COMPUTER-ASSISTED INSTRUCTION IN AN URBAN SCHOOL SETTING: FIFTH-GRADE TEACHERS' PERCEPTIONS AND STUDENTS' ATTITUDES TOWARD SCIENCE

A Dissertation

by

LEANNE HOWELL

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2010

Major Subject: Curriculum and Instruction

Computer-Assisted Instruction in an Urban School Setting:

Fifth-Grade Teachers' Perceptions and Students' Attitudes

Toward Science

COMPUTER-ASSISTED INSTRUCTION IN AN URBAN SCHOOL SETTING: FIFTH-GRADE TEACHERS' PERCEPTIONS AND STUDENTS' ATTITUDES TOWARD SCIENCE

A Dissertation

by

LEANNE HOWELL

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Approved by:

Chair of Committee,	Chance W. Lewis
Committee Members,	Fred A. Bonner, II
	Lynn M. Burlbaw
	Dennie Smith
Head of Department,	Dennie Smith

December 2010

Major Subject: Curriculum and Instruction

ABSTRACT

Computer-Assisted Instruction in an Urban School Setting:

Fifth-Grade Teachers' Perceptions and Students' Attitudes Toward Science.

(December 2010)

Leanne Howell, B.S., Baylor University;

M.S., Baylor University

Chair of Advisory Committee: Dr. Chance W. Lewis

The purpose of this dissertation study was to investigate a specific computer-assisted instructional software, Study Hall 101, in fifth-grade science. The study was conducted on an urban, elementary school campus in a northeastern school district in Texas. A mixed-methods approach was utilized in an attempt to understand two teachers' perceptions about its use in fifth-grade science and evaluate its impact on fifth-grade students' attitudes toward science.

The first inquiry employed a qualitative research design in an attempt to understand teachers' perceptions towards the use of Study Hall 101. Data collection methods used in this study included interviews, focus groups, and electronic-mail (e-mail) responses to open-ended sentence stems. Four favorable themes emerged from teachers' responses: (1) students' attitudes toward science, (2) students' participation in science class discussions, (3) content individualization, and (4) students' engagement.

Teachers' frustrations also emerged into themes: (1) time constraints, (2) technology glitches, and (3) specific design elements.

The second inquiry employed a quantitative research design in an attempt to investigate the impact of Study Hall 101 on seventy fifth-grade students' attitudes toward science after an eight-week period. The Modified Attitudes Toward Science Inventory (mATSI) was used for data collection and was administered to students on two occasions, before and after treatment. Results indicated no statistically significant change in fifth-grade students' *overall* attitudes toward science as a result of its use; however, two statistically significant findings did occur when data were analyzed across attribute variables of gender, ethnicity, and economic status, as well as specific domains within the mATSI. First, the use of Study Hall 101 was associated with males' and females' attitudes in opposite ways in regard to one domain of the mATSI: self-concept toward science. Second, students in the control group experienced a decline in another attitude domain of the mATSI: desire to do science.

The results of this study contribute to the field of K-12 education as we search for effective educational tools to reach diverse student populations. This study concludes that teachers' perceptions of this software are favorable and that its use in fifth-grade science should be considered as a tool to engage students in their own learning process.

DEDICATION

This dissertation is a reflection of my faith in God that all things are possible. I dedicate this effort to my family. All of them, in their own unique way, have encouraged me throughout this journey. To my wonderful husband Brian, thank you for your unconditional love, support, and encouragement as I furthered my education in an attempt to reach a life-long dream. I truly could not have accomplished this without your support. To my three beautiful daughters, Caroline, Morgan, and Rachel, I hope that I have illustrated to you, through my tireless nights of staying up late and getting up early, that you can achieve anything through your faith in God and strong determination. I promise to make up to you the soccer tournaments, lemonade stands, and sunny days on the lake that I missed as a result of my dedication to earning this degree. To my mother, Rosanne Stripling, this dissertation began and ended in your kitchen and I sincerely thank you for proving by example that women (and mothers) can pursue and earn their doctorates.

ACKNOWLEDGEMENTS

I would like to gratefully acknowledge the faculty in the College of Education at Texas A&M University for your guidance, support, and training. You have provided me with a firm foundation in which to go forth and make a difference for students of all ages. Also, I would like to extend a special acknowledgement to all of my graduate student colleagues, especially those in urban education. I will always hold dear the memories we made together as we tackled challenges and gained new knowledge. It is my sincere hope that we can continue to work together as professionals to put into action the dreams that originated in the classrooms of Texas A&M University. To my committee chair, Dr. Chance Lewis, mere words cannot express how much I appreciate the high standards you set and the encouragement you gave. You are a wonderful role-model and I will be forever grateful for your influence in my life. To my other committee members, Dr. Smith, Dr. Burlbaw, and Dr. Bonner, each of you have provided words of encouragement and challenged me to attain excellence. Thank you for believing in me and investing your time to conference with me throughout this journey. I take with me influences from each of you. To Trish Raley and the staff at The Center for Learning and Development, thank you for giving me access to Study Hall 101 and working with me to ensure it was properly installed on the school campus. Finally, to the school district administrators and teachers who were kind enough to allow me into your school halls, thank you for your willingness to participate in this study.

TABLE OF CONTENTS

CHAPTER Page

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION: COMPUTER-ASSISTED INSTRUCTION

The increased use of technology, specifically the use of computers, has impacted almost every aspect of life in modern-day society. Shopping, driving, navigating directions, and certainly communicating with friends and relatives have all been greatly impacted by the surge in technology during the 21st century (Johnson, 2000; Scherer, 2009). Wenglinsky (2006) cites that K-12 education has also been greatly impacted by its use. This trend is evident when considering the exponential growth in computer-to-student ratio in the United States, even over the past 20 years. In the early 1990s, the computer-to-student ratio in K-12 educational settings was approximately 1 to 20 (Wenglinsky, 2006). More recent data from the National Center for Educational Statistics (NCES, 2009) indicate that this ratio is now about 1 to 5. This ratio decreases even more by almost 1 to 1.8 when considering the total number of computers available per student campus-wide, when combining computers located in classrooms, computer labs, as well as mobile laptops (NCES, 2009).

Considering these trends, it is certainly reasonable to expect that computers will continue to be an integral part of K-12 educational settings. In fact, the Obama administration has emphasized this expectation by allotting over $650 million dollars through the federal government's technology program, Enhancing Education Through Technology (Davis, 2010). Funding from this economic stimulus package has been

---

This dissertation follows the style of *Urban Education.*

designated for use in a broad spectrum of technology-associated services, from consolidating data systems, making technology investments on school campuses, to updating computer hardware with the most recent high-quality digital software (Davis, 2010). As of January 2010, data from the United States Department of Education indicate that about $25.4 million dollars of this allocation had been used for its designated purpose (Davis, 2010). Considering these large amount of federal financial allocations, all aspects of computer-assisted instruction (CAI) should be continually investigated in order to determine its value in K-12 classrooms. Doing so would seem to make financial sense, so that data-driven decisions pertaining to CAI can be utilized to maximize its use in classrooms to the fullest extent. Exploring these aspects is critical "as politicians propose to spend billions of tax dollars on expanding access to computers in schools in order to bridge a so-called digital divide" (Johnson, 2000, p. 1).

This introductory chapter has several aims: (1) to develop a theoretical framework that underpins CAI in K-12 educational settings, in general, (2) to offer a brief history of CAI in school settings, (3) to provide a literature review pertaining to its use in K-12 settings, and (4) to frame the basis of the two subsequent studies pertaining to CAI by providing guiding research questions, definitions of key terms, as well as overall limitations and delimitations associated with the studies.

Theoretical Framework of Computer-Assisted Instruction

Several theories form the underpinnings of CAI, in general. Simonson and Thompson (1997) posit that the learning theory of behaviorism (Niemiec & Walberg, 1989) has had the greatest influence on CAI and its use as an instructional strategy. One of the major hallmarks of this theory includes the Law of Effect (Thorndike, 1911) for which the major tenet includes the use of reinforcement and its effect on shaping behavior. Thorndike proposed when behaviors are positively reinforced, they are strengthened and much more likely to occur again, whereas behaviors that are punished are weakened and less likely to occur again. In summary, the stimulus-response connection is reinforced when positive results are achieved (Erkfritz-Gay, 2009).

Thorndike's contributions later provided the framework for other conditions of learning, most notably B. F. Skinner's work (1954) regarding operant learning. Skinner's approach posits that the use of reinforcement after a response can produce changes in behavior. More specifically, positive reinforcement adds to the likelihood that a particular behavior will occur again. As it pertains to CAI, many software programs are designed to provide positive reinforcement to students for correct responses. These reinforcements may include points, more privilege within the program, virtual money, or simply encouraging phrases on the screen. Not surprising, Skinner (1984) advocates the use of computer-assisted instructional methods in that they require elicit responses from learners and are designed to provide them with "pre-programmed consequences" after each response (Erkfritz-Gay, 2009, p. 15).

Reiser (2001) claims that CAI also has roots from the epistemological standpoint of constructivism. This theory places emphasis on the acquisition of knowledge and emphasizes that knowledge is not accumulated or received, but rather acquired through an active process of learning between learners and their physical and social surroundings. This knowledge is further shaped by learners' ability to constantly form different mental concepts and pictures of their newly acquired knowledge (Cobb, 1994; Lin & Hsieh, 2001). Tucker (2009) adds that the connection between constructivism and CAI primarily relates to the opportunity for students to be actively engaged in the learning process as they acquire new knowledge. Dalgarno (2001) further supports the involvement of behaviorism and constructivism theories within the framework of CAI by making this connection: learning is primarily centered around repetitive conditioning in the behaviorism theory; however, learning is primarily centered around how learners' acquire new knowledge through their actual cognitive activity and formation of mental models in the constructivism theory.

In summary, both of these theories help to create a framework for CAI. One emphasizes reinforcement to form new concepts (behaviorism) while the other emphasizes the process of active learning to reform and shape cognitive concepts (constructivism). Simonson and Thompson (1997) further make a connection between these two theories as they relate to CAI by offering that behaviorism focuses on the final outcome of instruction while constructivism focuses more on the process to achieve the final outcome of instruction. In other words, computers, like all other forms of technology, are just tools. The way in which they are used slants their epistemological underpinnings. Taken together, both theories provide rationales for how and why learning occurs and are helpful when considering CAI as strategy for use in K-12 educational settings.

History of Computer-Assisted Instruction in K-12 Classrooms

CAI has been utilized for instruction in the United States for several decades, and its origins can be traced back to the 1960s and 1970s with various research projects conducted on several university campuses. Specifically, four projects appear to have had significant impacts on the development of computer-assisted instruction: (1) Stanford University's Institute for Mathematical Studies in the Social Sciences, directed primarily by Richard Atkinson and Patrick Suppes, (2) Programmed Logic for Automated Teaching Operations (PLATO), fathered by Donald Bitzer, (3) LOGO, developed by Seymour Papert at Massachusetts Institute of Technology (Brady, 2007), and (4) the Apple Classrooms of Tomorrow (ACOT), conducted in 1985 as a collaboration with Apple Computer, Inc. and public schools across the United States (Muir-Herzig, 2004). All of these projects helped shaped computer use for instructional purposes.

The main goal of the Stanford University project during the 1960s was to create a computer system that would provide individualized and effective tutoring to classroom students. Originally, Suppes utilized the rapidly growing field of computer technology as an avenue to develop a system whereby elementary students received individualized tutoring via computers for the curriculum contents of reading and math. Excitement grew among educators shortly after the launching of this project, simply due to the future possibilities that were becoming apparent through this rapidly growing innovation and its ability to provide individual instruction (Suppes, 1967).

PLATO's impact on CAI traces its roots back to the need in the early 1950s to educate a large number of elementary-university students in a cost-effective manner. As a result of Sputnik, more funding was allocated for science, technology, and math in an attempt to keep the United States in line with other countries that were making great gains in these fields. As a result of the issues brought about by Sputnik, Donald Bitzer and his colleagues created PLATO during the 1960s. Its use has been documented on all ranges of school campuses, from elementary school to college, and it is still in use today. Its inception eventually lead to other technological advances such as online messaging boards and other novel technology tools such as e-mail, chat rooms, and instant messaging (Plato Organization, 2010).

LOGO originated during the mid 1960s as a result of the works of Seymour Papert. Influenced by the work of Piaget, his works were instrumental in creating a computerized system of learning whose primary tenet was to involve learners in problem solving while exploring new ideas. Since its use in the mid 1980s in schools in Dallas and New York, its use has spread to a wide range of ages, young and old, and offers avenues of simulations and multi-media presentations. Books and software are now available that guide learners in using the available activities.

Lastly, the ACOT studies (Sandholtz, Ringstaff, & Dwyer, 1997) occurred in the mid 1980s and encompassed data over a period of ten years to investigate the impact of technology on learning and teaching in five public school settings across the United States. Results from the study indicated that teachers viewed computer-use among their students as favorable and instrumental in assisting their students to acquire new knowledge and also improve their self-esteem (Sandholtz et al., 1997). Additionally, the ACOT studies also revealed that teachers appeared to move away from the more traditional roles of lecturers while moving towards new roles of mentors and guides while utilizing CAI in their classrooms. Most importantly, these studies assisted in highlighting the use of technology in school settings as more than just computers in classrooms, but rather as integrated elements within the curriculum that potentially made learning more meaningful for students as they constructed their own knowledge (Sandholtz et al., 1997).

In summary, the history of CAI traces its roots back to a combination of many earlier studies. Four studies highlighted in this chapter- the Stanford University project, PLATO, LOGO, and ACOT all had importance in the early development of the origins of CAI in K-12 classrooms. When taken together, they not only provide a brief historical perspective of CAI in school settings, but also provide, both directly and indirectly, a framework for other technological advances such as e-mail, instant messaging and chat rooms.

Review of Literature in K-12 Settings

Academic Effectiveness Studies

A review of literature pertaining to the academic effectiveness of CAI in K-12 classrooms reveals studies conducted primarily in the content areas of reading, mathematics (math), and science (Macaruso & Rodman, 2009; Park, Khan, & Petrina, 2009; Tucker, 2009). With regard to younger students in elementary school settings, CAI has proven to be very beneficial for struggling learners as they seek to master the basic skills associated with reading texts (Cassady & Smith, 2005; Elkind & Elkind, 2007; Hecht & Close, 2002; Macaruso, Hook & McCabe, 2006). Still further, studies conducted with older readers reveal that CAI provides significant academic benefits for these youngsters, as well (Higgins & Raskind, 2004; Kim et al., 2006). Unfortunately, Brooks, Miles, Torgerson, and Torgerson (2006) conclude from a randomized trial with seventh-grade students that students who received CAI showed no academic gains in reading over students who did not receive CAI. In fact, this study indicated that students who received CAI actually experienced a decline in reading after the CAI treatment was administered (Brooks et al., 2006).

Tucker (2009) examined a collection of dissertations written from 2000 through 2007 regarding the effectiveness of CAI in mathematics. These studies involved a broad age-range of students in elementary, middle, as well as high school settings, and were conducted in a variety of urban, suburban, and rural school settings. Among elementary students, studies revealed that there was a statistically significant increase (37.7%) in academic gains in math. Ironically, among middle and high school students, no studies among those examined reported significant academic gains from CAI over traditional supplemental instruction. In summary, Tucker (2009) calculated that academic effectiveness studies among the sixteen dissertations examined revealed an almost even split between those finding CAI effective (Arbuckle, 2005; Ash, 2005; Clark, 2005; Irish, 2001; Mintz, 2000; Vietti, 2005: Wood, 2006, as cited in Tucker, 2009) and those finding CAI either ineffective or showing no gain at all (Atkins, 2005; Hodges, 2001; Phillips, 2001; Rosales, 2005; Soeder, 2001; Taepke, 2007, as cited in Tucker, 2009).

In regards to the content subject of science, a meta-analysis conducted by Bayraktar (2001) revealed that academic achievement among secondary students improved after using CAI and that this strategy appeared to more actively engage learners in their own learning process than other more traditional methods of direct review. Additionally, Kahn (2005) and Webb (2005) opine that computers contain the capabilities to shape new ideas and concepts within students' frame of references and are therefore capable of assisting students to make positive gains in their academic achievement in science. Still further, others (Bang, 2003; Baggott la Velle et al., 2003) support the contributions of CAI in the classroom learning environment to boost student achievement in science, especially low achieving students.

Another complex issue with CAI and its presence in the science classroom setting is its relationship between achievement, students' attitudes towards science, and its impact on students to pursue science as a future career (Park, Khan, & Petrina, 2009). These researchers posit that there may be a relationship between these three factors and opine if students' science achievement can be improved, the other two factors (attitudes towards science and desires to pursue science as a career) may also be positively influenced. Accordingly, Chang (2002) also notes that students' attitudes toward science appear to improve when their achievement increases.

Critical Reviews

Just as previously mentioned studies have supported the use of CAI in K-12 settings, others raise questions about its use. Earlier studies by Kelman (1989) and Cole and Griffin (1987) note that CAI often involves isolated and monotonous lessons that dwell on convergent thinking while also isolating learners from their social peers. Other studies also caution that it can have a detrimental effect on students' social and emotional development (Alliance for Childhood, 2004) and prove to be ineffective in producing higher academic gains (Rehmann, 2005). Lowe (2001) cautions that CAI should never be considered as the sole form of instruction and take the place of a teacher. Additionally, Oppenheimer (2003) suggests that CAI often entails simple assignments that are often meaningless. Other studies conducted by Guerrero, Walker, and Dugdale (2004) reveal that teachers do not perceive technology use in their classrooms as successful methods to assist learning, and that software does not necessarily expedite teaching or evaluation. D'Souza and Wood (2004) also add to the literature in noting that students often prefer traditional methods of instruction over computer software simply due to their comfort levels of using such and the reliability and ease of using methods they are more familiar with. Lastly, Li (2007) opines that computers have been "over-sold, under-used" (p. 379) implying that purchasing frenzies have certainly not yielded exponential use of these machines in K-12 educational settings.

Teacher-Related Issues

In addition to academic effectiveness studies relating to CAI, many school-related factors certainly hold the potential to affect its overall use in K-12 classrooms, as well (Levin & Wadmany, 2008). In fact, Levin and Wadmany (2008) opine there is a wide disparity between the intentions of using CAI and the reality of its actual use. The National Center for Education Statistics (2005) supports this claim by offering that computer implementation in classrooms has actually been much slower in some countries than once expected. Considering this, it seems necessary to explore other factors that may influence its use in K-12 classroom settings.

Issues that relate to teachers themselves serve to foreshadow the degree of CAI implementation in classrooms settings, as teachers' views towards CAI are certainly primary determinants of its actual use in the classroom (Levin & Wadmany, 2008). In earlier studies (Hardy, 1998) cites the importance of teachers' attitudes as determining factors of CAI use in classroom settings and further suggests that their attitudes are often related to their confidence in using technology, in general. A more recent study offered by Becker (2000) supports these findings, as well.

Many other teacher-related issues also appear to have an effect on the degree to which computers play a role in the educational process of K-12 students. Certainly the fast-growing field of technology requires teachers to be adaptive in the methods they employ to teach all students. Jones (2004) and Snoeyink and Ertmer (2001) cite that teachers' resistance to adapt their long-standing pedagogical skills may also be a driving force that impedes computer-use in the classroom. Fryer (2003) further offers that teachers may also have feelings of intimidation from technology-savvy students who may know more than they do in regards to computers and their uses. Papa (2003) supports this by concluding that teachers' realization of their limited technology skills may be frustrating and cause them to limit computer-use, especially when they are expected to the be experts in their field of teaching. Additionally, the perceptions teachers have in regards to innovative advances in technology, as well as their beliefs in themselves to actually be innovative in the process, appear to influence the extent they incorporate methods such as CAI into their teaching repertoire (Dawson & Rakes, 2003; Norton, McRobbie, & Cooper, 2000). Still further, their awareness of the advantages of incorporating technology into their teaching pedagogy, as well as their past experiences in using it also appear to affect its use (Scrimshaw, 2004). In summary, Yildirim (2000) claims that even though there are vast changes in the landscape of computers and their uses, teachers are often slow to integrate them into their classroom environments for a variety of reasons.

