Adjusted $R.^2$ - $R.^2$ )
H3: Demographic, academic, and curriculum characteristics of students completing 12 <sup>th</sup> grade are significant explanatory variables of critical thinking performance on the FCAT Reading and FCAT Mathematics.	Partially Supported	
H <sub>3a</sub> Demographic, academic, and curriculum characteristics of students completing 12 <sup>th</sup> grade are significant explanatory variables of critical thinking performance on the <i>Reading</i> FCAT.	Partially Supported	39.3%-40%
H <sub>3b</sub> Demographic, academic, and curriculum characteristics of students reaching 12 <sup>th</sup> grade are significant explanatory variables of critical thinking performance on the <i>Mathematics</i> FCAT.	Partially Supported	22.9%-23.1%

**Hypothesis 1: The frequency of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the frequency of courses taken in the fields of Language Arts and Mathematics.** To test Hypothesis 1, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the frequency of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 1 had two separate hypotheses. Research Hypothesis 1<sub>a</sub> tested the explanatory relationship of frequency of Fine Arts courses and the FCAT *Reading* scores and Hypothesis 1<sub>b</sub> tested the explanatory relationship of frequency of Fine Arts courses and FCAT *Mathematics* scores. The results of the regression analysis partially supported each of the sub-hypotheses. These findings

correlate with studies conducted by Vaughn and Winner (2000), who concluded that students involved in arts coursework outperformed their peers on standardized tests such as the SAT. Other empirical literature reviewed also proposed that coursework in the arts has the unique capacity to enhance critical thinking (Gullat, 2007; Lampert, 2006; Smithrim & Upitis, 2005; Winner & Hetland, 2000). The analysis of the sub-hypotheses follows:

***Research Hypothesis 1<sub>a</sub>: The frequency of fine arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the reading FCAT than the frequency of courses taken in the fields of language arts or mathematics.*** Three different models were produced from the hierarchical regression. Each model had significant *F* values, which is the significance of the regression model as a whole. Model 1 had significant *F* values ( $p = .000$ ), as well as Model 2 ( $p = .000$ ) and Model 3 ( $p = .000$ ). The *Adjusted R*<sup>2</sup> increased steadily from Model 1 (28.9%), to Model 2 (31.1%), to Model 3 (32.2%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT Reading scores Model 3 was selected as the best explanatory model to explain.

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Reading scores. Frequency of *Visual Arts* courses was the most important predictor ( $t = 14.5$ ,  $p = .000$ ,  $\beta = .540$ ) in the model. A positive relationship was reported between frequency of visual art courses and critical thinking as measured by the FCAT Reading scores. As a result, higher frequencies of Visual Arts courses correlated with higher FCAT Reading scores.



Frequency of *Music* courses ( $t = 3.95, p = .000, \beta = .146$ ), was the second most important predictor in the model. A positive relationship was also reported between the frequency of Music courses and critical thinking as measured by the FCAT *Reading* scores. Higher frequencies of Music courses correlated with higher FCAT Reading scores.

Finally, frequency of Language Arts courses was the third most important predictor ( $t = -3.03, p = .003, \beta = -.112$ ) in the model. The inverse  $\beta$  value of frequency of Language Arts courses had a negative relationship with critical thinking as measured by the FCAT *Reading* scores; thus, higher frequencies of language arts courses resulted in lower scores on the Reading. This may be a result of the data showing students with more Language Arts credits also taking remedial reading coursework.

According to the findings, Hypothesis 1<sub>a</sub> was partially supported. The frequency of Visual Arts and Music courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. An inverse negative relationship was determined between frequencies of Language Arts courses and FCAT Reading scores. No significant relationship, either positive or negative, was demonstrated between the relationship of frequency of Drama courses or Mathematics courses and critical thinking as measured by the FCAT *Reading* scores.

***Research Hypothesis 1<sub>b</sub>: The frequency of fine arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the mathematics FCAT than the frequency of courses taken in the fields of language arts or mathematics.*** The variables of frequency of Visual Arts, Music, Drama, Language Arts, and Mathematics were entered into a hierarchical forward

linear regression model from the strongest Pearson  $r$  correlation to the weakest. The highest level of measurement was used for each variable. Three different models were produced from the hierarchical regression. Each model had significant  $F$  values. Model 1 had significant  $F$  values ( $p = .000$ ), as well as Model 2 ( $p = .000$ ) and Model 3 ( $p = .000$ ). The *Adjusted R*<sup>2</sup> increased steadily from Model 1 (20.8%), to Model 2 (27%), to Model 3 (27.6%). Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores.

Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT *Mathematics* scores. Frequency of *Visual Arts* courses was the most important predictor ( $t = 12.30$ ,  $p = .000$ ,  $\beta = .473$ ) in the model. A positive relationship was reported between frequency of visual art courses and critical thinking as measured by the FCAT *Mathematics* scores. Higher frequencies of Visual Arts courses correlated with higher FCAT *Mathematics* scores.

Frequency of *Music* courses ( $t = 6.43$ ,  $p = .000$ ,  $\beta = .246$ ) was the second most important predictor in the model. A positive relationship was also reported between the frequency of Music courses and critical thinking as measured by the FCAT *Mathematics* scores. Higher frequencies of Music courses correlated with higher FCAT *Mathematics* scores.

Finally, frequency of Language Arts courses was the third most important predictor ( $t = -2.31$ ,  $p = .022$ ,  $\beta = -.088$ ) in the model. The inverse  $\beta$  value of frequency of Language Arts courses had a negative relationship with critical thinking as measured

by the FCAT *Mathematics* scores, thus higher frequencies of Language Arts courses resulted in lower scores on the FCAT Mathematics.

According to the findings, Hypothesis 1<sub>b</sub> was partially supported. The frequency of Visual Arts and Music coursework were significant positive explanatory variables of critical thinking as measured by the FCAT *Mathematics* scores. An inverse negative relationship was determined between frequencies of Language Arts courses and FCAT Mathematics scores. No significant relationship was demonstrated between the relationship of frequency of Drama courses or Mathematics courses and critical thinking as measured by the FCAT *Mathematics* scores.

**Hypothesis 2: The cumulative GPA of Fine Arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the FCAT than the cumulative GPA of courses taken in the fields of Language Arts and Mathematics.** To test Hypothesis 2, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the cumulative GPA of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 2 had two separate hypotheses. Research Hypothesis 2<sub>a</sub> tested the explanatory relationship of cumulative GPAs of Fine Arts courses, and the FCAT *Reading* scores and Hypothesis 2<sub>b</sub> tested the explanatory relationship of cumulative GPAs of Fine Arts courses and FCAT *Mathematics* scores. The results of the regression analysis partially supported each of the sub-hypotheses.

To test Hypothesis 2, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the cumulative GPAs of Fine Arts courses taken by students during high school and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 2 had two separate hypotheses. Research Hypothesis 2<sub>a</sub> tested the explanatory relationship of cumulative GPAs of Fine Arts courses and the FCAT *Reading* scores and Hypothesis 2<sub>b</sub> tested the explanatory relationship of cumulative GPAs of Fine Arts courses and FCAT *Mathematics* scores.

*Research Hypothesis 2<sub>a</sub>: The cumulative GPAs of fine arts courses taken by students completing 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the reading FCAT than the cumulative GPAs of courses taken in the fields of language arts or mathematics.* Three different models were produced from the hierarchical regression. Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores. Analysis of individual predictors in Model 3 indicated three significant explanatory relationships between the three predictors and critical thinking skills as measured by the FCAT Reading scores. The cumulative GPAs of *Visual Arts* courses had the greatest impact on the model ( $t = 12.04, p = .000, \beta = .466$ ). A positive relationship was reported between the GPAs of Visual Arts courses and critical thinking as measured by the FCAT *Reading* scores. As a result, higher GPAs of Visual Arts courses correlated with higher FCAT Reading scores.

Cumulative GPAs of *Language Arts* courses ( $t = 5.64, p = .000, \beta = .260$ ) was the second most important predictor in the model. Additionally, a positive relationship was

reported between the cumulative GPAs of Language Arts courses and critical thinking as measured by the FCAT *Reading* scores. Higher GPAs of Language Arts courses correlated with higher FCAT Reading scores.

Lastly, frequency of Mathematics courses was the third most important predictor ( $t = -2.34$ ,  $p = .019$ ,  $\beta = -.106$ ) in the model. The  $\beta$  value of cumulative GPAs of Mathematics courses symbolized an inverse relationship with critical thinking as measured by the FCAT *Reading* scores, thus higher GPAs of Mathematics courses correlated with lower scores on the Reading FCAT.