System-Related Issues

In addition to their overall attitudes towards computer-use in K-12 classrooms, Scrimshaw (2004) opines one of the major frustrations of CAI among teachers may be the lack of their relationship to the curriculum content that teachers are required to teach. Still further, its connection to supporting materials like textbooks is often very broken and sometimes not significantly related (Scrimshaw, 2004). Preston, Cox, and Cox (2000) further extend this thought by offering that teachers have very little time to integrate and transform CAI applications to meet their curriculum needs when these applications are not aligned with curriculum requirements set forth by school districts.

Wenglinsky (2006) posits that teachers still lack the professional development skills necessary to implement CAI effectively. Zhao and Frank (2003) add that even philosophical views held by schools' administrative staff may also hinder its use in K-12 academic settings. Additional issues of not having enough technology mentors on campus to guide and redirect teachers when they need specialized assistance are also factors that may influence its use (Sherry, Billig, Tavalin, & Gibson, 2000).

In summary, a literature review of CAI and its use in K-12 classroom settings reveals that although some effectiveness studies suggest it may be instrumental in students' academic success and their motivation to learn, other studies exist that shed doubt on its potential. In addition, teacher-related issues, specifically related to their attitudes towards computers, suggest that many teachers are still skeptical of its benefits in classroom settings and are often slow to incorporate it into their daily instructional routines. Still further, system-related issues such as adequate professional development, integration and alignment with current curriculum, as well as philosophical views held by campus administrators also appear to be obstacles that must be overcome.

CAI in the Context of Urban School Settings

Changing demographic trends in K-12 schools across America demand that school boards, administrators, teachers, and other school personnel embrace a wide range of strategies to meet the needs of a culturally diverse, urban school population (NCES, 2009). Rubinson (2007) emphasizes that the resistance to embrace such strategies certainly adds ammunition to the spiraling number of students who disengage from educational settings and ultimately drop out of school before graduation. Certainly there are many students in urban settings who are excelling academically in school, but just as true, there are many others who struggle to survive in classroom settings where teaching practices are outdated and painfully mundane. Wilder and Black (2001) opine that computer-assisted instruction offers one avenue for actually engaging and motivating students in their own learning process.

Teachers who teach in urban classrooms must not solely rely on instructional strategies to reach their culturally diverse student populations. Instead, they must combine teaching strategies such as CAI with a firm understanding of the "context in which the learner operates" (Kincheloe, 2007, p. 21). To achieve this, it is essential that teachers embrace concepts of their students' culture and ethnicity in ways that foster uniqueness and appreciation rather than marginalization (Goldstein, 2007). In summary, the sole use of any instructional strategy without pairing it with true attempts to embrace students' backgrounds and experiences will certainly pave the way for futile attempts to engage urban learners in the learning process. Doing so would ultimately add to the aforementioned downward spiral of school disengagement and foster life-long consequences for students often associated with low self-esteem, unemployment, and even depression (United States Congress, House Committee on Ways and Means, 2000).

Urban teachers must work with the equipment they are provided, often times with the realization that their schools are not as equipped with the latest technological hardware and software as other more affluent campuses. Kincheloe (2007) sheds light on this issue by soundly emphasizing that "the popularity of massive tax cuts in the political climate of the first decade of the twenty-first century does not bode well for the future of urban schooling" (p. 15). When considering that CAI requires resources sometimes not found in urban classrooms, conversations must transpire that not only advance the use of varied pedagogical practices, but also shed light on the issue that many urban students attend schools that have limited access to resources associated with CAI. Thompson, Ransdell, and Rousseau (2005) confirm this dilemma by offering that that landscape of urban schools is often jaded by the lack of resources necessary to supplement learning.

To further extend this thought, conversations must also focus on current systemic issues of resource equity. Lewis, James, Hancock, and Hill-Jackson (2008) contend that the current state of the educational system in the United States has resulted in a lack of equity with regards to resources. This vicious tenet helps foster deficit-model thinking and undermines any attempt to mend "cultural disconnects" (Lewis et al., 2008, p. 138) that so often plague the hallways of K-12 schools. Certainly the federal government's latest attempt to emphasize technology in K-12 settings with their technology program, Enhancing Education Through Technology (Davis, 2010) offers hope that all schools, no matter what their zip code, will be able to acquire the necessary technology tools to provide learners with diverse learning strategies associated with CAI. However, this realization also brings about several other questions: If urban schools do receive their fair share of technology-related equipment, will there be funding, both currently and in the future, to adequately train and maintain teachers to properly use strategies that are associated with such? The inclusion of technology into K-12 school environments must not be seen as a one-stop-shop of sorts, but rather a tool that needs to be sharpened, oiled, and tuned so that its inclusion in urban school pedagogy can be optimalized.

Study Overview and Guiding Research Questions

Addressing all aspects of CAI in K-12 educational settings is necessary in order to fully assess its use as a pedagogical practice. Certainly, its use as a tool to improve academic achievement is tantamount; however, teachers' perceptions of the selected software, and its effect on students' motivation are also critical elements that should be considered by school personnel when selecting software to supplement students' learning (Boling, Martin, & Martin, 2002; Ertmer, 2005). In fact, Hermans, Tondeur, Valcke, and van Braak (2006) opine that teachers' beliefs and attitudes in regards to technology and associated software are so instrumental, that they are often the most influential factors that determine its actual use in the classroom. Still further, Osborne (2003) claims that classroom curriculum strategies have the ability to influence students' attitudes towards curriculum content, ultimately empowering them to embrace the overall learning process in a more favorable light (Ndakwah, 2006). Considering this, it seems critical to examine software from these lenses- teachers' perceptions and its effect on students' motivation to learn.

The present effort to analyze CAI from these lenses consisted of two separate but interrelated mixed-method studies. Both studies centered around the CAI software known as Study Hall 101 (http://www.cldtx.org/sh101.asp) developed by Dr. Trish Raley in 1997 (T. Raley, personal communication, March 20, 2009). Study Hall 101 is designed to provide additional support to students as they learn key facts and vocabulary related to curriculum content. This software is currently in use as a part of a larger, more extensive support system offered by The Center for Learning and Development, a non-profit organization located in Waco, Texas, whose mission includes assisting students to maximize their learning potential through supportive learning strategies (T. Raley, personal communication, March 20, 2009). No studies to date have been conducted to understand teachers' perceptions of its use or its impact on students' motivation to learn curriculum content. Therefore, this study is offered as an attempt to fill the gap in literature with regards to this specific software.

The first study in Chapter II was conducted in an effort to understand teachers' perception of its use in fifth-grade science. This qualitative study analyzed data from individual interviews, focus groups, and electronic-mail (e-mail) responses to open-ended sentence stems. Specifically, this study explored the following questions: (1) Do fifth-grade science teachers perceive any changes in their fifth-grade students' attitudes towards science as a result of using Study Hall 101? (2) Do fifth-grade science teachers perceive any changes in their students' participation in science class discussions as a result of using Study Hall 101? and (3) What are fifth-grade science teachers' overall perceptions of using Study Hall 101 in their fifth-grade science classrooms?

The next study in Chapter III examines the impact of Study Hall 101 on fifth-grade students' attitudes toward science. This quantitative study employed the Modified Attitudes Toward Science (mATSI) (Weinburgh & Steele, 2000) in pre and posttest administrations in attempt to determine if this software influenced students' attitudes towards science. This study was primarily guided by one research question: What impact does the computer-assisted instructional software, Study Hall 101, have on fifth-grade students' overall attitudes towards science? A secondary purpose was to determine whether or not selected student attribute variables (gender, ethnicity, and economic status) influenced the impact of treatment on students' overall attitudes toward science and/or specific domains within the mATSI regarding attitudes toward science.

Definitions of Key Terms

The following key terms were used throughout this study:

Study Hall 101 Learning Systems Software (Study Hall 101) - a computer-assisted instructional software designed to assist students in learning content-related concepts such as key facts and vocabulary (www.cldtx.org)

Computer-Assisted Instruction (CAI) - the use of computers and associated software to provide supplemental learning to students (Lowe, 2001). For this study, this term does not imply that computers should replace teachers, but rather supplement the content that has already been taught.

Teacher Perceptions- the beliefs and attitudes that teachers have towards an object, idea, or concept (Crano & Prislin, 2006).

Attitude- an individual disposition or view towards an object, person, place, or concept that causes one to act, think, or feel positively or negatively towards something (Crano & Prislin, 2006).

Attitude Toward Science- a term used to describe how one views the various constructs of science (Dhindsa & Chung, 2003). For the purposes of this study, these constructs are: (1) self-confidence toward science, (2) value of science to society, (3) anxiety toward science, and (4) desire to do science.

Limitations

Several limitations exist with regard to the following studies. First, the campus on which the studies took place was selected by district administrators. Furthermore, the classes of students who were identified as the control and experimental groups were also selected by campus officials. Additionally, the four classes of students were already intact, so that random assignment of students to these classes was not possible.

The sample size for both studies was limited in number, and included only two teachers and 70 students. Further, the control group and experimental group of students were not balanced. Although these numbers were more evenly distributed at the beginning of the study, in the end these groups comprised 30 students in the control group and 40 students in the experimental group. Additionally, the computer-assisted instruction at the heart of these studies was only utilized in the classroom for eight weeks.

Delimitations

There are delimitations to the following studies. The first study was conducted with two teachers that only taught fifth-grade science. Consequently, only fifth-grade students were used as participants in the second study. Furthermore, all participants were from within one urban school district in the northeast region of Texas.

CHAPTER II

COMPUTER-ASSISTED INSTRUCTION: TEACHERS' PERCEPTIONS OF USING STUDY HALL 101 IN FIFTH-GRADE SCIENCE

Teaching in urban educational settings requires teachers to be creative with the instructional strategies they employ to reach diverse student populations in our nation's classrooms. All too often, efforts of educators appear to be situated solely around increasing students' academic, specifically test-score achievement, while failing to focus on the building blocks of students' success- their attitudes and motivation to learn. This article features a qualitative study that seeks to examine fifth-grade science teachers' perceptions towards a specific computer-assisted instructional software, Study Hall 101. Specifically, this article explores two teachers' perceptions of this software in general, and more specifically as a method to increase students' attitudes towards science and improve their participation in science class discussions. Data collection methods were triangulated through individual interviews, focus groups, and electronic-mail (e-mail) responses to open-ended sentence stems. Implications for further research and practice are shared.

Introduction

Changing demographic trends in our nation's K-12 public school population highlight the fact that schools must adopt curriculum strategies to meet the needs of a more diverse group of learners. Over the last three decades, there has been a substantial increase in students of color in our nation's public schools. Nationally, the percentage of White students has decreased from 78% to 56%, while the percentage of students of color has increased from 22% to 44% (National Center for Educational Statistics, 2009). More specifically, in Texas the ethnic distribution of students reflects that White students only represent approximately 34% of the overall population, while students of color comprise almost 66% of the total school population (Texas Education Agency, 2009). Current trends indicate that enrollment of White students is declining, while enrollment of students of color continues to increase. Consequently, these statistics seemingly reflect a need within educational settings to embrace teaching strategies that ensure all students, regardless of ethnicity, have the opportunity to experience academic success in the classroom.

Kincheloe (2007) proposes that teachers and educators need to recognize that changing student demographics must be met by a "rigorous and inter/multidisciplinary understanding of urban education" (p. 14). Further, Kincheloe adds that it is necessary to investigate disciplines of history, cultural studies, economics, anthropology and geography in an attempt to truly understand the complexities that exist in many urban school classrooms. By more fully investigating these aspects of students' culture, teachers are placed at a better advantage of implementing pedagogical practices that reflect these interrelationships (Slaughter-Defoe, 2002) and ultimately empower their students to embrace the learning process.

Consequently, teaching strategies may be one method of confronting the academic complexities that exist in classrooms with such varied student populations. Students' attitude, motivation, and academic achievement work together as necessary ingredients needed for their academic success in the classroom, regardless of gender or ethnicity. Computer-assisted instruction (CAI) appears to be a strategy that offers hope in meeting students' academic needs, as well as impacting their motivation and attitudes towards learning (Wilder & Black, 2001).

Hew and Brush (2007) opine that the inclusion of technology in the instructional process offers one solution to the enormous task of meeting students' vastly different learning needs. Extant literature suggests the use of computer-assisted instruction in the classroom has the potential to improve students' academic performance on standardized tests (Bain & Ross, 1999; Bereiter, 2002; Camancho, 2002); enhance their problem-solving ability (Forum on Education and Technology, 2001); and improve their self-concept and motivation towards learning (Sivin-Kachala & Bialvo, 2000). Kinzi (1990) and others (Angers & Machtmes, 2005; Bigatel, 2004) support the claim that computer-assisted instructional tools have the potential to improve students' motivation to learn while also increasing their success in the classroom. Perhaps it is such optimism that has encouraged national, state, and local governing bodies to promote the use of technology in K-12 classrooms.

In recent years, K-12 classrooms have experienced a surge of computers. Throughout the 1990s, the United States spent over $38 billion to equip classrooms with technology and Internet access (Benton Foundation, 2001). More recently, the federal economic stimulus package has earmarked $650 million for Enhancing Education Through Technology, an initiative created to increase the focus and use of technology in classrooms across that United States (Davis, 2010). This surge would lead to the assumption that classroom teachers must embrace the "age of technological development" in order to keep their classroom teaching strategies up-to-date (Yaworski, 2000, p. 19).

In order to adequately assess the use of technology in schools, its actual purpose must first be examined (Ringstaff & Kelley, 2002). Bebell, Russell, and O'Dwyer (2004) proclaim there is no set definition that describes technology use in K-12 classroom settings. For scholars, there appears to be a multitude of ways that technology is used and therefore defined within academic settings. Given this, it is essential to define its use for the purposes of this study. Consequently, in this context, technology use will be referred to as computer-assisted instruction (CAI). This term is offered simply to explain that the use of computers and associated software provide supplemental learning to students and, thus, should not be viewed within the context of this study as a strategy to replace classroom teachers (Chambers & Sprecher, 1980). Extant scholarly literature (Johnson, Perry, Shamir, 2010; Kulik, Kulik, and Bangert-Downs, 1985; Lowe, 2001) supports that technology should not be considered as a complete replacement for traditional teaching.

Computer-Assisted Instruction in K-12 Settings

Extensive studies have been conducted in an attempt to ascertain the significance of computer-assisted instruction in K-12 educational settings. Extant literature has suggested through rigorous research that CAI does, indeed, offer promising hope in closing the achievement gap that currently exists among diverse student populations (Bayraktar, 2001; Blok, Oostdam, Otter, & Overmaat, 2002; Christmann & Badgett, 2003; Hoffner, 2007; Kulik & Kulik, 1991; O'Bannon & Puckett, 2007). Boling and

Martin (2002) point to the use of computers as a motivating medium among student populations and offer that this motivation may be a primary factor in closing the aforementioned achievement gap. Consequently, others (Campbell, 2000; Nauss, 2002; Rehmann, 2005; Sorrell, 2003) have criticized its use and concluded that it does not produce significant academic gains or particularly enhance motivation to learn among students.

Although there appears to be adequate literature in favor of CAI use in the classroom, research findings indicate that many teachers still remain hesitant to incorporate it into the teaching and learning process (Iding, Crosby, & Speitel, 2002; Ma, Anderson, & Streith, 2005). Cuban, Kirkpatrick, and Peck (2001) and Hew and Brush (2007) conclude that teacher skepticism may be due to certain barriers such as lack of teacher training, lack of administrative support, lack of time, lack of available resources, as well as overall general feelings by teachers that computers may one day replace them in the classroom. In addition, Demetriadis, et al. (2002) add that teachers often perceive it difficult to incorporate technology into already prepared curriculums often used across grade levels within school districts.

Hermans, Tondeur, Valcke, and van Braak (2006) offer that teachers' beliefs and attitudes towards technology tend to be major factors to its integration within learning environments. Calderhead (1996) and Richardson (1996) proclaim that beliefs can be defined as suppositions about a topic that are thought to be true. Specifically, teachers' beliefs often pertain to their pedagogical beliefs surrounding teaching and learning or as in this case, their beliefs regarding technology and its place in the classroom (Ertmer, 2005; Windschitl & Sahl, 2002). Bodur, Brinberg, and Coupey (2000) opine there is a connection between one's beliefs and one's attitudes. Furthermore, one's attitudes are shaped by beliefs. Simpson, Koballa, Oliver, and Crawley (1994) define attitudes as specific feelings one has to determine likes or dislikes. In the context of this study, teacher perceptions are associated with their beliefs and attitudes towards not only technology, but the specific software at the heart of this study- Study Hall 101.

Studies appear to support connections between teachers' educational beliefs about pedagogy as it relates to technology integration in the classroom (Garthwait & Weller, 2005; Kim, Grabowski, & Song, 2003). Ertmer (2005) goes a step further to offer that the extent to which teachers actually use technology in the classroom ultimately depends on teachers themselves and their beliefs about technology. Hardy (1998) concludes that even teachers' confidence affects the use of technology in the classroom. Fryer (2003) supports these findings by offering that technology use has the potential to create rifts between students and teachers if teachers sense their students know more about technology than they do. Additional studies point to other predictors of technology integration in the classroom and include: (a) the extent to which teachers recognize the advantages of technology (Scrimshaw, 2004); (b) teachers' resistance to changing the status quo (Jones, 2004); and (c) teachers' ability and desire to adapt their age-old pedagogical practices (Snoeyink & Ertmer, 2001). Yuen and Ma (2002) suggest that when computers are perceived as easy tools to operate, teachers tend to use them more often in the classroom.

Overall, the impact and use of technology in K-12 classrooms continues to be debated. Unfortunately, there appears to be no "magic formula" to determine if the academic and attitudinal gains in students are really worth the investment (Ringstaff & Kelley, 2002, p. 24). Perhaps rather than spinning wheels in an attempt to discover the worth of the technology use, efforts should be made to discover the conditions that it is most beneficial to students.

Purpose of Study

For teachers to use computer-assisted instruction within their classrooms, they must buy-in to its value among their students. This study is offered in an attempt to understand two fifth-grade teachers' perception regarding a specific software program, Study Hall 101. This study is offered not only to add to the existing literature on teachers' perceptions of CAI use in the classroom, but to also fill the void that appears to exist, particularly pertaining to the use of Study Hall 101.

Increased use of technology is a growing trend in K-12 school settings (Cookson, 2009; Karchmer, 2001; Lowe, 2001; Wenglinsky, 2006). Therefore, while it is important for educators to investigate specific software packages in regards to the effectiveness of their use, teachers' perceptions of their use are also critical factor that must be considered. Hermans, et al. (2006) conclude that teachers who have favorable perceptions of CAI programs are more likely to utilize them as opposed to teachers who do not. Therefore, the value of this study serves to guide instructional specialists, administrators, and other school personnel who make campus curriculum decisions, as they specifically pertain to CAI in classroom settings.

The purpose of this study was to understand the perceptions of two fifth-grade science teachers regarding their use of Study Hall 101. Specifically, the research questions that guided this study were:

(1) Do fifth-grade science teachers perceive any changes in their fifth-grade students' attitudes towards science as a result of using Study Hall 101?

(2) Do fifth-grade science teachers perceive any change in their students' participation in science class discussions as a result of using Study Hall 101?