Hypothesis 2<sub>a</sub> was partially supported by these findings. The cumulative GPAs of Visual Arts courses were significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. Also, a significant positive relationship was established between cumulative GPAs in Language Arts coursework and FCAT Reading scores. No significant relationship was demonstrated between the cumulative GPAs of Music or Drama courses and FCAT Reading scores. However, an inverse negative relationship was determined between cumulative GPAs of Mathematics coursework and critical thinking as measured by the FCAT *Reading* scores.

***Research Hypothesis 2<sub>b</sub>: The cumulative GPAs of fine arts courses taken by students reaching 12<sup>th</sup> grade is a significantly greater explanatory variable of critical thinking performance on the mathematics FCAT than the cumulative GPAs of courses taken in the fields of language arts or mathematics.*** The hierarchical regression produced three different models. Model 3 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Mathematics* scores. Analysis of individual predictors in Model 3 indicated three significant explanatory

relationships between the three predictors and critical thinking skills as measured by the FCAT Mathematics scores. The cumulative GPAs of *Visual Arts* courses had the greatest impact on the model ( $t = 11.484$ ,  $p = .000$ ,  $\beta = .445$ ). A positive relationship was reported between the GPAs of Visual Art courses and critical thinking as measured by the FCAT *Mathematics* scores. Consequently, higher GPAs of Visual Arts courses correlated with higher FCAT Mathematics scores.

Cumulative GPAs of *Music* courses ( $t = 4.66$ ,  $p = .000$ ,  $\beta = .177$ ) was the second most important predictor in the model. Additionally, a positive relationship was reported between the cumulative GPAs of Music courses and critical thinking as measured by the FCAT *Mathematics* scores. Hence, higher GPAs of Music courses correlated with higher FCAT Mathematics scores.

Finally, the cumulative GPAs of Mathematics courses was the third most important predictor ( $t = 3.695$ ,  $p = .000$ ,  $\beta = .143$ ) in the model. The  $\beta$  value of cumulative GPAs of Mathematics courses also demonstrated a positive relationship with critical thinking as measured by the FCAT *Mathematics* scores; therefore, higher GPAs of Mathematics courses correlated with higher scores on the Mathematics FCAT. According to the findings, Hypothesis 2<sub>b</sub> was partially supported. A significant positive relationship between the cumulative GPAs of Visual Arts coursework, Music coursework, and Mathematics coursework and critical thinking as measured by the FCAT *Mathematics* scores was determined.

**Hypothesis 3: Demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the FCAT Reading and FCAT Mathematics.** To test

Hypothesis 3, multiple regression analyses using the hierarchical (forward) method were performed to determine whether there was a significant explanatory (correlational) relationship between the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and the dependent variable, critical thinking as measured by the FCAT. Research Hypothesis 3 had two separate hypotheses. Research Hypothesis 3<sub>a</sub> tested the explanatory relationship of the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and the FCAT *Reading* scores and Hypothesis 3<sub>b</sub> tested the explanatory relationship of the demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade and FCAT *Mathematics* scores.

***Research Hypotheses 3<sub>a</sub>: demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the reading FCAT.***

The six demographic characteristics (gender, race, birth year, socioeconomic status, area, and school), the five curriculum characteristics (frequency of Visual Arts coursework, frequency of Music coursework, frequency of Drama coursework, frequency of Language Arts coursework, and frequency of Mathematics coursework), as well as the five academic characteristics (cumulative GPAs of Visual Arts coursework, cumulative GPAs of Music coursework, cumulative GPAs of Drama coursework, cumulative GPAs of Language Arts coursework, and cumulative GPAs of Mathematics coursework) were entered into a hierarchical forward linear regression model from the strongest Pearson  $r$  to the weakest. Six different models were produced from the hierarchical regression. All models had significant  $F$  values, including Model 1 through Model 6 ( $p = .000$ ). The

*Adjusted R*<sup>2</sup> increased steadily from Model 1 (28.9%), to Model 2 (32.4%), to Model 3 (35%), to Model 4 (36.8%), to Model 5 (38.1), to Model 6 (39.3%). Therefore, Model 6 was selected as the best explanatory model to explain *critical thinking performance* as measured by the FCAT *Reading* scores.

Analysis of individual predictors in Model 6 indicated six significant explanatory relationships between the six predictors and critical thinking skills as measured by the FCAT Reading scores. The standardized beta coefficient ( $\beta$ ) for each of the six predictors indicated its relative importance in explaining critical thinking as measured by the FCAT *Reading* scores. The frequency of *Visual Arts* courses was the most important predictor of the model ( $t = 6.93$ ,  $p = .000$ ,  $\beta = .347$ ). A positive relationship was reported between the frequency of Visual Arts courses and critical thinking as measured by the FCAT *Reading* scores. Accordingly, higher frequencies of Visual Arts courses correlated with higher FCAT Reading scores.

The cumulative GPAs of *Visual Arts* courses ( $t = 4.41$ ,  $p = .000$ ,  $\beta = .219$ ) was the second most important predictor in the model. A positive relationship was shown between the cumulative GPAs of Visual Arts courses and critical thinking as measured by the FCAT Reading scores. A higher cumulative GPA in Visual Arts coursework was associated with higher FCAT Reading scores. The cumulative GPAs of *Language Arts* coursework was the third most important predictor ( $t = 4.43$ ,  $p = .000$ ,  $\beta = .162$ ) in the model. A higher cumulative GPA in Language Arts correlated with higher FCAT Reading scores.

The *race* of the student was the fourth most significant predictor ( $t = 3.68$ ,  $p = .000$ ,  $\beta = -.134$ ) in the model. The inverse  $\beta$  value of race had a negative relationship with



critical thinking as measured by the FCAT Reading scores. The multiple ANOVA tests, followed by Tukey's post hoc comparisons presented in Research Question 2 (Table 4-4) show that FCAT Reading scores were significantly higher for white students ( $M = 3.44$ ) than Hispanic ( $M = 2.91$ ), Black ( $M = 2.84$ ), or Asian ( $M = 2.83$ ) students.

The frequency of *Music* courses ( $t = 3.68, p = .000, \beta = .130$ ) was the fifth most important predictor in the model, which showed a positive relationship between the frequencies of Music coursework and FCAT Reading scores. Higher frequencies of music coursework correlated with higher FCAT Reading scores. Finally, the *county area* ( $t = 3.22, p = .001, \beta = .112$ ) was also a significant predictor in the model. The multiple ANOVA tests, followed by Tukey's post hoc comparisons presented in Research Question 2 (Table 4-4) show that FCAT Reading scores were higher for the South area schools ( $M = 3.21$ ) than the North area schools ( $M = 2.90$ ).

According to the findings, Hypothesis 3<sub>a</sub> was partially supported. Some demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on FCAT Reading scores. The *demographic* characteristics of birth year and county area in which the student attended school were found to be significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. The  $\beta$  value of race and socioeconomic status symbolized an inverse relationship with critical thinking as measured by the FCAT Reading scores. No significant relationship was established between the demographic characteristics of gender or individual schools in the study that students attended.

The *curriculum* characteristics of frequency of Visual Arts coursework and Music coursework were found to be significant positive explanatory variables of critical thinking as measured by the FCAT *Reading* scores. No significant relationship was demonstrated between the frequencies of Drama coursework or Mathematics coursework and critical thinking performance in Reading. However, an inverse negative relationship was shown between the frequency of Language Arts coursework and critical thinking as measured by the FCAT *Reading* scores.

Finally, a significant positive explanatory relationship was established between the *academic* characteristics of cumulative GPAs of Visual Arts coursework, cumulative GPAs of Language Arts coursework, and cumulative GPAs of Mathematics coursework and critical thinking as measured by the FCAT *Reading* scores. No significant relationship was shown between the cumulative GPAs of Music or Drama coursework and critical thinking as measured by the FCAT *Reading* scores.

***Research Hypotheses 3<sub>b</sub>: demographic, academic, and curriculum characteristics of students completing 12<sup>th</sup> grade are significant explanatory variables of critical thinking performance on the mathematics FCAT.*** Within the category of *curriculum* characteristics (frequency of coursework), Pearson *r* correlations showed a significant positive correlation between the FCAT Mathematics scores and frequency of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). A significant inverse relationship was reported between FCAT Mathematics scores and frequency of Language Arts coursework ( $r = -.162, p = .000$ ). No significant correlation was found between FCAT Mathematics scores and the frequency of Drama coursework or Mathematics coursework.