(3) What are fifth-grade science teachers' overall perceptions of using Study Hall *101* in their fifth-grade science classrooms?

A Closer Look Into Study Hall 101

Study Hall 101 was designed by Trish Raley, Ph.D., in 1997. Dr. Raley designed this computer-assisted instructional program in an attempt to provide a fun and innovative way for students to learn key subject-related concepts while easing frustration and humiliation often brought about from studying for content assessments in schools. The program is especially designed for students who appear to need additional supports than traditional study methods (such as flashcards and course outlines) to attain mastery of course content. According to Dr. Raley, its primary purpose is to help students learn key facts and vocabulary from core classes and be able to store this information in long-term memory (T. Raley, personal communication, March 9, 2009). Although this program can be used with students of any age, it is ideally suited for students in grades 3-12. In addition, it can be used across most content areas within schools, but is especially designed for subjects such as science and social studies, rich with key facts and vocabulary. Geared uniquely around how the brain stores information, this software uses three main cognitive strategies to assist learners in retaining information: chunking, automaticity, and scaffolding. The built-in positive reinforcement element allows students to earn computerized money for correct answers. Units within the program are composed of twenty-four facts within the specified curriculum of study. Time-saving tools included in the software for teachers include its capability of generating flash cards and practice quizzes. Grading capabilities of computerized practice tests are also available.

In summary, this computer-assisted instructional program was designed to provide academic support to students after their teacher actually introduces and teaches the curriculum objective(s). Its use by students is not designed to take the place of teachers nor be the sole method of instruction. In other words, this software should be primarily utilized as a tutor. Due to its design, Ringstaff and Kelley (2002) offer that this type of program can be considered as a method to learn "from" computers, and is, therefore, considered a form of computer-assisted instruction, or CAI (p. 3).

Methodology

Epistemological Framework

In an attempt to discover and understand the perceptions of two fifth-grade science teachers, an interpretive epistemology was used. This epistemology focuses on "multiple realities" and attempts to understand the "construction of the human mind" (Merriam, 1991, p. 48). Merriam (2002) offers that this epistemology generally employs qualitative research methods in an attempt of "making meaning- how people make sense of their lives, what they experience, how they interpret these experiences, and how they structure their social worlds" (Merriam, 1988, p. 19). Consequently, qualitative research involves observing, recording, and interviewing in search of "patterns that throw light on the meaning" of a phenomenon being studied (Houle, 1961, p. 14) as well as to provide rich, thick descriptions of perceptions and experiences (Lincoln & Guba, 1985). Patten (2009) offers that these patterns and theories emerge through an inductive approach to discover meaning as theories of behavior "emerge through consideration and analysis of the data" (p. 159). As a result, this study employed a basic interpretive qualitative research design.

Role of Researcher

Due to the nature of qualitative research, the researcher is the "primary instrument for both data collection and data analysis" (Merriam, 1991, p. 49). Consequently, the researcher engages in reflexivity so that unbiased attitudes and predispositions can be dispelled before data collection begins (Patten, 2009). The lead researcher became interested in Study Hall 101 almost 10 years ago when a version of the software was begin used with adjudicated youth in a facility in which she worked as a school counselor. Although those directly involved witnessed students becoming more motivated towards academics while using the program, no perceptions from teachers who actually used the software were ever gleaned and recorded (Merriam, 2002).

Theoretical Framework

The primary theory that underpins this study is based on extant literature that claims teachers' beliefs and attitudes toward technology tend to be primary determinants of its actual use in the classroom (Garthwait & Weller, 2005; Hermans et al., 2006; Kim, Grabowski, & Song, 2003.) While it is important for educators to investigate specific software packages in regards to the academic effectiveness, teachers' perceptions of their use must also be considered (Fryer, 2003). In fact, Ertmer (2005) opines that the extent to which teachers actually use technology in the classroom ultimately depends on teachers' beliefs about technology and its associated software. In sum, this theory suggests a relationship between teachers' attitudes about CAI and the frequency in which they utilize it in academic settings. Therein lies the significance of this study. Based on this theory, teachers' perceptions of this software ultimately determine the extent of its use in the classroom.

Data Collection

Grade and Subject Contexts

Although Study Hall 101 is designed to be used within many content areas and among students of all ages, the focus of this study is fifth-grade science. These contexts were chosen for one primary reason: In 2003, the Texas Education Agency (TEA) added fifth-grade science to the requirements for statewide standardized testing (R. Jamison, personal communication, May 5, 2010). Due to this requirement, teachers are continually challenged to utilize teaching strategies that meet the needs of their diverse student populations in order to empower all students to attain mastery in the subject of science. Accordingly, statistics from NCES (2009) indicate that continued academic gains in science are still needed among students in the fifth-grade. Although achievement gains in science were not included within this study, other studies (Boling, Martin, & Martin, 2002; Chang, 2002; Kulik, 2002) indicate that the use of CAI in academic settings may serve as a motivational medium to increase students' positive attitudes towards learning, ultimately improving their academic achievement. However, aside from these potential student effects, the main determinant of teachers actually using computer-assisted instruction in their classrooms is their perception of the software program in use (Hermans et al., 2006). Consequently, this study is offered to examine teacher perception of Study Hall 101 in fifth-grade science. Teacher perception of its use in the classroom will most likely determine its future as a teaching strategy in fifth-grade science to assist students in meeting the academic assessment standards set by the state of Texas.

District Context

The school district in which this study took place is located in the northeast region of Texas. This district serves approximately 6,660 students in grades PK-12 on eleven campuses, Over 60% of the student population is comprised of students of color. In addition, the district has a high number of students who are eligible for free and reduced meal programs, as over 65% of the student population is classified as economically disadvantaged (Texas Education Agency, 2009). Two elements of this district, the percentage of students of color, and the percentage of those that are economically disadvantaged, are often associated with urban school districts (Kincheloe, 2007). The district is rated as Academically Acceptable by the Texas Education Agency based on state assessment standards (Texas Education Agency, 2010).

Campus Context

District personnel assisted in identifying an elementary campus that would be best suited for this study. Since this study attempted to understand the perceptions of fifth-grade science teachers, it was convenient to use a campus that had several fifth-grade science teachers. Within this school district, fifth grade is still a part of elementary school; therefore, an elementary campus was needed. Further, because the study focused on technology, it was also necessary to locate a campus that had the instructional support to accommodate such needs. Administrators selected West Vern Elementary (pseudonym), in part, because it prides itself in being a campus that emphasizes technology. Therefore, a sample of convenience was identified (Patten, 2009).

The elementary school selected for this study has a population of approximately 675 students and 47 teachers. The campus is lead by two administrators, a principal and a vice-principal. In addition, there are six professional support staff, one of which is a technology coach. Student enrollment by ethnicity is: 33% African American, 59% White, 5.2% Hispanic, 1.5% Native American, and 1.3% Asian. Over 64% of the student population on this campus is considered economically disadvantaged, and the mobility rate of its students is approximately 17.8%. (Texas Education Agency, 2010).

Participants

After the district identified the campus on which the study would take place, the two participants were identified through purposive sampling. Patten (2009) further offers purposive sampling is often employed in qualitative research due to its ability to provide researchers with a sample of participants who "are likely to have relevant information" and be "rich sources of information" (p. 149). Since there were only two fifth- grade science teachers on the campus that district officials identified for this study, both were asked to participate in the study. Each agreed enthusiastically.

Ellen (pseudonym)

Ellen is a self-contained, fifth-grade science teacher. She is currently in her third year of teaching. She attended Texas Tech University, located in Lubbock, Texas, where she earned a Bachelor's degree in Finance and a Juris Doctor degree from a state university. Consequently, she practiced law for six years. Additionally, she obtained an alternative certification teaching certificate from the local university.

Whitney (pseudonym)

Like Ellen, Whitney also obtained her alternative certification in teaching after being in the field of marketing for almost eleven years. She recently completed a Masters degree in Science Education from the local university. Prior to teaching at this campus, she taught at another elementary campus within the same district for one year. Consequently, this is currently her fourth year of teaching.

Classroom Context

Two science teachers were the participants in this study. One class per teacher was selected by campus administrators to use the software to supplement instruction, while one class per teacher was selected to receive traditional supplemental instruction, such as flash cards and review sheets. Each teacher used the Study Hall 101 software in the same science class for eight weeks during the fall/winter of the 2009-2010 school year. The program was used at least three times per week for at least 10-15 minutes per session by all students in the designated class. Use normally occurred at the end of the regularly scheduled science class. A portable device known within the district as Computers-On-Wheels (COW) was moved into each classroom when the students used the software. This device housed enough laptop computers for students to individually and conveniently use the computers at their desks. Study Hall 101 was uploaded onto the campus server, with the assistance of the campus technology coach, so that it could be accessed from any location within the classroom and/or campus.

Training to use this software was conducted with the two participants, the campus technology curriculum coach, as well as one of the district technology specialists before students began using it in the classroom. The lead researcher of this study conducted the teacher-training after being trained personally by Dr. Trish Raley, the creator of the software. Training occurred on the school campus and lasted approximately three hours. Subsequent follow-up sessions occurred as needed throughout the duration of the study. Due to time and distance constraints specific to this study, representatives from the software company were unavailable to provide on-site training; however, telephone consultations were scheduled as needed. These occurred at least twice throughout the duration of the study.

Methods

The researcher for this study served as the primary instrument for both data collection and analysis (Merriam, 2002). Attempts were made to fully understand the two participants' perceptions of Study Hall 101; therefore, three different methods were employed for data collection (Merriam, 2002). Open-ended sentence stems, focus groups, and individual interviews were all utilized in an attempt to triangulate methods that would add validity to the emerging findings (Patten, 2009). Table 2.1 provides an overview of these data collection methods.

Table 2.1

Overview of Data Collection Instruments

Appendix:	A	B	C
What:	Open-Ended Sentence Stems	Focus Groups	Individual Interviews
Frequency:	Three times	Three times	Once
How:	Electronic mail (e-mail)	In person	In person

Procedures

Open-Ended Sentence Stems (Appendix A)

Open-ended sentence stems were sent to each participant via electronic mail (e-mail.) Different sets of four sentence stems were sent on three different occasions throughout the duration of the study. Participants responded to the stems at their convenience, sending their responses back via e-mail, as well. Participants were encouraged to respond candidly to each stem, giving reflective responses to each. This data collection method was utilized so that participants' comfort level of responding via e-mail would encourage candid responses. As illustrated in Table 2.1, this was the only data collection method not completed through face-to-face communication.

Focus Groups (Appendix B)

Focus groups with participants were conducted on three different occasions. The two participants and researcher met in the same conference room on campus each time. Each focus group session lasted approximately 45 minutes and was conducted during the teachers' conference periods. These focus groups created an interactive setting in which the participants were free to converse with each other about the software. The goal of the first group session was to review the format of the study, obtain consent, and answer any questions participants had. In addition, the researcher spent time during the first group session building rapport with the participants by sharing a bit of her own personal history and background.

Subsequent focus groups always began in an attempt to build rapport with participants by the researcher asking about their day and then telling them about hers. In addition, the researcher always attempted the process of "member checking" so that participants felt like "members of the research team" (Patten, 2009, p. 158). This also allowed an opportunity to validate previous findings and to ensure that interpretations thus far were accurate (Merriam, 2002). It was during this time that the researcher also shared the commonalities that were beginning to emerge between their sentence stems and focus group responses. At the conclusion of each focus group session, participants were also encouraged to add any other comments or concerns that had not been gleaned from prior collection methods.

Individual Interviews (Appendix C)

Patton (2002) offers that interviews are one of the most widely used methods of data collection in qualitative research; therefore, as a third data collection method, semi-structured, individual interviews with each participant were conducted at the conclusion of the study. The interviews were conducted in the same conference room on campus as were the focus groups. Each lasted approximately 1 hour in length and was conducted during the participants' conference period. Participants gave permission for the interviews to be audio-recorded. Consequently, the researcher later transcribed the audio-tapes in an attempt to add to hand-written notes so that the themes could be carefully considered. Interview protocols were established at the beginning of the interview and the researcher strived to continue building rapport with participants at the beginning of the interview. This semi-structured format was selected because it allowed initial interview questions to be presented, reword them if necessary, and then follow-up with additional questions in an attempt to probe for clearer understanding (Patten, 2009).

Data Analysis

Data analysis began at the onset of data collection. An inductive approach was used to develop concepts and identify patterns that were evident within the multiple sources of data (Merriam, 2002). Open coding was used to constantly compare data gleaned from the open-ended sentence stems, focus groups, and individual interviews (Bogdan & Biklen, 1998; Strauss & Corbin, 1990). As this process unfolded, code words were assigned to represent the big ideas across data sets. These code words eventually lead to the creation of concepts. In the end, patterns and themes began to emerge across data sets and individuals.

Later, the data were even revisited to identify exact words of participants that appeared to support a specific theme or pattern. This process of using low-inference descriptors, along with member checking, helped ensure the researcher's interpretations were accurate and that emic perspectives were represented in a complete and accurate way (Merriam, 2002). Eventually, through the process of member checking, the participants' lack of ability to add any new information, and the review of notes, it was determined that no new information regarding their perceptions was evident.

Validity and Reliability

Lincoln and Guba (1985) offer that the trustworthiness of any qualitative research ultimately lends to the credibility of its findings. Trustworthiness is established by using methods that “persuade audiences that the findings of an inquiry are worth paying attention to” (Lincoln & Guba, 1985, p. 290). Therefore, several methods were utilized within this study to ensure that the findings were dependable and reliable.

To more accurately understand and interpret the participants' true perceptions, it was first necessary for the researcher to build rapport with them. From the onset of the study, a diligent attempt was made to build collective and individual rapport through frequent campus visits and e-mails. Additionally, the researcher engaged in reflexivity (Johnson, 1997) in an attempt to self-disclose any personal biases or predispositions. This process helped ensure that the researcher "cleared the air as well as cleared the mind" before data collection began (Patten, 2009, p. 153).

Another strategy used in this study to enhance its trustworthiness and improve its credibility included participant feedback, or member checking (Lincoln & Guba, 1985). Initial conclusions and interpretations were consistently verified with participants so they could confirm that the interpretations of the researcher were, indeed, an accurate portrayal of their perceptions. Low-inference descriptors such as participants' direct quotes were also used in order to more closely capture their exact thoughts. In addition, the strategy of extended fieldwork or “prolonged engagement” was also employed, as the researcher spent approximately one full semester interacting with participants in various ways (Lincoln & Guba, 1985, p. 302).

Lastly, methods triangulation (Lincoln & Guba, 1985) was used as data were collected using a variety of methods, including open-ended stems via e-mail, focus groups and individual interviews. The use of more than one data collection method ensured that data could be triangulated in order to validate emerging themes, ultimately allowing the data to be constantly compared to identify emerging themes (Lincoln & Guba, 1985). Patten (2009) confers that using multiple methods to collect data contributes to the credibility of a qualitative study.

Findings

The purpose of this study was to understand the perceptions of fifth-grade science teachers regarding the use of the computer-assisted instructional software, Study Hall 101, in their fifth-grade science classes. Four favorable themes emerged from the responses resulting from the experiences of the two teachers in this study. These themes include: (a) students' attitudes towards science, (b) students' participation in science class discussions, (c) content individualization (for teachers and students), and (d) students' engagement in the learning process. Likewise, their frustrations emerged into themes, as well. These include: (a) time constraints, (b) technology glitches, and (c) specific design elements of the software. Below, these themes are developed in more detail. Then, considering these themes, recommendations for future studies are offered. Following a discussion of findings, implications for practice are presented.

Attitudes Toward Science

Both participants perceived their students' attitude towards science improved as a result of using this software. Ellen appeared to see the relationship of improved attitudes in science much quicker than Whitney. Even from the very beginning of its use, Ellen noted, "My students definitely appear to exhibit an increased motivation to learn about the concepts in each chapter. They come in to class much more excited than I remember them coming in before the program's use." In addition, she expressed that some of her students appeared to "get to class and get down to business quicker" when the computer-software was scheduled to be used. She also offered that she overheard one of her lower-achieving students in conversation with another student expressing, "I used to never like science, but I do now." This comment was made as the computers were being passed out and directions were being given instructing the students to log into the software.

Although Whitney indicated after the first few weeks of the study that she saw no real signs of her students' attitudes towards science increasing, she admitted during the middle part of the study that she did, in fact, feel that some of her students' attitudes towards science had improved. She felt this especially true concerning her academically lower-performing students. Specifically, she said, "My academically lower students seem to light up more now when they walk in my classroom." She further commented regarding the same students, "They don't seem to be as scared of science any more." One student was even overheard exclaiming to another student that he was "good in science now."

Students' comments and actions among students lead the teachers to believe that their attitudes towards science had improved over the duration of this study. As indicated by their comments and body language, students who used the software appeared to be more self-confident in science class and perceived science as less threatening than prior to the study. For many of these students, the use of the software had given them more confidence in themselves, especially as it related to the subject of science. Perceptions by both participants appear to substantiate findings (Reed, Drijvers, Kirschner, 2010; Kulik, 2002) that support CAI as an effective tool to increase students' positive attitudes towards learning.

Students' Participation in Science Class Discussions

Along with an improvement in their students' attitudes towards science, both teachers reported that their students also became more active in class discussions. Ironically, this theme developed over time and was not as evident at the onset of the study as was the prior theme relating to attitudes. However, as the software was used on a consistent basis, both teachers reported that students' participation in class discussions did, in fact, appear to increase.

This was especially evident again, in students who had histories of performing lower academically. Whitney noted that these students were not as apt to shrug their shoulders when called upon as in the past. Further, they even appeared to raise their hands more in an attempt to be called on to share correct answers in class discussions. Specifically, she noted that "more hands appeared to be raised" when questions were posed to the entire class. Whitney noticed that there seemed to be a connection between the students whose attitudes towards science had improved and those who took a more active role in science class discussions.

Ellen supported Whitney's observations by adding that her class also appeared to be more "vibrant" in class discussions. She corroborated these thoughts by adding that she even had to often remind students to raise their hands before blurting out answers aloud. She even remembered a time when her students wanted to ignore the bell that signified the end of class so that they could finish a class discussion. Like Whitney, she also noted that some of her academically lower performing students were not as "shy" to raise their hands and participate in on-going class discussions.

It could be concluded that the first theme pertaining to students' improved attitudes towards science might, indeed, be related to this theme of students more actively participating in science class discussions. Okolo (1992) puts forth evidence that suggests when students feel competent about their abilities and more in control of their own learning, they are more intrinsically motivated to take part in active-learning. Together, these two themes allude that the use of CAI may hold implications that reach far beyond the walls of the science classrooms in which it was used.

Content Individualization

For Teachers

From the onset of this study, both teachers confirmed that the software's design of allowing *them* to individualize their content was something that most other popular software programs were not equipped to provide. Specifically, the participants noted that this software is designed so that teachers can customize the content of material being offered. Unlike many other software programs, Study Hall 101 allows teachers to input specific content that students need to master, while not having to use predetermined content often programmed into other software programs. Even after students begin using Study Hall 101, teachers have the ability to go into the software and change the definitions, key words, or other content related information to more closely mirror their specific objectives.

Both participants actually took advantage of this feature several times throughout the study. Whitney offered, "It felt great to go into the program and put the definition that I always teach in class. So many other programs offer a definition that doesn't closely match what I give to my students." Ellen conferred by succinctly adding, "I've never been able to do this with any of the other software programs I've used in the past. Most programs offer a word definition that is out-dated or doesn't pertain to our curriculum here in the district." Ellen even noted that she would utilize this feature even more in the future as she became more at-ease with the process of doing so.

For Students

In addition to the advantage of individualizing the curriculum, both Ellen and Whitney confirmed that one of the most powerful advantages of using Study Hall 101 was the benefit that supplemental instruction can be individualized to meet their students' needs. Their perceptions are consistent with CAI literature, in general, by offering that teachers can more easily take into consideration students' learning styles, places in the curriculum, and interests by using CAI in the classroom (Lim & Barnes, 2002; Volman, 2005). For example, both participants noted that the screen reader option used in conjunction with Study Hall 101 provided much needed reading support for some students who were struggling readers. Accessed by any compatible but separate read-aloud download, each screen of Study Hall 101 can be read aloud to the students. When in classroom settings, such as this study, headphones can be used so that students have the ability to move through the screens while hearing a computerized voice read the content to them. Ellen noted, "This factor alone was huge! I was finally able to allow those students some time to move themselves through the curriculum without having to read every word to them." Whitney added, "This component of the program allowed me to move around the room more fluidly because I didn't have to stand in one place with one student to read the screen." She reported that her students who used this option were able to experience more independence in their learning, as they didn't have to wait for a teacher to come and read a hard-to-decipher word. Salomon and Gardner (1986) support these perceptions by offering research which supports the empowerment of CAI on student learning.

In summary, this theme emerged in two different directions, individualization for teachers and individualization for students. It was clearly evident that both teachers highly valued the ability to individualize their curriculum with the design of Study Hall 101, as well as provide tailored, individualized instruction for their students. Based on the enthusiasm exuberated by the two teachers, individualization, especially pertaining to the curriculum content, rated as a major advantage of this software among teachers.

Students Actively Engaged in Learning

Another emerging theme from the data indicated that students in both classes that comprised the experimental group appeared to be much more actively engaged in learning science while using the software. Whether by using body language to illustrate their engagement or by using mere words, the teachers witnessed their students as being active participants in their own learning process. Both teachers' added comments pertaining to this theme on a continual basis.

Whitney supported her perception by noting, "The game-like format used in the program to reinforce concepts really kept many of my students' on the edge of their seats." She further offered, "The smiles and excitement were contagious as students moved through the software. Many of my students would ask if they could use the software, even on days that it was not scheduled." She concluded by adding, "I wish they acted as excited when we were doing written work."

This theme appeared to be evident in Ellen's class, as well. She supported her opinion by offering, "Some of my students who have had difficulty in the past paying attention don't seem to have that trouble while using Study Hall 101. They seem to be able to sit for long periods of time without getting so distracted." Ellen also added that her students "loved the colors that chunked the material." Consequently, she noted that some of her students expressed they wanted to "just finish the section they were on," even when the class was over.

Chang (2000) and others (Angers & Machtmes, 2005; Bigatel, 2004) add to the connection of student motivational factors and CAI in noting that this association supports using technology integration in the classroom. Study Hall 101 appears to contain design elements that are successful in actively involving students in their own learning process. The content chunked by color, the game-like simulations, and the beat-the-clock challenges are all components within this software that helped students not only become actively involve in their learning process, but also get excited about learning facts within the curriculum content.

Time Constraints

Despite the positive perceptions of participants in this study, there were also occasional frustrations from both teachers. One of the most noted frustrations pertained primarily to the issue of time. Both participants expressed that finding time to consistently use the software for the recommended amount of time per week for this study (at least 3 times for 10-15 minutes per session) often proved to be difficult. Due to the guidelines of the study, the teachers were instructed to use the software during their regularly-scheduled science class. Consequently, the length of the science class, 1 hour and 20 minutes, left little time for the teachers to stray far from their plotted course of instruction, especially on days where the software was scheduled to be used.

Both teachers often cited they felt rushed to get through the objectives that were planned for each day when the software was scheduled to be in use. Ellen cited that she often felt a need to move through the regular curriculum at a quicker pace to ensure that she covered all of the objectives from each unit before allowing students time to utilize Study Hall 101. She added, "I sometimes feel that I need the whole science class period to explain a concept or new idea." Furthermore, she expressed that "some concepts took longer than others to introduce, and I felt that I always had to watch the clock."

Whitney conferred with Ellen by stating, "Sometimes I feel really cramped for time." In addition, she also expressed that the amount of time needed to get the laptops out and assigned to each student took "time that I just didn't feel like I had." Furthermore, Whitney confirmed that several extra minutes were also needed at the end of each class period for students to properly shut-down the computers and store them away.

These elements, combined with students navigating key boards and menu bars, appeared to be key factors of time-management in using the software within the regularly-scheduled science class. Both teachers concurred that this unfavorable issue might well be eliminated in the future by incorporating the software into another class period, such as tutoring or study hall, rather than the regularly-scheduled class. Otherwise, its use might be limited to the mere factor of time.

Technology Glitches

Another frustration that arose throughout the duration of the study pertained to the naturally occurring headache of technology use. As previously mentioned, laptop computers were rolled into each classroom for the purposes of this study. Although this certainly made the logistics of computers more accessible, technology in and of itself often brings about frustration.

Whitney appeared to experience the most frustration in regard to this theme. Her frustration was evident as she stated, "Sometimes students' screens just go blank and they don't know what to do." Ellen noted that the arrow buttons on her students' keyboards would sometimes get "stuck" as they navigated through the software. She elaborated by expressing that she attempted to see if the glitch occurred among the same particular computers and discovered that it actually occurred on different computers on most occasions.

Ellen cited similar concerns, although not as frequent. Her concerns with technology glitches were not as forthcoming as Whitney's. On several occasions she did experience situations where students' computer screens "blacked out" and "started over at the beginning." Fortunately, she was able to successfully assist the students in finding their original places within the software after this occurred.

It should be noted that the creator of Study Hall 101 was consulted about these issues, especially those pertaining to the screens going blank. After troubleshooting, it was determined that the problems were most likely *not* related to the software itself, but rather the computers and/or their location in the building. The creator of the software confirmed that this issue had not been noted as occurring frequently among other users.

Specific Components Within the Software

Another frustration of both participants pertained specifically to the design of the software. Ellen and Whitney expressed their dissatisfaction with students being able to move through the software without having to first demonstrate mastery of the previous concepts. This problem allowed students to basically scan through the content without spending enough time to demonstrate mastery. Or, students would rush through the content that interested them the least, trying to get to the game-like formats as quickly as possible.

Ellen supported her frustration by noting, "There should be built-in checks within the program that ensure students have mastered the previous objectives before it allows them to move on to new ones." "I sometimes caught my students at the end of the content when I knew they hadn't had enough time to really work through every objective." Additionally, she added that although she liked the fact that her students were allowed to "pick up where they left off in the program from prior use," she further expressed that she got frustrated when students would tell her they had completed the unit but still appeared to not know the content. Whitney provided more detail by offering, "My students sometimes just fly through the content without really having to prove they know what they have covered within the unit." Although there are certain places within the software that ask students if they are ready to move on, there are no roadblocks within the program that prevent them from advancing to other concepts before they have attained mastery of prior objectives. Both teachers expressed a desire for this type of component to be included, as they agreed the current design "encouraged students to rush towards the games at the end" before really grasping the content. It appears that this addition might help make this software more pleasing to teachers, especially since content mastery is an important objective.

Discussion

This study was guided by an interpretive epistemology which asserts that people's lived experiences and the way they interpret these experiences are of value to the field of research (Merriam, 2002). Utilizing this premise, two teachers' perceptions regarding Study Hall 101 were examined in an attempt to understand their perspectives regarding this software's use in their fifth-grade science classes. Several themes emerged from this study. First, both teachers revealed that their students' attitudes towards science, as well as their classroom participation in science discussions, did appear to increase while using this software. These finding are consistent with other studies which conclude that CAI can potentially increase students' positive attitudes towards learning (Kulik, 2002; Reed, Drijvers, & Kirschner, 2010) while, in turn, motivating students in the learning process (Angers,& Machtmes, 2005; Bigatel, 2004; Boling et al., 2002).

Individualization was another theme that emerged. Consistent with other studies pertaining to CAI use in the classroom, this theme highlighted the use of computers to individualize supplemental instruction for students; a necessary ingredient for school success for diverse populations of students (Bialvo & Savin, 1990; Braun, 1993; Hamre & Pianta, 2005; Mastropieri & Scruggs, 2004). This study also unearthed another relevant theme pertaining to teachers' needs to individualize the curriculum content of CAI. Both teachers in the study took advantage of this unique feature in Study Hall 101 and later reported that this option gave them the ability to meet their district-required curriculum guidelines while also tailoring the content to meet their own content expectations. Perhaps this theme will add to the already-existing literature that connects teachers' decisions to use computers in the classrooms with the ease in which their use can be incorporated into pre-prepared curriculums (Demetriadis et al., 2002).

Another emergent theme in this study further supports current literature regarding students' needs to be actively engaged in the learning process. Wilder and Black (2001) indicate that students who take active roles in their learning are more likely to improve their own academic outcomes. Likewise, it may be fair to assume that students who are active participants in their own learning will certainly have more probability of not only school success, but life-long success, as well (Guskey, 2002; Richardson & Swan, 2003).

Lastly, this study added to the already-existing literature that suggests that technology use in the classroom can be a double-edged sword. Issues of time constraints, as well as general glitches that occur with technology use (Bauer & Kenton, 2005), require teachers to plan ahead to ensure that these and other unfortunate issues associated with technology be prevented and, consequently, do not interfere with classroom instructional time.

Overall, findings of this study support the use of computer-assisted instructional software, specifically the one at the heart of this study- Study Hall 101. In addition, it adds to the already-existing literature previously offered pertaining to CAI use, in general, in K-12 classroom settings. These findings are relevant for district administrators, instructional specialists, teachers, counselors, and other researchers as they seek to create a vast array of strategies to meet the diverse needs of urban learners.

Implications for Practice

In the age of No Child Left Behind legislation, more creative strategies are needed in an attempt to ensure that all students are engaged in the learning process, and that no child is left behind in the academic journey. Based on the theory that teachers' perceptions of CAI are strong determinants of its use in the classroom (Garthwait & Weller, 2005; Hermans et al., 2006; Kim et al., 2003) the findings of this qualitative study indicate that Study Hall 101 is one such CAI software that teachers perceive in a favorable light. Teachers who participated in this study expressed that the advantages outweighed the disadvantages of using this particular software in their fifth-grade science classes and concluded they would recommend this software to other teachers and administrators for classroom use.

One implication for practice that should be considered regarding the consistent use of this or any other CAI software is the element of time constraint. Both teachers in this study used this software in their regularly-scheduled science classes and both expressed frustrations with not feeling there was enough time to adequately use the software as directed. Due to short class periods and an extensive amount of curriculum content that had to be taught, both felt rushed for time in using the software. One recommendation for future practice when considering the use of this or any other CAI software on a consistent basis is to schedule its use within a tutoring or study hall period, rather than the regularly-scheduled class

On a larger scale, it is recommended that CAI in K-12 classroom settings be explored by educational professionals as a strategy to assist teachers in individualizing supplemental instruction- a strategy that also has potential to motivate and engage students in their own learning process. When considering the use of CAI, it is recommended that administrators and curriculum specialists comprehensively explore *each* CAI software in order to determine not only the effects on student achievement, but teachers' perceptions of the software, as well as its user-friendliness for both students and teachers, alike. Teachers should be assured that selected software packages are free from technical complications that serve to provide additional headaches, rather than fluid, supplemental strategies that aid in the learning process.

The underpinning theory of this study highlights the importance of teachers' perceptions in regards to the actual use of CAI in classroom settings. Teachers should be active, rather than passive, participants in the software selection process. Specifically, teachers should be invited to collaborate with administrative officials regarding their perceptions of potential software, its' incorporation into their already-existing curriculum. Moreover, teachers' feedback of selected software should be constantly assessed to ensure its' use in the classroom is appropriately incorporated.

In order to ultimately integrate this or any other CAI in the classroom, teachers need access to adequate resources that facilitate its consistent use in their classrooms. Up-to-date technology, i.e., computers, and appropriate resource personnel are both critical elements that need resolution and support from administrative levels (Wozney, Venkatesh, & Abrami, 2006). Although laptop computers for each student are certainly not requirements, teachers should have access to a set of computers on an at-will or scheduled basis to allow their consistent and fluid use among students. In addition, comprehensive professional development is needed to ensure that teachers are adequately trained to use computers, as well as the specifically selected software.

Additionally, findings from this study should not imply that CAI methods be considered to provide initial and/or sole instruction to students (Kulik, Kulik, & Bangert-Downs, 1985; Lowe, 2001). This author supports its use as designated for the purposes of this study- to provide *supplemental* instruction. The implications of this study certainly are not offered to imply that any form of CAI take the place of teachers. Teachers- quality teachers- are not only necessary, but critical participants in ensuring that students of every cultural background experience success in the place we call school (Darling-Hammond, 2007).

Recommendations for Future Studies

Both participants in this study taught in the same school district on the same elementary campus. Further, the study only focused on the use of Study Hall 101 in fifth-grade science. Since the program is designed for a broad range of ages and subjects, its use in more than one age-group and subject content would most likely yield more varying teacher perceptions.

The campus selected by officials for the study was also deemed as a campus that emphasized technology; therefore, it may be fair to assume that teachers who participated in this study were, indeed, more savvy with computers than other teachers on campuses where this focus is not present. In addition, their overall perception of computer-use in the classroom may have begun more favorable than other teachers who do not teach on such technology-driven campuses. Lastly, the study was conducted in short time-frame of eight weeks, due, in part, to the time it took the researcher to get district approval for the study.

Future studies should include evidence of the effectiveness of this software on student's academic achievement. In addition, students' own perceptions of this tool should also be explored.

Conclusion

Given our current multicultural school population, coupled with the stringent academic standards set by our state, it is essential that educational professionals in urban school settings provide strategies that potentially promote learning for *all* students. The findings of this qualitative study regarding teachers' perceptions of the specific software, Study Hall 101, appear to be favorable, and add to the already existing literature that indicates CAI may offer one avenue to meet this demand. Moreover, this study appears to suggest that at least from teachers' perspectives, Study Hall 101 does, indeed, offer promise in improving students' attitudes towards science and increasing their participation in science class discussions, while also engaging them in their own learning process. In summary, this study offers that Study Hall 101 should, therefore, be added to the existing arsenal of other existing software programs in K-12 classrooms in an attempt to empower students to reach their full potential, not only in science, but also in their quest to become life-long learners.

CHAPTER III

EFFECTS OF COMPUTER-ASSISTED INSTRUCTION ON FIFTH-GRADE STUDENTS' ATTITUDES TOWARD SCIENCE

The purpose of this study was to investigate changes in attitudes toward science among fifth-grade students in an urban school district in northeast Texas. Using the Modified Attitudes Toward Science (mATSI) created by Weinburgh and Steele (2000), this study examined changes in students' science attitudes across four domains as a result of using a specific computer-assisted instructional software, Study Hall 101, for an eight-week period in the context of their regularly scheduled science class. This quantitative study utilized pre- and posttests of 70 fifth-grade students in four intact science classes. Two statistically significant findings were discovered. First, students who did not receive the treatment (CAI) experienced a negative change in attitude in one domain, the desire to do science. Second, the interaction of gender and treatment (CAI) had a statistically significant effect on another domain, self-concept toward science. Implications for practice are offered.

Introduction

Students' desire to actively pursue science-related professions in the 21st century is a national concern (Weinburgh & Steele, 2000). In fact, Osborne, Simon, and Collins (2003) proclaim this pursuit as an "urgent agenda for research" (p. 1064). Data from the Occupational Outlook Handbook, 2008-09 (Bureau of Labor Statistics, 2010) indicate that a considerable amount of occupations will continue to require professionals who possess higher levels of skills and competencies in science. Unfortunately, data from the National Science Foundation (NSF, 2010) indicate that only about 17% of undergraduate students in the United States are choosing to major in science-related fields. This number, by any standards, is considered low when compared to other countries, including China (at 50%) and France (at 47%), as well as Singapore (at 67%). Perhaps this staggering difference in occupational choice is a direct result of United States students' attitudes toward science decreasing by their middle and high school years (Zacharia & Calabrese-Barton, 2003).

Extant literature appears to connect students' attitudes toward science to their achievement in science (Bloom, 1976; Cannon & Simpson, 1985; Dhindsa & Chung, 2003; Freedman, 1997; Lederman, 1992; Oliver & Simpson, 1988; Schibeci & Riley, 1986). According to this plethora of research, improving students' attitudes toward science should be an important component in addressing the small percentage of the nation’s students currently pursuing science-related careers. Specifically, Weinburgh and Steele (2000) conclude, "the selection to continue in science may be dependent on students enjoying science and feeling good about it as a discipline" (p. 87). As a result, this study examines the use of computer-assisted instruction as an avenue to improve students' attitudes toward science.

Theoretical Framework

Several theoretical models form the basis for this research. The first theory pertains to the relationship between the constructs of classroom learning environments and attitudes (Haladyna, Olsen, & Shaughnessy, 1982; Myers & Fouts, 1992; Talton &

Simpson, 1987). Early studies (Simpson & Troost, 1982; Talton & Simpson, 1987) offer that specific curriculum interactions within the classroom shape the learning attitudes of students. A more recent study by Osborne, et al. (2003) identifies the potential of classroom curriculum strategies in shaping students' attitudes. Extensive scholarly work by Haladyna, et al. (1982) more specifically outlines the importance of various components of the learning environments and their influence on student attitudes. This body of research suggests that environmental characteristics within the curriculum that allow students to be actively involved in their own learning process have a positive effect on students' attitudes toward learning. Wilder and Black (2001) support the use of computer-assisted instruction within the classroom as a means to actively engage students in the learning process. Considering this, computer-assisted instruction may offer hope in improving students' attitudes in science.

Another relevant theory that grounds this study is Holland's theory of occupational choice (1973). According to this theory, individuals choose to learn and succeed in academic disciplines that interest them. Their decision to master specific skills in academic disciplines may be related to many elements, including their attitudes, interests, and values toward that discipline. Overall, this theory suggests a relationship between individuals' attitudes toward certain school subjects and the careers they choose to pursue. Miller, Lietz, and Kotte (2002) specifically relate Holland's theory to the present study by offering that students' long-term decisions to pursue science-related occupations may be influenced by their attitudes towards science. Therein lies the significance of this study. Liu, Hsieh, Cho, & Schallert (2006) offer solid evidence for the need to further investigate the use of computer-assisted instruction within K-12 classroom settings in that "the instructional strategies that teachers use to teach science can ultimately affect students' attitudes toward science as a subject and a career" (p. 226).

Literature Review

In order to provide a solid framework of scholarly background pertaining to this study, the following literature review is organized into several broad categories. First, the varied components that encompass the definition of attitude are explored. Second, the relationship between attitude and science is examined. Next, the importance of science attitudes among fifth-graders is offered. The following section highlights connections between students' attitudes and achievement. Finally, the potential of computer-assisted instruction within the K-12 classroom learning environment to affect students' attitudes toward science is investigated.

Opinions vary in regards to the exact definition of attitudes. Gall, Borg, and Gall (2003) offer that attitudes encompass an individual's disposition or view toward a specific object, whether it be a person, place, idea, or concept. Others add that attitudes are multidimensional and encompass components such as cognition, behavior, and affect (Bagozzi & Burnkrant, 1979; Gall, Borg, & Gall, 1996; Koballa, 1988; Rajecki, 1990; Reid, 2006). Still further, some argue that the components of cognition, behavior, and affect should be treated in more isolated terms and that attitudes should primarily be defined as judgments about concepts, ideas, or things (Ajzen, 2001; Crano & Prislin, 2006). Specifically, Crano and Prislin (2006) offer that attitudes are always formed toward a specific object, known as the attitude object. For the purposes of this study, attitudes are considered as a disposition to act, think, or feel positively or negatively towards a concept or object, in this case, the object of science, as studied within the K-12 curriculum (Crano & Prislin, 2006; Gall et al., 2003).