Under the category of *academic* characteristics (cumulative ), Pearson  $r$  correlations showed a significant positive correlation between the FCAT Mathematics scores and cumulative GPA of Visual Arts coursework ( $r = .480, p = .000$ ) and Music coursework ( $r = .197, p = .000$ ). A significant positive correlation between the FCAT Mathematics scores and cumulative GPAs of Language Arts coursework ( $r = .267, p = .000$ ), and cumulative GPAs of Mathematics coursework ( $r = .237, p = .000$ ) was also established. No significant correlation was found between FCAT Mathematics scores and cumulative GPAs of Drama coursework.

### **Practical Implications**

- 1.) This study supports the literature that suggests that arts education influences students to think critically. Dewey (1933), who is generally considered the father of current critical thinking conventions, contends that learning to think critically is the fundamental purpose of education. Consequently, the focus of the American educational system should be to create thinking individuals who are prepared not only to be productive members of our society, but also to succeed in a progressively changing global work environment.
- 2.) An inquiry-based curriculum, such as arts education, may positively influence gains, not only in students' critical thinking abilities, but overall intellectual development.
- 3.) Critical thinking performance in both Reading and Mathematics standardized assessments may result in significantly higher scores for students who have higher frequencies of arts coursework.

- 4.) Schools may want to explore more inclusion of arts coursework within their curriculum offerings, as multiple studies show that engagement in such coursework increases critical thinking performance.
- 5.) Increased knowledge of the benefits of arts education and a re-examining of the purpose of arts education may serve as a catalyst for educational policy-makers to, not only to support, but to increase funding for arts education.
- 6.) The important role of arts education needs to be revisited not only at the school level, but also by policy-makers and curriculum-developers at the state and national levels. Arts education has been eroded in recent years as other priorities, such as test-driven curricula, have “relegated the arts to the sidelines of critical conversations in mainstream education” (Davis, 2005, p. 12).

### **Conclusions**

- 1.) The gender of students in the study was an approximately even match, with 246 males (48.8%) and 258 females (51.2%). However, there was not a significant difference reported between males and females in FCAT Reading scores ( $t = 1.208, p = .227$ ) or FCAT Mathematics scores ( $t = 1.916, p = .160$ ).
- 2.) FCAT Reading scores were significantly higher for white students ( $M = 3.44$ ) than Black ( $M = 2.84$ ), Hispanic ( $M = 2.91$ ), or Asian ( $M = 2.83$ ). Also, FCAT Mathematics scores were significantly higher for white students ( $M = 3.75$ ) than Black ( $M = 3.23$ ). A study conducted in 2008 by the Florida Department of Education involving the relationship of arts coursework and student achievement determined that for students divided by ethnicity, the more music and arts classes taken, the higher student achievement in all measures. Consequently, procedures

need to be established to ensure that minority students are exposed to arts education.

- 3.) A comparison of socioeconomic status illustrated a significant difference in critical thinking performance between students who received free or reduced lunch and those who did not ( $p = .000$ ). Students who did not receive free or reduced lunch ( $M = 3.35$ ) outperformed those who did receive free or reduced lunch ( $M = 2.95$ ). An approach to guarantee that students who are economically disadvantaged are exposed to arts education needs to be explored.
- 4.) There was a significant difference in FCAT Reading scores according to individual schools ( $p = .000$ ). Students in the designated *high performing* schools for all three areas (schools 4, 5, and 7) outperformed students designated in the *low performing* schools in all three areas (schools 3, 6, and 9). Parity in the quality of general education and arts education in all the county schools needs to be implemented.
- 5.) State-mandated standardized tests such as the FCAT, which are required to successfully complete K-12 education, measure students' abilities to engage in higher order or critical thinking skills.
- 6.) The study revealed a positive significant relationship between FCAT Reading scores and GPAs of Fine arts coursework ( $r = .348, p = .000$ ) and a positive significant relationship for FCAT Mathematics scores and GPAs of Fine arts coursework ( $r = .431, p = .000$ ).
- 7.) The findings indicated a positive significant relationship for FCAT Reading scores and the frequencies of Fine Arts coursework ( $r = .456, p = .000$ ) and a

positive significant relationship for FCAT Mathematics scores and the frequencies of Fine Arts coursework ( $r = .460, p = .000$ ).