Considering this definition of attitudes, consideration must also be given to what the term means as it relates to science. Kind, Jones, and Barmby (2007) confer that specific scholarly works regarding science as the object of one's attitude have been muddied due to the unclear use of exactly what the term *science* means. Klopfer (1971), an early contributor to this body of research, offers that attitudes toward science are multidimensional and consist of elements such as "the acceptance of scientific inquiry as a way of thought, the adoption of scientific attitudes, the enjoyment of science learning experiences, the manifestation of favorable attitudes towards science and scientists, the development of interests in science and science-related activities, and the development of an interest in pursuing a career in science or related work" (as cited in Osborne et al., 2003, p. 1053). Others, such as Freedman (1997), Koballa (1988), and Simpson and Oliver (1990) condense this idea and suggest that attitudes towards science possess both conceptual and operational components and can be viewed as affective attachments by an individual to respond in a favorable or unfavorable way to science-related issues. Still further, Osborne, et al. (2003) contend that the attitude one has towards science develops from the beliefs and feelings about a larger body of science-related issues, which include not only school science, but how science impacts society as a whole.

Despite the varying scholarly definitions of exactly what it means to develop and possess attitudes toward science, Dhindsa and Chung (2003) offer that the instrument used to measure attitudes toward science plays an important role in operationally defining the concept. Consequently, for the purposes of this study, four of the five domains on the Modified Attitudes Toward Science Inventory (mATSI) serve to further frame the specific constructs of science as they relate to students' attitudes. This inventory is a shortened version of the Attitudes Toward Science (ATSI) and has been established as a valid and reliable instrument for measuring attitudes towards science among fifth-graders (Weinburgh & Steele, 2000). These four domains within the mATSI are (1) self-concept toward science, (2) value of science to society, (3) anxiety toward science, and (4) desire to do science (Wienburgh & Steele, 2000). [Note: The fifth domain of the mATSI, perception of teacher, was not considered in this study because the research question does not address students' perceptions of their teachers. This application of the mATSI has been used in previous studies (Buck, Cook, Quigley, Eastwood, & Lucas, 2009).]

In exploring the definition of attitudes toward science, assumptions can be made that attitudes are formed as a result of an interaction with something (Crano & Prislin, 2006). In fact, early studies by Hassan (1985) and Koballa and Crawley (1985) form the groundwork for this assumption. Hassan (1985) proclaims that the attitudes one has about science and its related components are formed through both direct and indirect exposures that shape thoughts. Koballa and Crawley (1985) further add that attitudes toward science are learned and, therefore, subject to be changed. Consequently, the present study seeks to examine the effect of a specific computer-assisted instructional program, Study Hall 101, on fifth-grade students' attitudes toward science.

Do attitudes toward science really matter among such a young population of students? After all, fifth-graders are usually between the ages of 9 and 11 years old and are still several years from having to determine their professional career choices. Liu, et al. (2006) opine that there are several reasons why students' attitudes within this age-group should be of interest to educators. First, students' early experiences toward science may, indeed, predict their future desires to pursue science-related courses not only during, but beyond high school. Second, it may be easier to improve students' attitudes toward science during their initial years of science exposure. An earlier review of the literature involving this age group revealed that students' attitudes toward science appear to be greatly influenced when they are between the ages of 8 and 13 (Koballa, 1995).

Another issue that certainly holds more relevance on an everyday basis for science teachers pertains to students' attitudes toward science and their relationship to academic achievement. In early studies, Bloom (1976) suggested that attitudes and achievement in science may be more connected than for any other school subject. Several more recent scholarly studies have also concluded that students' attitudes toward science appear to be related to their achievement in science (Dhindsa & Chung, 2003; Freedman, 1997; Mattern & Schau, 2002; Soyibo & Hudson, 2000). This evidence and the national quest to improve students' science performance on standardized assessments (National Center for Educational Statistics, 2010) underpin the relevance of this study on K-12 agendas for many stakeholders-parents, classroom teachers, school counselors, campus administrators-and any others who have a vested interested in the academic performance of K-12 students.

Many studies have indicated that CAI may hold the potential to increase students' attitudes toward learning, as well as their academic achievement (Blok, Oostdam, Otter, & Overmaat, 2002; Christmann & Badgett, 2003; Gardner, 1995; Vockell & Rivers, 1984). Mastropieri and Scruggs (2004) draw connections to the use of CAI in the classroom as a method to provide a self-paced, supplemental form of instruction while also offering an element of positive reinforcement to students. Ndakwah (2006) indicates that CAI offers potential in providing more individualized instruction and therefore plays a role in empowering students to feel less intimidated by the whole learning process. Consequently, the potential for their attitudes to improve as a result of the use of CAI is of relevance in K-12 classrooms. Osborne, et al. (2003) offer that the use of classroom curriculum strategies, among several other factors, has the ability to influence students' attitudes. Therefore, how science is taught within classroom settings has the potential to affect students' interest in the subject and may ultimately determine the extent it is chosen as a career.

Purpose of Study

This study was guided primarily by one research question: What impact does the computer-assisted instructional software, Study Hall 101, have on fifth-grade students' overall attitudes toward science? A secondary purpose was to determine whether or not selected student attribute variables (gender, ethnicity, and economic status) (Best & Kahn, 2005) influenced the impact of the treatment on students' overall and/or specific domains within the mATSI regarding attitudes toward science. Finally, the researcher was interested in knowing if one or more of the four individual attitude constructs (anxiety toward science, value of science, self-concept toward science, and desire to do science) was differentially impacted by the treatment (Study Hall 101).

Methodology

Research Design

This study employed a quantitative, pretest/posttest quasi-experimental design (Campbell & Stanley, 1963). Due to district constraints, the random assignment of individual students to a specific science class was not feasible, weakening the overall validity of the study. Four intact fifth-grade science classes taught by two teachers (two classes each) were identified with the assistance of district and campus administrators and placed in either the control group or the experimental group. One of each teacher's classes was placed in the experimental group and the other in the control group, reducing the impact of teacher effectiveness as an extraneous variable. The independent variable for this study was computer-assisted instruction, specifically Study Hall 101. The dependent variable was students' attitude toward science (Patten, 2009).

Population

The school district in which this study took place serves approximately 6,660 students in grades prekindergarten-12 on a total of eleven campuses. Approximately 60% of the student population is comprised of students of color. Student ethnicity includes 48.7% African American, 7.9% Hispanic, 41.5% White, and approximately 2% Native American and Asian, combined. Approximately 65% of students within this district qualify as economically disadvantaged (Texas Education Agency, 2009). Given that the majority of students are classified as economically disadvantaged and that the student population is largely comprised of students of color, this district reflects elements often associated with urban school districts even though student enrollment in an urban district would typically be larger than 6,600 (Kincheloe, 2007).

One elementary school within this district was chosen by district officials to be the site of the study; hence, the campus was selected on the basis of convenience (Patten, 2009). West Vern Elementary (pseudonym) has a student population of approximately 675 students, in grades PK-6. Overall student enrollment by ethnicity is: 33% African American, 59% White, 5.2% Hispanic, 1.5% Native American, and 1.3% Asian (TEA, 2009). As mirrored in the district context, two features in particular add to this campus' complexities: (a) ethnic diversity and (b) the large percentage of students who are considered economically disadvantaged (64%).

The target population for this study was approximately 500 fifth-grade students within the designated school district. District-wide, over 60% of the fifth-grade student population is comprised of students of color. Over 65% classify as economically disadvantaged (TEA, 2009).

Sample

The sample for this study consisted of 70 students, with 40 students in the control group and 30 in the experimental group. Throughout the study, students were referenced by identification numbers, in lieu of using their real names, to ensure anonymity. For the purpose of assessing generalizability of the study results, a comparison of the population and sample demographics is provided in Table 3.1.

Table 3.1

A Comparison of Study Population and Sample Demographic Characteristics

Group	N	% Eco. Dis.[1]	% Stu. of Color[2]	% Gender	
				Male	Female
*Texas	352,371	58.3	66.0	51.3	48.7
# Independent School District	500	65.4	60.0	53.6	46.4
#Sample Elementary School	113	54.0	39.8	57.5	42.5
Control Group	40	52.5	35.0	62.5	37.5
Experimental Group	30	66.6	46.6	53.3	46.6
Total Sample (Both Groups)	70	58.5	40.0	58.6	41.4

*2008-09 PEIMs data; October 2009 snapshot data
[1]Eligible for federal free/reduced meal program; [2]All students of color combined
Data Sources: Texas Education Agency and Independent School District Records

As indicated in Table 3.1, the percentage of economically disadvantaged students among the groups depicted ranged from a low of 52.5% (control group) to a high of 66.6% (experimental group.) The total sample percentage of 58.5 mirrors the state percentage of 58.3 and supports generalizing results of the study to other Texas fifth-grade students from the perspective of economic status. With regard to students of color, percentages ranged from a low of 35.0% (control group) to a high of 66.0% (Texas.) The total sample percentage of 40.0 is 26 percentage points less than the state percentage of 66.0 and 20 percentage points less than the district percentage of 60.0. The percentage of students of color in the experimental group is almost 12 percentage points higher than that of the control group. From the gender perspective, the percentage of males in the control group ranges from five to 11 percentage points higher than the campus and state, respectively, over nine percentage points higher than the experimental group.

Instrumentation

The Modified Attitudes Toward Science Inventory (mATSI) (http://www.pearweb.org/atis/tools/7), a shortened version of another instrument, Attitudes Toward Science Inventory (ATSI) (Weinburgh, 1994), was used to measure students' attitudes toward science in this study (Appendix D). The mATSI was selected for several reasons. First and foremost, it has been established as a valid and reliable instrument for measuring attitudes towards science among male and female fifth-grade students in urban school settings (Weinburgh & Steele, 2000). With regard to construct validity, alpha coefficients of ≥.50 were established on all domains (Buck et al., 2009). Internal consistency (reliability) with a Cronbach's alpha of .70, well above the minimum level of .50 suggested by McMillan and Schmacher (1993) and Nunnally (1967), was verified by Weinburgh and Steele (2000). Additionally, it can be administered in a relatively short amount of time, approximately 25 minutes (Hussar et al., 2008), facilitating convenience and user-friendliness of the instrument when administered to fifth-grade students.

The mATSI consists of 25 items that measure students' attitudes toward science across five domains, as reported in Table 3.2.

Table 3.2

Composition of the mATSI by Domain

Domain	Items	Total
1. Perception of science teacher	10, 13, 20	3
2. Anxiety toward science	5, 12, 18, 19, 22	5
3. Value of science in society	1, 6, 8, 15, 16	5
4. Self-concept toward science	4, 9, 11, 14, 25	5
5. Desire to do science	2, 3, 7, 17, 21, 23, 24	7

As indicated in Table 3.2, each of the domains includes from three to seven items, with domains 2-4 comprised of five items each; domain 5 with seven items; and domain 1 with only three items. As reported in the literature review section, only domains 2-5 were used in this study to define students' attitudes toward science. Each of the 25 statements on the mATSI is assessed on a 5-point Likert scale: 1= strongly disagree, 2= disagree, 3= undecided, 4= agree, and 5= strongly agree (Hussar et al., 2008.). This approach to measuring the construct of attitude is supported by Gall, Gall, and Borg (2007) and Likert (1932).

Procedures

Research Protocols

Prior to beginning the study, permission was granted from the Texas A&M University Institutional Review Board. As a protocol of this process, parent/guardian permission, as well as student assent, was secured before the study began. In addition, teacher consent forms were also completed.

Treatment

This study was conducted during the 2009-10 school year, from mid-November to mid-January. After the four fifth-grade science classes were assigned to the control or experimental group, both teachers were instructed to teach students in all four science classes using previously established methods of instruction. After the concepts in each unit were introduced by the teacher, students in the experimental group received supplemental science instruction via Study Hall 101, a computer-assisted instructional (CAI) software program designed to assist learners in mastering objective concepts.

Students in the experimental group used Study Hall 101 three times per week, for at least 10-15 minutes per session, during their regularly scheduled science class, usually toward the end of the class period. Laptop computers were accessed within each classroom to maximize time. Each student accessed the computer software by using an assigned password. After signing in, students were immediately able to individually access the content within each curriculum unit.

The content within each section of the software correlated with the science content that the science teacher had already taught. One of the software's main objectives is to assist students in learning key vocabulary terms and concepts for each science unit. The program is self-paced; therefore, students were encouraged to spend as much time as they needed on each section of the program until they felt comfortable with their attained mastery. Additionally, the program is designed to inform students which concepts on each screen are incorrect, allowing them as much time as they need to work on and correct their answers before moving on to the next screen. Color-coded terms and concepts assist students in associating terms with their correct definition. In addition, game simulations with sound effects provide students with another avenue within which to master the science concepts. Screen-reader options that can be paired with the software also provide students the option of having each screen read to them, if needed.

Study Hall 101 is designed to supplement curriculum content already taught by the teacher "while offering a fun and innovative way for students to learn key content facts without humiliation or frustration" (T. Raley, personal communication, March 9, 2009). While it can be used with students of all ages, it is ideally suited for students in grades 3-12 in subjects that are "rich with key facts and vocabulary, such as science or social studies. The software uses three main cognitive strategies to assist learners: (1) chunking, (2) automaticity, and (3) scaffolding" (T. Raley, personal communication, March 9, 2009).

Students in the control group did not receive supplemental instruction through the use of the CAI software, Study Hall 101. Instead, after the teacher taught the science content, they received supplemental instruction in the form of more traditional formats, such as review sheets, oral reviews, outlines, and note cards to assist them in learning the content material.

Data Collection

All students within the sample were administered the mATSI on two occasions, before and after treatment. The first administration of the inventory, the pretest, occurred in early November, and the second administration, the posttest, occurred in late January. On both occasions, the inventory was administered to students in their regularly scheduled science classes and was read aloud by their respective classroom science teacher.

Data Analysis

The Statistical Package for Social Sciences (SPSS), Version 17 was used to analyze the data to answer the research question. Individual mATSI domain and overall summary scores were calculated. A total of eight items on the instrument were negatively stated. Therefore, the scores on these items were reversed so that positive responses received higher scores and negative responses received lower scores. This data analysis procedure is supported by Weinburgh and Steele (2000).

All of the quantitative data were either ordinal or nominal (Best & Kahn, 2005). Therefore, only non-parametric statistical tests (Wilcoxon signed ranks, Mann-Whitney *U*, Pearson Chi-Square, and Kruskal Wallis) were used in the analysis. The five percent alpha level ($\leq .05$) was used to determine statistical significance in all analyses (Patten, 2009).

To address the general research question regarding the impact of the treatment Study Hall 101 on overall attitude toward science, a Chi Square analysis was conducted to compare overall change in attitude toward science of the experimental and control groups after treatment. As illustrated in Table 3.3, this analysis revealed no statistically significant change in student's overall attitude toward science.

Table 3.3

Pearson Chi-Square Results of Overall Attitude Toward Science by Group

	Value	df	Asymp. Sig. (2 tailed)
Pearson Chi-Square	1.726	1	.189

When results were coded as either positive or negative from pre-posttest, they indicated all students did experience a change in overall attitude except two in the experimental group who reported no change in their attitude toward science, as indicated by their responses from pre to posttest. These numbers are illustrated below in Table 3.4.

Table 3.4

Comparison of Changes in Overall Attitudes Toward Science by Group

Group	Negative Change in Attitude	Positive Change in Attitude	Total
Control	25 (63%)	15 (37%)	40 (100%)
Experimental	13 (46%)	15 (54%)	28 (100%)
Total (*N*)	38	30	68 (100%)

As indicated in Table 3.4, 63% percent of the control group students reported a pre-posttest decline in positive attitude toward science, while only 46% percent of the experimental group reported a pre-posttest decline in positive attitudes toward science after the CAI treatment. Consequently, 37% of the control group reported a pre-posttest improvement in their attitudes toward science, while 54% of the experimental group reported an improvement in their overall attitudes toward science. Although the between-group difference in attitude change was not statistically significant, the frequencies indicate an emerging trend for students in the control group to become increasingly negative about science over the course of instruction.

Subsequent to the overall analyses, impact of the treatment on each of the four domains was addressed. The preliminary step in this analysis was to determine whether there were statistically significant differences between the experimental and control groups in each of the four domains at the time of the pre-test. Results of the Mann-Whitney *U* test are reported in Table 3.5.

Table 3.5

Between Group Differences in Attitudes Toward Science at Pre-test (by Domains)

	PRE Anxiety to Science	PRE Value of Science	PRE Self Confidence In Science	PRE Desire to do Science
Mann-Whitney U	499.000	520.500	444.500	448.000
Asymp. Sig. (2-tailed)	.227	.343	.064	.070

As indicated in Table 3.5, the data analysis revealed the experimental and control groups expressed no statistically significant difference in any of the four domains at the time of the pre-test.

The next step was to determine whether there were statistically significant differences between the experimental and control groups in each of the four domains at the time of the posttest. Results of the Mann-Whitney *U* test are reported in Table 3.6:

Table 3.6

Between Group Differences in Attitudes Toward Science at Posttest (by Domains)

	POST Anxiety to Science	POST Value of Science	POST Self Confidence in Science	POST Desire to do Science
Mann-Whitney U	548.500	478.000	529.000	538.000
Asymp. Sig. (2-tailed)	.538	.146	.398	.461

As indicated in Table 3.6, the data analysis revealed that there was no statistically significant difference between the experimental and control groups' attitudes toward science in any of the four domains at posttest.

Next, a Wilcoxon test was performed to see if the control and experimental groups differed from time 1 (pretest) to time 2 (post test) on each of the four domains. The results are provided in Tables 3.7 and 3.8.

Table 3.7

Pre to Posttest Control Group Changes in Attitudes Toward Science

	POST Anxiety to Science - PRE Anxiety to Science	POST Value of Science - PRE Value of Science	POST Self Concept Toward Science - PRE Self Concept Toward Science	POST Desire to do Science - PRE Desire to do Science
Z	-.985	-.652	-.825	-2.525
Asymp. Sig. (2-tailed)	.325	.514	.409	.012*

*Statistically significant at p = ≤.05

Table 3.8

Pre to Posttest Experimental Group Changes in Attitudes Toward Science

	POST Anxiety to Science - PRE Anxiety to Science	POST Value of Science - PRE Value of Science	POST Self Concept Toward - PRE Self Concept Toward Science	POST Desire to do Science - PRE Desire to do Science
Z	-.796	-1.293	-.251	.-764
Asymp. Sig. (2-tailed)	.426	.196	.801	.445

As indicated in Table 3.7, the analysis revealed a statistically significant change from pre-to posttest for the control group in the domain addressing students' desire to do science (p = .012). This data indicate that control group students' desire to do science actually declined over the eight-week period of time (.012), well below the statistically significant probability level of 0.05 (Patten, 2009). Consequently, this data also reveals that there were no statistically significant changes in any of the other three domains among this group, as no other domain total fell below $p = 0.05$ at the time of post-test. Patten (2009) offers that the magnitude of these differences in these three domains should, therefore, be regarded as "unreliable" (p. 137).

Additionally, the data in Table 3.8 indicate there was no statistically significant change from pre- to posttest for the experimental group in the domain that measures attitudes toward science. Furthermore, as indicated by the data, no differences in *any* domain fell below the accepted probability level of 0.05 (Patten, 2009). Simply stated, these two tables reveal that students who did not receive computer-assisted instruction (Study Hall 101) experienced a statistically significant decline in one of the attitudinal domains, desire to do science (Table 3.7); however, students who did receive computer-assisted instruction (Study Hall 101) did not experience this or any other statistically significant decline (Table 3.8), resulting in an avoidance of a negative outcome.

Next, a Kruskal-Wallis test was used to determine the influence of attribute variables of gender, ethnicity, and economic status as each is combined with treatment on the difference score for each of the four domains. Results indicated that the only attribute variable that was influence by the treatment was gender, and this influence was only statistically significant in one domain: self-concept toward science. This is illustrated in Table 3.9.

Table 3.9

Influence of Gender on the Treatment Effect (by Domains)

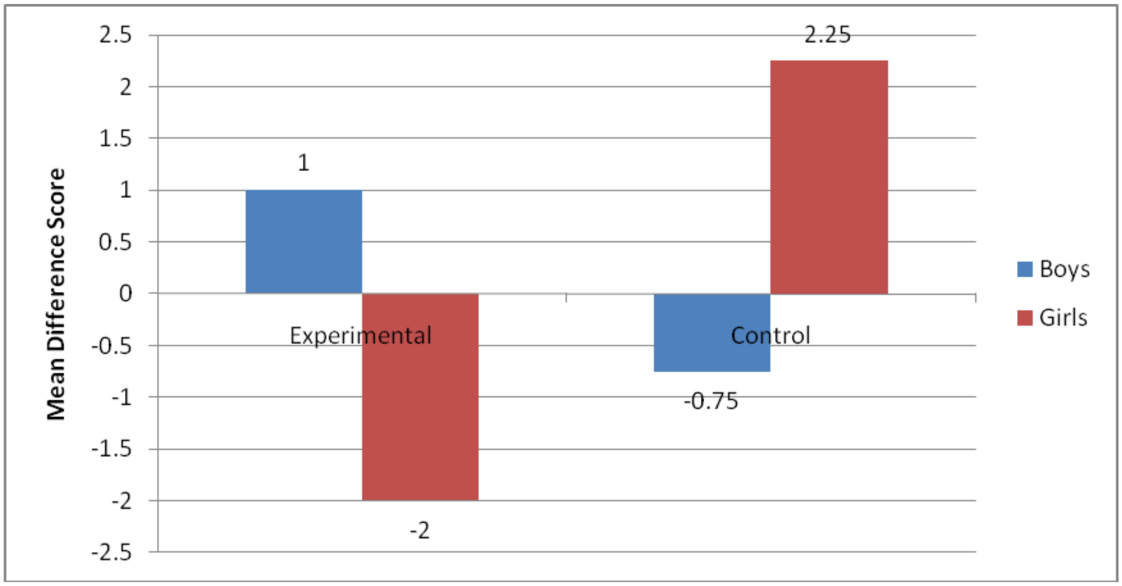
	DIFF Anxiety	DIFF Value	DIFF Self-Conc.	DIFF Desire
Chi-Square	6.651	.966	8.316	1.420
df	3	3	3	3
Asymp. Sig.	.084	.810	.040*	.701

*Statistically significant at p = ≤ .05

Further analysis indicated that the treatment, when paired with gender, influenced male and female students in opposite ways with regard to this domain. The pre to posttest mean difference in the self-concept domain of the male students in the experimental group increased by approximately one point, while the pre to posttest mean difference in the self-concept domain among their male peers in the control group decreased by almost three-fourths of a point. The opposite was true for females. The pre to posttest mean difference in the self-concept domain of female students in the experimental group decreased by approximately two points, while their female peers in the control group actually reported an increase in this domain of over two and a half points, as indicated by the pre to posttest mean difference. This effect is illustrated in Figure 3.1.

Figure 3.1

Effect of Gender and Treatment on Self-Concept Toward Science



Discussion

The purpose of this study was an attempt to discover if a particular computer-assisted instructional program, Study Hall 101, had any effect on fifth-grade students' attitude toward science. In order to determine this effect, the mATSI was used in pre and posttest administrations before and after the use of an eight-week treatment (Study Hall 101). Results indicated there was no statistically significant change in fifth-grade students' overall attitude toward science.

A more detailed analysis of the data revealed there were two statistically significant findings. First, when data were analyzed across the attribute variables of gender, ethnicity, and economic status, the use of CAI affected only one of these attribute variables-gender. In fact, the use of CAI affected males and females in opposite ways in regards to one domain: self-concept toward science. Females who received the treatment (Study Hall 101) actually experienced a decline in their self-concept toward science, while those that did not receive the treatment experienced an increase in their self-concept toward science. The opposite was true in regards to males. Males who received the treatment (Study Hall 101) actually experienced an increase in their self-concept toward science, while those that did not receive the treatment experienced a decline in this domain. Second, when data were analyzed by domain, students in the control group experienced a decline in one domain- their desire to do science, while students in the experimental group did not experience this or any other statistically significant decline. As indicated by this data, the treatment (Study Hall 101) resulted in an avoidance of a negative outcome. These findings are discussed in more detail below.

First, while there were no statistically significant differences noted in either variable of ethnicity or economic status when combined with treatment, evidence from this study supports extant literature indicating that gender *does* matter when considering the effectiveness of CAI in K-12 classroom settings (Akpinar, Yildiz, Tatar, & Ergin, 2009; Brosnan, 1998; Colley & Comber, 2003; Cooper, 2006; Karavidas, 2004; Kay, 2008; Mucherah, 2003; Wilder et al., 1985). Males and females responded to the treatment of computer-assisted instruction in opposite ways in one domain of the mATSI, self-concept toward science. The pre and posttest mean differences within this domain indicate that male students in the experimental group experienced an increase in their self-concept toward science as a result of the CAI, while those in the control group actually experienced a decrease in their self-concept toward science. Conversely, female students in the experimental group actually experienced a decline in their self-concept toward science after using the CAI, while self-concept toward science of the females in the control group increased. These findings warrant further investigation into what Cooper (2006) coins as a "digital divide based on gender" when considering the impact of computer-assisted instruction on males and females (p. 320).

Cooper and Weaver (2003) opine that one of the primary reasons females may not be experiencing the benefits of "the technological revolution on a par" with males (p. 321) relates to their higher levels of anxiety associated with computer-use. Just as important, Cooper (2006) reports that the roots of this anxiety may be nurtured in the "social developmental difference between boys and girls" (p. 322). This dilemma may be fueled by societal notions which promote expectations that computers are "boy toys" and are more often the desires of primarily males rather than females (Cooper, 2006, p. 322). Consequently, many computer games that are available for young children are inclined to be designed with males in mind, prompting them to become more computer-savvy at younger ages than females. Karavidas (2004) concludes that this initial attachment pattern developed at young ages may, indeed, persist well into adolescence and adulthood.

Still further, Cooper and Weaver (2003) offer another explanation for the disparity in attitudinal differences between girls and boys- the existence of a stereotype threat that impedes a self-fulfilling prophesy, of sorts. Prior research on the effects of stereotype threats indicate that even the knowledge of a positive or negative stereotype can impact performance in either direction, leading individuals of certain groups (males and females, in this case) to act in accordance with how the stereotype indicates they should (Cooper, 2006; Cooper & Weaver, 2003; Steele, 2004). For example, boys may tend to benefit more from computer use simply due to their belief in the societal expectations that imply they *should* react in a positive way. The opposite may be true for girls. The negative stereotype that society creates for girls and computers may serve to paint pictures of self-doubt in their minds that create negative associations between themselves and computers and ultimately cause them to view themselves as inferior when it comes to using computers. These feelings ultimately serve to underpin their avoidance and poor performance in association with computers altogether.

Results from this study pertaining to CAI and gender are not new, but rather support existing literature. Longitudinal studies across recent decades indicate that the gender issues related to computers is not a passing fad, but have abated little since documented studies as early as the 1980s (Temple & Lips, 1989; Weil, Rosen, & Sears, 1987), through the 1990s (Brosnan, 1998; Todman & Dick, 1993) and well into the 21st century (Akpinar, Yildiz, Tatar, & Ergin, 2009; Cooper, 2006; Cooper & Weaver, 2003; Kay, 2008; Mucherah, 2003). Certainly, the prevailing presence of gender imbalance in technology warrants investigations on how to eliminate or, at least, reduce its impact on the use of computers as an effective learning tool for females. If ignored, this "digital divide" among genders will, no doubt, continue to grow deeper over time.

The second statistically significant finding in this study revealed that students in the control group experienced a decline in their attitude toward science in one domain of the mATSI--desire to do science. Conversely, students in the experimental group did not experience a statistically significant decline in their attitude toward science within this domain. Although no statistically significant positive gains were calculated among students within this group, it is logical to conclude that the association of treatment (Study Hall 101) resulted in the avoidance of a negative outcome.

The decline in the control group's desire to do science warrants further investigation. Due to the fact that the experimental group did not experience this same decline, conclusions can be drawn indicating that the teaching strategies employed within the groups played a significant role in this change (or lack of). As indicated earlier, teachers supplemented their experimental group students' learning through the use of the computer-assisted instructional tool, Study Hall 101, while these same teachers supplemented their control group students' learning through more traditional forms of instruction, such as review sheets, oral reviews, outlines, and note cards.

It is well documented that adolescents should be receive a wide variety of instructional strategies within K-12 classroom settings in order to keep them engaged and maximize their learning potential (Eggen & Kauchak, 2001; Faulkner & Cook, 2006; Jackson & Davis, 2000; Manning & Bucher, 2005; National Middle School Association, 2003).Unfortunately, the high-stakes testing era often makes teachers feel they need to cover as much curriculum-ground as possible in the least amount of time. This pressure, in turn, leads teachers to abandon strategies that require more preparation and delivery time and cling to the strategies they know best, often while admitting they are not using the developmentally responsive teaching strategies they *know* they should

(Faulkner & Cook, 2006). Specific to science content, some of the strategies include effective problem solving, hands-on-learning, discovery through scientific inquiry, as well as engaging in dialogue to explain and predict (Staver, 2007). Unfortunately, an earlier study by Leonard (1968) indicates that this phenomenon of convenience is not new, but rather has been occurring since the late 1960s. Leonard (1968) specifically sheds light on this age-old issue by offering, "educators feel justified in clinging to methods that have been developed, hit or miss, over the centuries-even when they are shown to be inefficient" (p. 214). One study (Faulkner & Cook, 2006) indicates that teachers are still primarily using ineffective and boring teaching strategies in the classroom such as lectures (90.1%) and worksheets (85.7%) to the exclusion of practices that are more student-centered and age-appropriate, including hands-on, more student-centered approaches that support more constructivist thinking among students (Snoeyink & Ertmer, 2001).

Literature is replete with studies that indicate CAI is an ever-growing strategy that offers hope in meeting the needs of diverse student populations (Bauer & Kenton, 2005; Faulkner & Cook, 2006; Kulik, 2002; Snoeyink & Ertmer, 2001; Uibu & Kikas, 2008). One primary advantage for its use in classrooms is that students are encouraged to take more control of their own learning, constructing their own knowledge, while managing their time more wisely as they work without the constant supervision of the teacher (Snoeyink & Ertmer, 2001). Additionally, teachers are better able to support students' varying learning needs, while providing more individualized strategies that promote mastery for all students, not just a select few (Uibu & Kikas, 2008). Chang

(2002) opines that CAI has the ability to increase students' motivation to learn. Another, more long-term advantage of using CAI as a teaching strategy, offered by Guskey (2002) and Richardson and Swan (2003), is a connection to learning that reaches far beyond the classroom walls: when students are more active participants in their own process of learning, they are much more likely to experience not only school success, but life-long success, as well. Although results of this study do not indicate that CAI improved students desire to do science, its use did avoid a reduction in students' desire to do science, as reported by those in the control group who were supplemented by traditional pedagogy.

Implications for Practice

Results of this study have implications for all stakeholders in urban school settings. First, external K-12 stakeholders (e.g., parents, community and business leaders, governing boards) must communicate to internal stakeholders (e.g., administrators and teachers) that continuing the two-pronged status quo of a CAI gender divide and use of low student engaging science strategies is unacceptable and must be discontinued. Subsequent steps should be taken by school boards to include setting non-negotiable expectations, standards, and accountability measures (including incorporating the implementation of effective strategies for ameliorating the dual problem) into annual administrator and teacher performance reviews and/or establishing incentives to encourage and recognize successful efforts.

Second, teachers' knowledge, skills, and confidence in using effective strategies for teaching science must become a high priority in K-12 schools. This will require sustained quality professional development in the use of a variety of student-centered, highly engaging pedagogical science strategies, including but not limited to the integration of computer-assisted instruction. Summer camps and/or long-term professional development for science teachers that provide (1) sufficient time and support their understanding of the long-range positive effects of changing their teaching strategies; (2) opportunities to observe high quality demonstration teaching; and (3) practice to achieve mastery and confidence in delivery of the effective strategies are recommended.

Third, an overt, focused effort must be implemented to eliminate the three decade "gender digital-divide" (Cooper, 2006) related to girls' lack of interest, confidence in using, and/or belief in technology as a tool to maximize their learning. Perhaps attacking the stereotype threat that perpetuates this divide is one place to begin. Educators, as well as parents, must wholeheartedly decide that they will promote and embrace all efforts to neutralize this generational phenomenon-including extinguishing thoughts among females that they are inferior with regards to computers, refusing to purchase or use computer software that does not conform to the interests of both males and females, and promoting females as role models within computer settings.

Recommendations for Future Research

This study should be replicated with random assignment of students and teachers to increase the validity of results. Ideally, the sample of students and teachers should be increased, including the expansion of other grade levels, not just fifth-grade, as well as the inclusion of students and teachers from other school campuses. Also, the treatment

(CAI) should be administered for a longer period of time-a minimum of one semester-but ideally, one full academic school year. Lastly, student achievement in science should be added as another dependent variable, since the ultimate goal in K-12 educational settings is academic achievement.

Conclusion

The theoretical framework of this study was developed around two theories. The first theory pertains to the connection between classroom learning environments and students' attitudes towards learning. The second theory pertains to Holland's theory of occupational choice, which asserts that there is a relationship between students' attitudes towards academic school subjects and the careers they choose to pursue. The findings from this study directly relate to both theories and indicate the importance of classroom teaching strategies for both short and long term benefits in science for students in K-12 settings. First, results indicate that strategies employed by teachers in classroom learning environments are, indeed, associated with students' attitudes toward learning. Second, although CAI did not have a statistically significant positive effect on students' overall attitudes towards science, the lack of this teaching strategy can be associated to a decline in students' science attitudes in one domain-the desire to do science. The ever-changing landscape of urban student populations, the pressure of attaining high academic standards for all students, along with the national urgency for students to pursue science-related occupations create a demand for these issues to be immediately addressed and sustained in all K-12 science classrooms. Waiting for another decade only suggests that the seriousness of these issues is not a national concern.

CHAPTER IV

CONCLUSION: COMPUTER-ASSISTED INSTRUCTION

The goal of this dissertation study was to fill the gap in scholarly literature in regard to a specific computer-assisted instructional software, Study Hall 101, used in fifth-grade science. Consequently, a mixed-methods research approach was utilized to understand teachers' perceptions about its use in fifth-grade science and to evaluate its impact on fifth-grade students' attitudes toward science as a result of its use in an urban school setting. This chapter is offered to summarize these findings, connect these findings to existing literature, and offer recommendations for practitioners and policymakers within the context of urban school settings.

Summary of Qualitative Study

The first study (Chapter II) employed a qualitative research design in an attempt to understand teachers' perceptions regarding the use of Study Hall 101. Overall, this study explored two fifth-grade science teachers' perceptions of this software after using it in their fifth-grade science classes for approximately eight weeks. More specifically, these teachers' perceptions were gleaned in an attempt to understand its impact on their fifth-grade students' attitudes toward science, as well as its impact on their participation in science class discussions. Data collection methods used in this study were triangulated and included individual interviews, focus groups, and electronic-mail (e-mail) responses to open-ended sentence stems. Four favorable themes emerged from the responses resulting from the experiences of the two teachers in the study. These themes were: (1) students' attitudes towards science, (2) students' participation in science class discussions, (3) content individualization (for students and teachers), and (4) students' engagement in the learning process. Likewise, teachers' frustrations emerged into three themes that completed the full circle of their experiences in regard to its use in their classroom. These themes included: (1) time constraints, (2) technology glitches, and (3) specific design elements of the software.

First, both teachers revealed from their observations that their students' attitudes toward science increased as a result of using the software. One teacher supported this observation by offering, "My students definitely appear to exhibit an increased motivation to learn about the concepts in each chapter. They come to class much more excited than I remember them coming in before the program's use." Students in the experimental group came into class excited to learn and were much quicker to get their supplies out than before the study began. Some students actually expressed in their *own* words that their attitudes toward science had improved. One student commented, "I used to never like science, but I do now." This comment was made as the computers were being passed out and directions were being given instructing students to log into the software. Clearly, students' comments and actions lead teachers to believe that their attitudes towards science had improved over the duration of the study. As indicated by their body language, students who used Study Hall 101 appeared to be more self-confident in science and perceived science as less threatening than prior to the onset of the study. According to the teachers, it appeared that the software had given many of them confidence in not only themselves, but their ability to learn science. These findings are consistent with other studies which conclude that CAI can potentially increase students' positive attitudes towards learning (Reed, Drijvers, Kirschner, 2010; Kulik, 2002) while, in turn, motivating them in the learning process (Bigatel, 2004; Angers & Machtmes, 2005; Boling, Martin, & Martin, 2002).

Along with an improvement in their students' attitudes toward learning, a second theme emerged: students' participation in science class discussions. Both teachers reported that students in the experimental group became more active in science class discussions than they had been prior to the treatment. Ironically, this theme developed over time and was not as evident at the onset of the study as was the prior theme relating to attitudes. Teachers reported that students in the experimental group appeared more "vibrant" in class discussions as they noticed "more hands appeared to be raised" when questions were posed to the entire class. Additionally, one teacher specifically noted this in connection to students who had histories of performing lower academically. She supported this observation by citing, "these students were not as apt to shrug their shoulders when called upon as in the past." Certainly, it could be concluded that the first theme pertaining to students' improved attitudes towards science affected their participation in science class discussions. Okolo (1992) puts forth evidence that suggests when students feel competent about their abilities and more in control of their own learning; they are more intrinsically motivated to take part in active-learning. A more recent study by Ottenbreit-Leftwich, et al (2010) also draws connections to student engagement and CAI.

The third theme emerged as teachers expressed Study Hall 101 allowed them to individualize instruction for their students, as well as for themselves, via the content within the science curriculum. Both teachers expressed that Study Hall 101 allowed their students to spend as much time as needed on certain content objectives, while not having to rush through the content to keep up with other students. Their perceptions are consistent with other scholarly literature that connects CAI and its ability to take into consideration students' learning styles and places in the curriculum (Lim & Barnes, 2002; Volman, 2005). Specifically, both teachers noted that the screen reader options that were compatible with Study Hall 101 provided much needed reading support for some students who were struggling readers. One teacher offered, "This feature allowed me to move around the room more fluidly because I didn't have to stand in one place with one student to read the screen." A plethora of existing scholarly literature supports student individualization as an important ingredient for school success among diverse student populations (Bialvo & Savin, 1990; Braun, 1993; Hamre & Pianta, 2005; Mastropieri & Scruggs, 2004).

Still further, teachers' perceptions were positive in regard to the software's design that allowed the teachers to individualize *their* content within the software. This design option gave them the ability to follow their district-required curriculum guidelines, while also tailoring the content to meet their own classroom expectations. Demetriadis, et al. (2002) opine that the ease in which computer-assisted instructional software can be incorporated into the already-existing curriculum is a strong determinate of when and how much teachers will actually select to use it. Even in such landmark CAI studies such as Apple Classrooms of Tomorrow (ACOT), findings suggested that student engagement was enhanced as a result of CAI that was integrated and aligned within the components of the already-existing curriculum (Sandholtz et al., 1997).