- 8.) The study investigated the relationship of each area of Fine Arts coursework: those under the umbrella of Visual Arts, those under the area of Music, and those under the area of Drama. A positive significant relationship exists for FCAT Reading scores and the frequencies of Visual Arts coursework ( $r = .539, p = .000$ ) and Music coursework ( $r = .097, p = .030$ ). No significant correlation was found between FCAT Reading scores and the frequencies of Drama coursework. Again, a positive significant relationship exists for FCAT Mathematics scores and the frequencies of Visual Arts coursework ( $r = .458, p = .000$ ) and Music coursework ( $r = .202, p = .000$ ). Likewise, no significant correlation was found between FCAT Mathematics scores and the frequencies of Drama coursework.

### **Limitations**

- 1.) This was a non-experimental design, which is weaker than an experimental research design.
- 2.) The data-collection instrument, designed by the researcher, is a new tool. Therefore, validity and reliability are difficult to determine. Generalizing the study results must be done with caution.
- 3.) While the relationships among the study variables were explored, other extraneous variables could have intervened to affect the students' critical thinking performance (i.e., the students' mental or physical health, the quality of the testing conditions, the quality of the instruction of Language Arts or Mathematics at the individual schools in the study, or the quality of the arts

education program at individual schools in the study). However, in other studies, participation in arts education has been shown to correlate with increased critical thinking performance (Gullat, 2007; Lampert, 2006; Smithrim & Upitis, 2005; Winner & Hetland, 2000, Shaw and Rauscher, 1993, 1999).

### **Recommendations for Future Study**

- 1.) More empirical research should be done to explore the relationship of arts education and the development of students' critical thinking skills.
- 2.) This study should be replicated with a larger sample size to allow for further comparisons to strengthen both internal and external validity of the study.
- 3.) A longitudinal study utilizing this study's model should be conducted.
- 4.) This model should be tested within different geographical areas within the United States and different cultures globally.
- 5.) A qualitative study should be conducted using this study's model in order to capture the individual "human voice" of arts students about the impact of participating in arts coursework on their lives.
- 6.) A quasi-experimental pre/post evaluation design should be conducted to compare changes in critical thinking performance before and after students participate in arts coursework.
- 7.) The unique capacity of arts education to teach students to think critically should inform administrative curriculum planning, course scheduling, and course requirements at not only the district, but state and national levels.

The goal of this study was to contribute to the literature on the relationship of arts education and the development of critical thinking skills. To ensure that students will be equipped with the requisite skills to be successful not only in school, but in the global work environment, the unique capacity of arts education to enhance critical thinking skills must be examined. Chapter V discussed the summary and interpretation of findings, practical implications, conclusions, limitations, and recommendations for future study.



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## APPENDIX A

### Data Recording Instrument

PART I STUDENT DEMOGRAPHICS	PART II CURRICULUM CHARACTERISTICS FREQUENCY OF CLASSES	PART III ACADEMIC CHARACTERISTICS CUMULATIVE GPA BY COURSES	PART IV CRITICAL THINKING CHARACTERISTICS BY LEVEL 1-5
STUDENT	AREA/SCHOOL		
1	GENDER		
2	RACE		
3	AGE BY BIRTH YEAR		
4	SOCIOECONOMIC STATUS		
5	VISUAL ARTS		
6	MUSIC		
7	DRAMA		
8	LANGUAGE ARTS		
9	MATHEMATICS		
10	FINE ARTS		
11	LANGUAGE ARTS		
12	MATHEMATICS		
13	READING		
14	MATHEMATICS		
15			

## Appendix B

### Permissions



## Permission to use Florida DOE 2007-2008 Cohorts Bar Charts

**Subject:** RE: permission to reproduce charts  
**Date:** 5/12/2010 1:27:24 P.M. Eastern Daylight Time  
**From:** [REDACTED]  
**To:** [REDACTED]

*Sent from the Internet (Details)*

Yes, you may use the charts with attribution.

Thanks,

James Perry

### **Hinckley Center for Fine Arts Education**

Florida Music Educators' Association  
Florida School Music Association  
Florida Art Education Association  
Florida Network of Arts Administrators  
402 Office Plaza  
Tallahassee, FL 32301

[REDACTED]  
[www.cfaefl.org](http://www.cfaefl.org)  
[www.flmusiced.org](http://www.flmusiced.org)  
[www.faea.org](http://www.faea.org)

**From:** [REDACTED]mailto:[REDACTED]  
**Sent:** Wednesday, May 12, 2010 12:20 PM  
**To:** James Perry  
**Subject:** permission to reproduce charts

Hello Mr. Perry,

My name is Leslie Rowntree Black and I am a Ph.D. candidate at Lynn University in Boca Raton, Florida. My dissertation is an investigation of the relationship of arts coursework and its impact on critical thinking skills. We spoke after your presentation for Broward County arts teachers in 8/09. At that time, I asked you if I may have permission to use the bar charts in the 2007-08 cohort shown in your PowerPoint presentation.