The fourth theme to emerge was that students in the experimental group were perceived by the teachers to be more actively engaged in learning science while using the software. Teachers reported that students were much more engaged in the learning process, primarily due to their motivation of actively learning with the software. Whether by body language or through verbal expressions, students illustrated their high levels of engagement as they actively participated in learning new objectives within the science curriculum. One teacher supported this theme by quoting, “The game-like format used within the program to reinforce concepts really kept many of my students on the edge of their seats.” She further offered, “The smiles and excitement were contagious as students moved through the software.” Another teacher described this observation by citing, "Some of my students who have had difficulty in the past paying attention don't seem to have trouble while using Study Hall 101. They seem to be able to sit for longer periods of time without getting distracted." Clearly, computer-assisted instruction appeared to be associated with higher levels of student engagement to learn science content. The content chunked by color, the game-like simulations, and the beat-the-clock challenges are all components within this software that helped students not only become actively involved in the process of learning, but also get excited about learning facts within the science curriculum. Extent scholarly literature (Chang, 2000; Ottenbreit-Leftwich et al., 2010) support the connection of CAI and its ability to actively involve and motivate students in the process of learning.

In conjunction with the positive themes expressed, there were also several emerging themes of frustration among the teachers. First, both teachers felt they were often pressed for time to cover the science curriculum objectives, leaving little time to incorporate the CAI towards the end of the class period, as planned. Although students accessed the computers at their own desks, adequate time was still needed for students to distribute the laptops, sign on, and get started. These elements, combined with students navigating key boards and menu bars, appeared to be key factors of time-management in using the software within the regularly-scheduled science class. The teachers in the study suggested that this unfavorable issue might well be eliminated in the future by incorporating the software into another class period, such as tutoring or study hall, rather than the regularly-scheduled science class. Otherwise, its use might be limited to the mere factor of time.

A second frustration that arose throughout the duration of the study pertained to the naturally occurring glitches of technology. This often caused frustration among the students, as well as the teachers. Both teachers reported that students' computer screens would sometimes go blank for no apparent reason, leaving students no alternative other than to start the program over at the beginning. Although this theme emerged from both teachers, one teacher, in particular, expressed more frustration pertaining to this technology headache. This teacher cited that "sometimes my students' screens just go blank and they don't know what to do." Over time, the creator of Study Hall 101 was consulted about this issue. After troubleshooting, it was determined that the problems were most likely not related to the software itself, but rather the computers and/or their location in the school building. The creator of the software confirmed that this issue had not been noted as occurring frequently with other users.

Lastly, a third emerging theme pertaining to software design was a frustration for both teachers. On many occasions both teachers expressed their dissatisfaction with students being able to move through the software without having to first demonstrate mastery of the previous concepts. Consequently, students often moved swiftly to the game-like screens they enjoyed playing and would simply scan over some of the more mundane material without first demonstrating mastery. This was evident as one teacher noted, “I sometimes caught my students at the end of the content when I knew they hadn’t had enough time to really work through the objectives.” Both teachers expressed a desire for there to be a design component added to the software for students to demonstrate consistent mastery, as they concurred the current design “encouraged students to rush towards the games at the end.” It appears that this addition might help make this software more pleasing to teachers, especially since content mastery is an important objective in K-12 educational settings.

In summary, findings from this qualitative study indicate that teachers’ perceptions of Study Hall 101 are overall positive. These findings are important to administrators and others who select educational software, as teachers’ beliefs and attitudes towards technology tend to be major factors to its integration within learning environment (Hermans et al., 2006; Ottenbreit-Leftwich et al., 2010). Ertmer (2005) further expands on the importance of teachers’ perceptions by opining that the extent to which teachers actually utilize computers in their classrooms ultimately depends on teachers themselves and their beliefs about technology. The findings are relevant for district administrators, instructional specialists, teachers, counselors, and other researchers as they seek to create a vast array of science strategies that are perceived favorably by science teachers in an attempt to meet the learning needs of diverse student populations in urban school settings.

Summary of Quantitative Study

The second study (Chapter III) employed a quantitative research design and was guided primarily by one research question: What impact does the computer-assisted instructional software, Study Hall 101, have on fifth-grade students' overall attitudes toward science? A secondary purpose was to determine whether or not selected student attribute variables (gender, ethnicity, and economic status) influenced the impact of the treatment on students' attitudes toward science. Additionally, the researcher was interested in discovering if one of the four attitude domains within the Modified Attitude Toward Science Inventory (mATSI) (Weinburgh & Steele, 2000) was differentially impacted by the treatment.

Using a pretest-posttest, quasi-experimental design, 70 fifth-grade students in four intact science classes (taught by two science teachers) were selected to be in one of two groups: control or experimental. Both teachers were instructed to teach students in each group using previously established methods of instruction. After the concepts within each unit were taught by the teachers, students in the experimental group received supplemental science instruction via Study Hall 101, three times per week, for at least 10-15 minutes per session, during their regularly scheduled science class. The treatment was administered over an eight-week period. Students in the control group did not receive supplemental instruction through the use of the software. Instead, after the teacher taught the science content, they received supplemental instruction in the form of more traditional formats, such as review sheets, oral reviews, outlines, and note cards to assist them in learning the content material.

All students within the sample were administered the mATSI on two occasions, before and after treatment. On both occasions, the inventory was administered to students in their regularly scheduled science classes and was read aloud by their respective classroom science teacher. Data were analyzed using the Statistical Package for Social Sciences (SPSS), Version 17.

Results indicated there was no statistically significant change in students' overall attitudes toward science. However, two statistically significant findings did occur in regard to domain and attribute variables. First, when data were analyzed across the attribute variables of gender, ethnicity, and economic status, the use of CAI affected only one attribute variable: gender. Specifically, the use of CAI affected males and females in opposite ways in regards to only one domain: self-concept toward science. Females who received the treatment (Study Hall 101) actually experienced a decline in their self-concept toward science, while those that did not receive the treatment experienced an increase in their self-concept toward in science. The opposite was true in regards to males. Males who received the treatment (Study Hall 101) actually experienced an increase in their self-concept toward science while their male peers who did not receive the treatment experienced a decline in this domain.

The results pertaining to CAI and gender are not new, but rather support existing scholarly literature. Longitudinal studies that span several decades (Akpinar, Yildiz, Tatur, & Ergin, 2009; Brosnan, 1998; Cooper, 2006; Cooper & Weaver, 2003; Kay, 2008; Temple & Lips, 1989; Todman & Dick, 1993; Weil et al., 1987) indicate there has been and still is a "digital divide based on gender" (Cooper, 2006, p. 320) when considering gender and its relationship to computer-use. Cooper (2006) opines that this disparity may be rooted in societal norms that actually promote the expectation that computers are more "boy toys" (p. 322). Karavidas (2004) supports this claim by citing that the computer games made available to young children are often designed more towards males than females, and attachment patterns developed at young ages may, indeed, persist well into adolescence. Still further, others (Cooper & Weaver, 2003) suggest that gender disparity in attitudinal differences between girls and boys in regard to computer use is a result of the existence of a societal stereotype threat that actually impedes a self-fulfilling prophesy, of sorts. For example, boys may tend to benefit more from computer use simply due to their belief in the societal expectations that imply they should react in a positive way. The opposite may be true for girls. Negative stereotypes that society creates for girls regarding computers may serve to paint pictures of self-doubt in their minds that create negative associations between themselves and computers and cause them to view themselves as inferior when it comes to using computers. These feelings ultimately serve to underpin girls' avoidance and poor performance in association with computers altogether. Certainly, the prevailing presence of gender disparity in regards to computers, specifically computer-assisted instruction, warrants further investigations on how to eliminate, or at least reduce its impact on the use of computers as an effective learning tool for females.

The second statistically significant finding in this study revealed that students in the control group experienced a decline in their attitude toward science in one domain of the mATSI: desire to do science. Conversely, students in the experimental group did not experience a statistically significant decline in their attitude toward science within this domain. As indicated by this data, it is logical to conclude that the association of the treatment (Study Hall 101) resulted in the avoidance of a negative outcome. This finding certainly continues to support existing literature citing the use of varied learning strategies within K-12 classroom settings in order to keep students engaged in learning and maximize their learning potential (Eggen & Kauchak, 2001; Faulkner & Cook, 2006; Jackson & Davis, 2000; Manning & Bucher, 2005; NMSA, 2003).

As with gender, this issue is also one that has been documented in previous decades (Leonard, 1968) indicating that this dilemma is not new, but rather has been occurring since the late 1960s. Gusky (2002) and Richardson and Swan (2003) opine that teaching strategies teachers employ within K-12 classroom settings may have major implications and reach far beyond classroom walls: when students are more active participants in their own process of learning, they are more likely to have positive attitudes toward learning, and are much more likely to experience not only school success, but life-long success, as well. Holland’s theory of occupational choice (1973) adds further importance to this claim by proclaiming that there is a relationship between students’ attitudes towards academic school subjects and the careers they choose to pursue. If true, perhaps this and other teaching strategies that actively engage students in their learning process are key ingredients that should exist in every K-12 science classroom. Their existence and use may offer hope in increasing the percentage of students in the United States who choose science as a science-related profession in the 21st century.

Contributions to Practice

The results of this study provide administrators, campus-decision making committees, as well as teachers with research-based information that supports the use of Study Hall 101 in fifth-grade science classrooms. First, results from the qualitative study within this dissertation indicate that teachers perceive this CAI as a successful teaching strategy that improves students' attitudes toward science, actively engages them in their own learning process, and also motivates them to take a more active role in science class discussions. Further, its design is conducive to individualization of content for both teachers and students, allowing teachers to input their own science curriculum- a component often not found in many other CAI software designs. Unfortunately, as with most instances regarding technology, glitches with its use can be expected and should be reviewed with campus technology support-staff to prevent students' screens from going blank during use. Additionally, teachers should monitor students as they advance through the software in order to prevent students from haphazardly moving through screens within the program too hastily before mastering the required content.

Second, results from the quantitative study indicate that the use of Study Hall 101 in fifth-grade science offers one teaching strategy for meeting the needs of diverse student populations. One primary advantage for its use in the classroom is that students are encouraged to take more control of their own learning while constructing their own knowledge. In addition, its use within this study proved to have a statistically significant impact on students' desire to do science. This finding contributes to other scholarly literature that suggests students' attitude and desire to do science within this age-group should be of interest to educators, primarily because of its connection in predicting students' future desires to pursue science-related professions (Liu et al., 2006). Additional studies (George, 2006; Mattern & Schau, 2002; Soyibo & Hudson, 2000) also indicate that students' attitudes and desire to do science may be related to their academic achievement. This evidence and the national quest to improve students' science performance on standardized assessments (National Center for Educational Statistics, 2010) underpin the relevance of this study for many stakeholders who have a vested interest in the academic performance of K-12 science students.

Third, results from this study suggest that teachers should employ a wide variety of supplemental teaching strategies within their fifth-grade science classrooms, not just supplemental computer-assisted strategies. Doing so will ensure that both males and females have opportunities to learn by utilizing strategies that best fit their needs, based on gender. Still further, administrators and teachers should be aware that the existence of stereotype threats exist that add to girls' lack of interest, confidence in using, and/or their belief in technology as a tool to maximize their learning. Efforts on all fronts should be maximized to extinguish this generational phenomenon, previously cited as a generational "digital divide based on gender" (Cooper, 2006, p. 320).

Last, Study Hall 101 or any other CAI strategy should not be considered to provide initial and/or sole instruction to students (Blok, Oostdam, Otter, Overmaat, 2002; Johnson, Perry, & Shamir, 2010; Kulik, Kulik, & Bangert-Downs, 1985; Lowe, 2001). This author supports its use as designed for the purposes of this study- to provide *supplemental* science instruction. The implications for this study certainly are not offered to imply that any form of CAI take the place of teachers, as quality teachers are critical participants in ensuring that students of all cultural backgrounds experienced success in school (Darling-Hammond, 2007).

Recommendations for Future Research

As a result of this study, several recommendations for future research are offered. First, this study should be replicated with random assignment of students and teachers to increase the validity of results. Ideally, the sample of students and teachers should be increased, including varying grade levels, and should include teachers and students from more than one school campus. Also, the treatment should be administered for a longer period of time over the course of the school year, ideally one to two semesters.

Most importantly, future research should also include effectiveness studies on student achievement in science as a result of using Study Hall 101, since the ultimate goal in K-12 academic settings is academic achievement. Additionally, the use of Study Hall 101 should be explored within other classroom settings, not just that of regularly scheduled class periods, such as science (as done in this study.) As suggested by the teachers in qualitative component of this study, its use in another class period, such as tutoring or study hall, might eliminate time-management issues that occurred over the course of time.

It is also recommended that studies involving the use of CAI be replicated to discover if the "digital divide based on gender" (Cooper, 2006, p. 320) does, indeed, exist when considering gender and its relationship to computer-use. Still further, future studies should include emphasis on exploring attitudinal gender disparities between girls and boys in regard to computer-use. The societal stereotype threat mentioned in this study (Chapter III) as a potential reason for this phenomenon might also further be explored and efforts to neutralize this generational phenomenon should be examined.

Next, future studies should explore other science teaching strategies that promote urban students' desire to do science while keeping them actively engaged in their own learning process. This study examined CAI as a one such teaching strategy and found that students' who did not use CAI actually experienced a decline in their desire to do science. Additional science strategies should be examined that not only promote active engagement of students, but also fosters and creates within them a desire to do science. The ever-changing landscape of urban student populations along with the national urgency for students to pursue science-related occupations create a demand for these issues to be immediately addressed and sustained in K-12 science classrooms.

Implications for Policy

The present study provides several implications for policy. First, in order to maximize the use of technology in science classrooms, teachers must be adequately trained in the use of any CAI software (Ottenbreit-Leftwich et al., 2010; Sandholtz, 2001). This effort will certainly require appropriate and sustained professional development. Sandholtz (2001) further offers that this professional development should include fundamental computer operations, how to use technology as a supplemental teaching tool, and how to include it in already-existing curriculums. Teachers should not be left to do this on their own time or at the expense of their students. Professional development that includes this training should not only be a requirement, it should be *provided* by school districts that choose to use any form of CAI. Follow-up sessions that offer trouble-shooting ideas should also be included as part of this training.

Second, teachers' knowledge and skills in using effective teaching strategies for teaching science must become a high priority in K-12 schools. This quest will also require sustained professional development in the use of a variety of student-centered, highly engaging pedagogical science strategies, including but not limited to the integration of computer-assisted instruction. Summer camps and other long-term opportunities should be provided for science teachers so that they can understand the long-term positive effects of incorporating effective teaching strategies. In addition, opportunities should be provided that allow them to observe high-quality teaching in others and practice the effective strategies they observe.

Third, mentoring systems that allow science teachers to collaborate on teaching strategies and curriculum issues should be implemented. Teachers who utilize CAI strategies such as Study Hall 101 could benefit from having others to discuss its use in their classrooms, troubleshoot problems that arise, and collaborate on how to use it best.

By developing a support system, teachers will feel part of a team, rather than isolated, as they seek to use supplemental teaching strategies like Study Hall 101.

Fourth, efforts should be made to change teachers' beliefs about how they facilitate learning in their classroom. For those teachers who still believe that the direct instruction, lecture-type model of teaching is the most effective in every circumstance, "even the best professional development on technology will have limited success" (Ringstaff & Kelley, 2002, p. 16). Teachers should begin to view themselves as facilitators of knowledge rather than creators of knowledge, so that students can engage in the process of constructing their own learning process and outcomes.

Fifth, school districts should include all stakeholders in their efforts to incorporate computer-assisted instruction into their existing curriculums. Administrators, teachers, parents, and even students should be involved as districts plan and implement instructional technology into their short and long-term plans. Focus group sessions with teachers and parents should be conducted by school districts to inform them of the vast array of CAI options on the market. Their input should be considered. Additionally, students' input should also be considered as districts adopt and decide which CAI software to incorporate into their arsenal of teaching tools. The buy-in from all of these stakeholders promotes a sense unity and ensures each group that their opinions do matter. Sivin-Kachala and Bialvo (2000) offer that districts must be willing to revisit their technology plans on a regular basis to adequately and successfully take advantage of new hardware and software innovations for classroom use. Doing so will ensure that all resources are capitalized and utilized in the most effective and efficient ways possible.

Next, school districts must accomplish the task of adequately providing the necessary equipment and staff to successfully integrate technology into their K-12 classrooms. Certainly the substantial allocation of money set aside in the federal government’s technology program, Enhancing Education Through Technology (Davis, 2010) offers hope to urban school districts as they seek to make technology investments on their school campuses. Districts who are vying for these federal allocations should attempt to continually investigate all aspects of CAI so that data-driven decisions can be made that maximize its use in classrooms to the fullest extent. Additionally, technical support should be put into place to assist teachers with hardware and software issues that arise from its use. Effective use of CAI requires adequate infrastructures from top to bottom and should include on-site technical support in a timely manner.

Lastly, an overt, focused effort must be implemented to eliminate the "gender digital divide" (Cooper, 2006, p. 320) as related to girls' confident in using and/or belief in technology as a tool to maximize their learning. Perhaps efforts to attack this stereotype threat that perpetuates this divide is one place to begin. Educators, as well as parents, must wholeheartedly decide that they will promote and embrace all efforts to neutralize this generational phenomenon-including extinguishing thoughts among females that they are inferior with regards to computers, refusing to purchase computer software that does not conform to interests of both males and females, and promoting females as role models within computer settings.

Summary of Conclusions

The landscape of urban schools is changing. Data indicate that enrollment of White students is declining in K-12 public school settings in the state of Texas, while enrollment of students of color continues to increase (Texas Education Agency, 2009). Consequently, there is a need in educational settings to embrace teaching strategies that ensure all students, regardless of ethnicity, have the opportunity to experience success in the place known as school. Students' attitudes, motivation, and academic achievement work together as necessary ingredients essential for students' academic success in the classroom, regardless of gender or ethnicity. Computer-assisted instruction, specifically Study Hall 101, appears to be a supplemental strategy for teaching science that should be considered by educators who are in search of an active way to engage students in their learning process.

In as much, teachers who teach in urban classrooms must not solely rely on instructional strategies to reach their culturally diverse student populations. These strategies must be combined with a rigorous effort by all teachers to embrace students' culture in ways that foster uniqueness and appreciation rather than marginalization (Goldstein, 2007). Teachers must challenge themselves to fully investigate the aspects of their students' history and culture and be willing to incorporate pedagogical practices that foster students' uniqueness, ultimately empowering *them* to embrace their own learning process. As a result of this cultural investigation, urban teachers can develop a contextual understanding about their students that will help them identify not only *which* appropriate teaching strategies to use in their classrooms but an understanding of *why* they choose to use them in their classrooms. One effort without the other ultimately deprives urban students from the quality education they deserve.

REFERENCES

Ajzen, I. (2001). *Attitudes, personality, and behavior.* Chicago: Dorsey Press.

Akpinar, E., Yildiz, E., Tatar, N., & Ergin, O. (2009). Students' attitudes toward science and technology: An investigation of gender, grade level, and academic achievement. *Procedia Social and Behavioral Sciences 1*, 2804-2808. Retrieved August 16, 2010 from Science Direct database.

Alliance for Childhood. (2004). *Tech tonic: Towards a new literacy of technology.* College Park, MD: Author.

Angers, J., & Machtmes, K. (2005). An ethnographic-case study of beliefs, context factors, and practices of teachers integrating technology. *The Qualitative Report, 10,* 771-794.

Baggott la Velle, B., McFarlane, A., & Brawn, R. (2003). Knowledge transformation through ICT in science education: A case study in teacher-driven curriculum development-case study. *British Journal of Educational Technology, 34*(2), 183-199.