You agreed and recommended that I contact you when I needed them. I am now preparing to present my study proposal to my committee and the Lynn IRB board. A requirement is to have confirmation of this permission from you included in my Appendices. Again, it was a pleasure attending your seminar and many thanks in advance for your permission to use this information. Your brief response to this email will suffice as permission to satisfy my Institutional Review Board's requirements.

Respectfully,  
Leslie Rowntree Black, Ph. Dc.

[REDACTED]

## Permission to use revised Bloom's Taxonomy charts

**Subject:** RE: Permission to reproduce chart  
**Date:** 5/21/2010 3:53:02 P.M. Eastern Daylight Time  
**From:** [REDACTED]  
**To:** [REDACTED]

*Sent from the Internet ([Details](#))*

Dear Leslie:

You have my permission to reprint in your dissertation the Taxonomy Table that appears on the inside front cover and again on page 28 of L. W. Anderson (ed.), D. R. Krathwohl (ed.), et al., (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives* (NY: Addison Wesley Longman).

Sincerely,

Lorin W. Anderson, Senior Editor and Contributor

**From:** [REDACTED] [mailto:[REDACTED]]  
**Sent:** Friday, May 21, 2010 1:41 PM  
**To:** [REDACTED]  
**Subject:** Permission to reproduce chart

Hello Dr. Anderson,

Per our telephone conversation, let me reiterate that I am a Ph.D. candidate at Lynn University in Boca Raton, Florida and would like permission to use your revised Bloom's critical thinking chart. My dissertation is an investigation of the relationship of arts coursework and its impact on critical thinking skills. I am now preparing to present my study proposal to my committee and the Lynn IRB board. A requirement is to have confirmation of this permission from you included in my Appendices. You agreed to give permission via this email. Again, it was a pleasure speaking with you and many thanks in advance for your permission to use this information. Your brief response to this email will suffice as permission to satisfy my Institutional Review Board's requirements.

Respectfully,

Leslie Rowntree Black, Ph. Dc.

[REDACTED]

**APPENDIX C**

**Correspondence from Florida Senators to Florida Commissioner of Education**

Senator Stephen R. Wise  
Detert  
1460 Cassat Avenue  
Whip  
Suite B  
Court  
Jacksonville, FL 32205  
[REDACTED]



Senator Nancy C.  
Majority (Republican)  
417 Commercial  
Venice, FL 34292  
[REDACTED]

April 22, 2009

Dr. Eric J. Smith  
Commissioner  
Florida Department of Education  
325 West Gaines Street  
Tallahassee, FL 32399-0400

Dear Commissioner Smith:

We would like to call your attention to the data supplied recently by the Department of Education regarding fine arts credits for high school students. It appears that Florida students confirm national studies: the more arts credits achieved, the better student achievement on SAT and FCAT and a greater likelihood of high school graduation.

Looking at last year's cohort of 12<sup>th</sup> graders:

- For the general population, the more music and arts classes taken, the higher student achievement by all measures (SAT, FCAT Reading, Writing, Math)
- For students on "free and reduced lunch," an indicator of socioeconomic levels, the more music and arts classes taken, the higher the student achievement in all measures (SAT, FCAT Reading, Writing, Math)
- For students divided by ethnicity, the more music and arts classes taken, the higher the student achievement in all measures.
- The more arts classes taken, the less likely a student is to dropout of the cohort group.

Given these measures (graduation rate, SAT, FCAT Reading, Writing, and Math) are the primary means established by the Department of Education and the Legislature for evaluating student achievement, and given that the arts have a significant, positive impact, we must conclude that the arts are an important element of the curriculum.

While undoubtedly there will be curriculum reductions in some areas by school districts, the Department of Education should do all possible to encourage principals and superintendents to ensure the continuation of music and other arts programs (visual art, drama, dance).

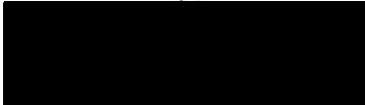
It is rare to find a curricular area that demonstrates such wide effect on student achievement and reaches across ethnic and socio-economic barriers. By the data provided, it is clear the arts do just that. Given that student achievement gains appear to increase with sequential arts

Page 2

instruction, it would be counter-intuitive to cut programs at elementary, middle, or high school levels.

It is also apparent that many students have had opportunities in the arts reduced because of remediation requirements. Policies of the Department should encourage student participation in the arts and encourage schools to offer the arts in ways that allow time and access in the schedule. If changes in statute are necessary for such encouragement, we welcome your recommendations for the 2010 legislative session. We thought you might want to share the data with the 67 superintendents and add your insight from the attached data.

Sincerely,



Stephen R. Wise

Sincerely,



Nancy C. Detert

SRW/cc

cc: Representative Anitere Flores

**APPENDIX D**

**Lynn University IRB Approval**



COPY

## LYNN UNIVERSITY

3601 North Military Trail  
Boca Raton, FL 33431-5598

Email:

June 18, 2010

Leslie Rowntree-Black

Dear Leslie:

As chair of the IRB Committee, I have reviewed your proposal, *Relationship Among Demographic, Academic, and Curriculum Characteristics, Emphasizing Arts Education* and concur that it should be exempt from the full IRB Review.

You are responsible for complying with all stipulations described under the Code of Federal Regulations 45 CFR 46 (Protection of Human Subjects). This document can be obtained from the following address:

<http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm>

Good luck in your research!

Warmest regards,

*Dr. Theodore Wasserman*

Dr. Theodore Wasserman  
IRB Chair

Cc: Dr. C. Patterson  
Dr. A Crawford  
File #2010-SU122E

2010-020

**APPENDIX E**

**Broward School Board IRB Approval**





THE SCHOOL BOARD OF BROWARD COUNTY, FLORIDA  
RESEARCH SERVICES

600 SOUTHEAST THIRD AVENUE • FORT LAUDERDALE, FLORIDA 33301-3125 • TEL 754-321-2500 • FAX 754-321-2520

MARIA R. LIGAS, Ph.D.  
Institutional Review Board (IRB) Chair

SCHOOL BOARD

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NORA RUPERT  
DAVID THOMAS, NBCT

JAMES F. NOTTER  
Superintendent of Schools

April 14, 2011

Ms. Leslie Rowntree Black

[Redacted]

Dear Ms. Rowntree Black:

Thank you for submitting your research proposal # 604 — *Relationship among Demographics, Academic, and Curriculum Characteristics, Emphasizing Arts Education, and Critical Thinking in 12th Grade High School Students*, for consideration by the Broward County Public Schools (BCPS). Staff has reviewed your research proposal and approval has been granted for you to contact the principals of the following High Schools only:

- |               |                 |                  |
|---------------|-----------------|------------------|
| Boyd Anderson | McArthur        | South Plantation |
| Coral Glades  | Cooper City     | Northeast        |
| Coconut Creek | Fort Lauderdale | Nova             |

This approval means that we have found your proposed research methods to be compatible with a public school setting and your research questions of interest to the school District. The expiration date on your proposal is *Friday, April 13, 2012*. If you are unable to complete your research by the expiration date, you must submit an Annual Report/Request for Renewal, ([http://www.broward.k12.fl.us/research\\_evaluation/IRB.Pdf](http://www.broward.k12.fl.us/research_evaluation/IRB.Pdf)), to the Research Services Department four weeks prior to the expiration date. If a renewal is granted, a Renewal Approval Letter and Memorandum will be issued.

Implementing your research, however, is a decision to be reached by the affected school-based staff on a *strictly voluntary basis*. To assist the school-based staff in their decision to participate, please outline the operational steps to be performed by staff at their school. Based upon this information, each school-based staff would then be *asked to make a decision to participate or not and inform you or the requesting research parties of their decision at the time of your/their request*. School-based staff have been instructed not to cooperate unless you provide both pieces of Approval Documentation.

The anticipated date for submitting an electronic copy of your research findings is *Monday, August 13, 2012*. If additional assistance is needed from our staff, please contact me at [Redacted]

Sincerely,

[Redacted Signature]

Maria R. Ligas, Ph.D.

MRL/MAL:bt  
Attachments

774M17G 3765 Group  
07/16/12 39800 K