Bagozzi, R. P., & Burnkrant, R. E. (1979). Attitude organization and the attitude-behavior relationship. *Journal of Personality and Social Psychology, 37*, 913-929.

Bain, A., & Ross, K. (1999). School reengineering and SAT-1 performance: A case study. *International Journal of Education Reform, 9*(2), 148-153.

Bang, M. (2003). ICT educational analysis for the estranged people: Focused on OECD countries. *Korea Education & Research Information Service.* Retrieved September, 2006, from http://www.keris.or.kr/data/research.jsp?layerNO=dataleft1.

Bauer, J., & Kenton, J. (2005). Toward technology integration in the schools: Why isn't it happening? *Journal of Technology and Teacher Education, 13*(4), 519-546. Retrieved January 3, 2010, from ProQuest Education Journals database.

Bayraktar, S. (2001). A meta-analysis of the effectiveness of computer-assisted instruction in science education. *Journal of Research on Technology in Education, 34*(2), 173-188. Retrieved December 3, 2008, from EBSCO database.

Bebell, D., Russell, M., & O'Dwyer, L. (2004). Measuring teachers' technology uses: Why multiple-measures are more revealing. *Journal of Research on Technology in Education, 37*(1), 45-63.

Becker, H. J. (2000). F*indings from the teaching, learning, and computing survey: Is Larry Cuban right?* Unpublished conference paper presented at The Center for Research on Information Technology and Organizations, University of California- Irvine.

Benton Foundation. (2001, December, 10). *Great expectations. The e-rate at five*. Retrieved April, 2002, from http://www.benton.org/e-rate/execsummary.html

Bereiter, C. (2002). *Education and mind in the knowledge age.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Best, J. W., & Kahn, J. V. (2005). *Research in education* (10th ed.). Boston, MA: Allyn and Bacon.

Blok, H., Oostdam, R., Otter, M. E., & Overmaat, M. (2002). Computer-assisted instruction in support of beginning reading instruction: A review. *Review of Educational Research, 72*(1), 101-130.

Bloom, B. S. (1976). *Human characteristics and school learning.* New York: McGraw-Hill.

Bodur, H. O., Brinberg, D., & Coupey, E. (2000). Belief, affect, and attitude: Alternative models of the determinants of attitude. *Journal of Consumer Psychology, 9*(1), 17-28. Retrieved January 15, 2010, from EBSCO database.

Bogdan, R. C., & Biklen, S. K. (1998). *Qualitative research for education: An introduction to theory and methods* (3rd ed.). Boston: Allyn & Bacon.

Boling, C., Martin, S. H., & Martin, M. A. (2002). The effects of computer-assisted instruction on first grade students' vocabulary development. *Reading Improvement, 39*(2), 79-88. Retrieved March, 2009, from EBSCO database.

Brady, K. C. (2007). Using computers for learning: A historical study of four early programs. *ProQuest Dissertations & Theses* (Publication No. 3268528).

Braun, L. (1993). Help for all students. *Communications of the Association for Computing Machinery, 36*, 66-69. Retrieved March, 2009, from EBSCO database.

Brooks, G., Miles, J., Torgerson, C., & Torgerson, D. (2006). Is an intervention using computer software effective in literacy learning? A randomized controlled trial. *Educational Studies, 32*, 133-143.

Brosnan, M. J. (1998). The impact of psychology, gender, gender-related perceptions, significant others, and the introducer of technology upon computer anxiety in students. *Journal of Educational Computing Research, 18*, 63-78.

Buck, G., Cook, K., Quigley, C., Eastwood, J., & Lucas, Y. (2009). Profiles of urban, low SES African-American girls' attitudes toward science. *Journal of Mixed Methods Research, 3*(4), 386-410. Retrieved on September 12, 2009 from http://sagepub.com/journals

Bureau of Labor and Statistics. (2010). *Tables and charts.* Retrieved on July 18, 2010, from http://www.bls.gov

Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 709-725). New York: McMillan.

Camancho, M. A. (2002). The effects of Waterford Early Reading Program on reading achievement of first-grade students. *Masters Abstracts International, 40*(05), 1114. (UMI No. 1408133).

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand-McNally.

Campbell, J. P. (2000). A comparison of computerized and traditional instruction in the area of elementary reading. *Dissertation Abstracts International, 61*, 953.

Cannon, R. K., & Simpson, R. D. (1985). Relationships among attitude, motivation, and achievement of ability grouped, seventh-grade life science students. *Science Education, 69*(2), 121-138.

Cassady, J. C., & Smith, L. L. (2005). The impact of a structured integrated learning system on first grade students' reading gains. *Reading and Writing Quarterly, 21*, 361-376.

Chambers, J. A., & Sprecher, J. W. (1980). Computer-assisted instruction: Current trends and critical issues. *Communications of the ACM, 23*(6), 332-342. Retrieved January 22, 2010, from ACM Digital Library database.

Chang, C-Y. (2002). Does computer assisted instruction + problem solving = improved science outcomes? A pioneer study. *The Journal of Educational Research, 95*(3), 143-149.

Chang, J. C. (2000). A field test of CAI software: Magic Tree. *Masters Abstracts International, 38*(6), 1438. Retrieved December, 2008, from EBSCO database.

Christmann, E. P., & Badgett, J. L. (2003). A meta-analytic comparison of the effects of computer-assisted instruction on elementary students' academic achievement. *Information Technology in Childhood Education Annual*, 91-104. Retrieved February 1, 2010, from Wilson Education Full Text database.

Cobb, P. (1994). Constructivism in mathematics and science education. *Educational Researcher, 23*(7), 4.

Cole, M., & Griffin, P. (1987). *Contextual factors in education: Improving science and mathematics education for minorities and women.* Madison: Wisconsin Center for Educational Research.

Colley, A., & Comber, C. (2003). School subject preference: Age of gender differences revisited. *Educational Studies, 29*(1), 59-67.

Cookson, P. (2009). What would Socrates say? *Educational Leadership, 67*(1), 8-14.

Cooper, J. (2006). The digital divide: The special case of gender. *Journal of Computer-Assisted Learning, 22*, 320-334.

Cooper, J., & Weaver, K. D. (2003). *Gender and computers: Understanding the digital divide*. Mahway, NJ: Erlbaum Associates.

Crano, W. E., & Prislin, R. (2006). Attitudes and persuasion. *Annual Review of Psychology, 57*, 345-374.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal*, *38*(4), 813-834. Retrieved January 23, 2010, from Sage Education Full Text Collection database.

Dalgarno, B. (2001). Interpretations of constructivism and consequences for computer assisted learning. *British Journal of Educational Technology, 32*(2), 183-194.

Darling-Hammond, L. (2007). A marshall plan for teaching. *Education Week, 26*(18), 48-50. Retrieved February 6, 2010, from EBSCO Academic Search database.

Davis, M. R. (2010). Multiple outlets crank up technology funding. *Education Week, 29*(21), 6-7. Retrieved January 26, 2010, from ProQuest Education Journals database.

Dawson, C., & Rakes, G. (2003). The influence of principals' technology training on the integration of technology into schools. *Journal of Research on Technology in Education*, *36*(1), 29-49.

Demetriadis, S., Barbas, A., Molohides, A., Palaigeorgiou, G., Psillos, D., Vlahava, I., et al. (2002). Cultures of negotiation: Teachers' acceptance/resistance attitudes considering the infusion of technology into schools. *Computers and Education, 41*, 19-37.

Dhindsa, H., & Chung, G. (2003). Attitudes and persuasion. *Annual Review of Psychology, 57*, 345-374.

D' Souza, S. & Wood, L. (2004). Secondary students' resistance toward incorporating computer technology into mathematics learning. *Mathematics and Computer Education, 37*, 284-295.

Eggen, P., & Kauchak, D. (2001). *Educational psychology: Windows on classrooms* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Elkind, K., & Elkind, J. (2007). Text-to-speech software for reading. *Perspectives on Language and Literacy, 33*, 11-16.

Erkfritz-Gay, K. (2009). Differential effects of three computer-assisted instruction programs on the development of math skills among primary grade students. *ProQuest* (AAT 3399298).

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25-39. Retrieved February 7, 2010, from ProQuest Education Journals database.

Faulkner, S. A., & Cook, C. M. (2006). Testing vs. teaching: The perceived impact of assessment demands on middle grades instructional practices. *Education Online,* 10848959, 2006, *29*(7). Retrieved from EBSCO database on June 26, 2010.

Freedman, M. P. (1997). Relationship among laboratory instruction, attitude toward science, and achievement in science knowledge. *Journal of Research in Science Teaching, 34*, 343-357.

Fryer, W. (2003). *Technology integration lessons from the TLA.* Retrieved July 28, 2006, from http://www.wtvi.com/teks/03_04articles/tla_lessons.html

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction* (6th ed.). White Plains, NY: Longman Publishers.

Gall, M. D., Borg, W. R., Gall, J. P. (2003). *Educational research: An introduction* (7th ed.). White Plains, NY: Longman Publishers.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed). Boston, MA: Allyn and Bacon.

Gardner, P. L. (1995). Measuring attitudes in science. *Research in Science Education, 25,* 283-289.

Garthwait, A., & Weller, H. G. (2005). A year in the life: Two seventh-grade teacher implement one-to-one commuting. *Journal of Research on Technology in Education, 37*(4), 361-377.

George, R. (2006). A cross-domain analysis of change in students' attitudes toward science and attitudes about the utility of science. *International Journal of Science Education, 28*(6), 571-589.

Goldstein, R. (2007). Who are urban students and what makes them so "different." In S. R. Steinberg & J. L. Kincheloe (Eds.), *19 urban questions: Teaching in the city* (pp.41-51). New York: Peter Lang.

Guerrero, S., Walker, N., & Dugdale, S. (2004). Technology in support of middle grade mathematics: What have we learned? *Journal of Computers in Mathematics and Science Teaching, 23*, 5-20.

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice, 8*, 381-391. Retrieved February 12, 2010, from EBSCO database.

Haladyna, T., Olsen, R., & Shaughnessy, J. (1982). Relations of student, teacher, and learning environment variables to attitudes to science. *Science Education, 66*, 671-687.

Hamre, B.K., & Pianta, R.C. (2005). Can instructional and emotional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development, 76*(5), 949-967, Retrieved May 10, 2010 from EBSCO database.

Hardy, J. V. (1998). Teacher attitudes toward and knowledge of computer technology. *Computers in the Schools, 14*(3-4), 119-136.

Hassan, O. E. (1985). An investigation into factors affecting attitudes toward science of secondary school students in Jordan. *Science Education, 69*, 3-18.

Hecht, S., & Close, L. (2002). Emergent literacy skills and training time uniquely predict variability in responses to phonemic awareness training in disadvantaged kindergartners. *Journal of Experimental Child Psychology 82*: 93-115.

Hermans, R., Tondeur, J., Valcke, M. M., & van Braak, J. (2006). *Educational beliefs as predictors of ICT use in the classroom*. Paper presented at the convention of the American Educational Research Association, San Francisco, CA.

Hew, K., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Education Technology Research and Development, 55*(3), 223-252.

Higgins, E., & Raskind, M. (2004). Speech recognition-based and automaticity programs to help students with severe reading and spelling problems. *Annals of Dyslexia 54*:365-392.

Hoffner, H. (2007). *The elementary teacher's digital toolbox*. Upper Saddle River, NJ: Prentice Hall.

Holland, J. L. (1973). *Making vocational choices: A theory of careers*. Englewood Cliffs, NJ: Prentice-Hall.

Houle, C. O. (1961). *The inquiring mind.* Madison: University of Wisconsin Press.

Hussar, K., Schwartz, S., Boiselle, E., Noam, G. G. (2008). *Toward a systematic evidence-base for science in out-of-school time: The role of assessment.* Program in Education, After-school, and Resiliency. Harvard University and McLean Hospital: Noyce Foundation. Retrieved from http://www.pearweb.org/atis/tools/7 on June 8, 2009.

Iding, M., Crosby, M. E., & Speitel, T. (2002). Teachers and technology: Beliefs and practices. *International Journal of Instructional Media, 29*(2), 153-170. Retrieved December 2008, from EBSCO database.

Jackson, A. W., & Davis, G. A. (2000). *Turning points 2000: Educating adolescents in the 21st century.* New York: Teachers College Press.

Johnson, E. P., Perry, J., & Shamir, H. (2010). Variability in reading ability gains as a function of computer-assisted instruction method of presentation. *Computers & Education, 55*(1), 209-217. Retrieved August 16, 2010 from Science Direct database.

Johnson, K. (2000). *Do computers in the classroom boost academic achievement?* Retrieved May 17, 2010 from http://www.heritage.org/research/reports/2000/06/do-computers-in-the-classroom-boost-academic-achievement?query=Do+Computers+in+the+Classroom+Boost+Academic+Achievement

Johnson, R. B. (1997). Examining the validity structure of qualitative research. *Education, 18*, 282-292. Retrieved January 7, 2010, from ProQuest Education Journals.

Jones, A. (2004). *A review of research literature on barriers to the uptake of ICT by teachers.* British Educational Communications and Technology Agency, Version 1. Retrieved November 29, 2007, from http://www.becta.org.uk

Kahn, B. H. (2005). Learning features in an open, flexible, and distributed environment. *AACE Journal, 13*(2), 137-153.

Karavidas, M. K. (2004). The effects of computer usage on retired, older adult population. *Dissertation Abstracts International: Science and Engineering, 64, 4076*. Retrieved from ProQuest database on June 9, 2010.

Karchmer, R. A, (2001). The journey ahead: Thirteen teachers report how the Internet influences literacy and literacy instruction in their K-12 classrooms. *Reading Research Quarterly, 36*(4), 442-466. Retrieved February 13, 2010, from Wilson Education Full Text database.

Kay, R. H. (2008). Exploring gender differences in computer-related behavior: Past, present, and future. In T.T. Chen and I. Chen (Eds.), *Social information technology: Connecting society and cultural issues* (pp. 12-30). Hershey, PA: Information Science Reference.

Kelman, P. (1989). *Alternatives to integrated instructional systems.* Paper presented at the annual meeting of the National Education Computing Conference, Nashville, TN.

Kim, A., Vaugh, S., Klingner, J., Woodruff, A., Reutebuch, C., & Kouzekanani, K. (2006). Improving the reading comprehension of middle school students with disabilities through computer-assisted collaborative strategic reading. *Remedial and Special Education, 27*: 235-249.

Kim, Y., Grabowski, B., & Song, H. (2003). *Science teachers' perspectives of web-enhanced problem-based learning environment: A qualitative inquiry.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL. Retrieved May 12, 2005, from http://www.ed.psu.edu/~bgrabow/pub12

Kincheloe, J. (2007). Why a book on urban education? In S. R. Steinberg & J. L. Kincheloe (Eds.), *19 urban questions: Teaching in the city* (pp. 1-27). New York: Peter Lang.

Kind, P., Jones, K., & Barmby, P. (2007). Developing attitudes towards science measures. *International Journal of Science Education, 29*(7), 871-893. Retrieved on March 28, 2010, from Informaworld database.

Kinzi, M. (1990). Requirements and benefits of effective interactive instruction: Learner control, self-regulation, and continuing motivation. *Educational Technology Research and Development, 38*(1), 5-21. Retrieved March, 2009, from PsycARTICLES database.

Klopfer, L. E. (1971). Evaluation of learning science. In B. S. Bloom, J. T. Hastings, and G. Madaus (Eds.), *Handbook for formative and summative evaluation of student learning* (pp. 561-641). London: McGraw-Hill.

Koballa, T. R., Jr. (1988). The detriments of female junior high school students' intentions to enroll in elective physical science courses in high school: Testing the applicability of the theory of reasoned action. *Journal of Research in Science Teaching, 25,* 479-492.

Koballa, T. R., Jr. (1995). Children's attitudes toward learning science. In S. G. Glynn and R. Duit (Eds.), *Learning science in schools* (pp.3-34). Mahwah, NJ: Lawrence Erlbaum.

Koballa, T. R., & Crawley, F. E. (1985). The influence of attitude on science teaching and learning. *School Science and Mathematics, 85*, 223-232.

Kulik, C. L, & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior, 7,* 75-94. Retrieved December, 2008, from EBSCO database.

Kulik, J. A. (2002). *School mathematics and science programs benefit from instructional technology* (Report No. NSF03301). Arlington, VA: National Science Foundation. Retrieved March, 2009, from EBSCO database.

Kulik, J. A., Kulik, C. L., & Bangert-Downs, R. (1985). Effectiveness of computer-based education in elementary schools. *Computers in Human Behavior, 1*(1), 59-74. Retrieved March, 2009, from EBSCO database.

Lederman, N. G. (1992). Students and teachers conceptions of the nature of science-a review of the research. *Journal of Research in Science Technology, 29*(4), 331-359.

Leonard, G. (1968). *Education and ecstasy.* New York: Delacorte Press.

Levin, T., & Wadmany, R. (2008). Teachers' views on factors affecting effective integration of information technology in the classroom: Developmental Scenery. *Journal of Technology and Teacher Education, 16*(2) 233-263. Retrieved February 12, 2009, from EBSCO database.

Li, Q. (2007). Student and teacher views about technology: A tale of two cities? *Journal of Research on Technology in Education, 39*(4), 377-397. Retrieved February, 13, 2010, from ProQuest database.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology, 140*, 1-55.

Lim, C. P., & Barnes, S. (2002). "Those who can, teach": The pivotal role of the teacher in the information and communication technologies (ICT) learning environment. *Journal of Educational Media, 27*, 9-40. Retrieved February 16, 2010, from EBSCO database.

Lin, B., & Hsieh, C. (2001). Web-based teaching and learner control: A research review. *Computer & Education, 3-4*(2001), 377-386.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.

Liu, M., Hsieh, P., Cho, Y., & Schallert, D. (2006). Middle school students' self-efficacy, attitudes, and achievement in a computer-enhanced problem-based learning environment. *Journal of Interactive Learning Research, 17*(3), 225-242.

Lowe, J. (2001). Computer-based education: Is it a panacea? *Journal of Research on Technology in Education, 34*(2), 163-171. Retrieved March, 2009, from EBSCO database.

Ma, W., Anderson, R., & Streith, K. (2005). Examining use acceptance of computer technology: An empirical study of student teachers. *Journal of Computer Assisted Learning, 21*, 387-395. Retrieved February 23, 2009, from EBSCO database.

Macaruso, P., Hook, P., & McCabe, R. (2006). The efficacy of computer-based supplementary phonics programs for advancing reading skills in at-risk elementary students. *Journal of Research in Reading, 29*: 162-72.

Macaruso, P., & Rodman, A., (2009). Benefits of computer-assisted instruction for struggling readers in middle school: Short report. *European Journal of Special Needs Education, 24*(1), 103-113. Retrieved February 2, 2010, from http://www.informaworld.com/smpp/ftinterface~content=a908039363~ Fulltext=713240930~frm=content

Manning, M., & Bucher, K. (2005). *Teaching in the middle school* (2nd ed.). Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Mastropieri, M. A., & Scruggs, T. E. (2004). Effective classroom instruction. In C. Speilberger (Ed.), *Encyclopedia of applied psychology* (pp. 687-691). Oxford, UK: Elsevier.

Mattern, N., & Schau, C. (2002). Gender differences in science attitude-achievement relationships over time among white middle-school students. *Journal of Research in Science Teaching, 39*, 324-340. Retrieved March 2009, from EBSCO database.

McMillan, J. H., & Schumacher, S. (1993). *Research in education: A conceptual introduction*. New York: Harper Collins College Publishers.

Merriam, S. B. (1988). *Case study research in education: A qualitative approach.* San Francisco: Jossey-Bass.

Merriam, S. B. (1991). How research produces knowledge. In J. M. Peters & P. Jarvis (Eds.), *Adult education* (pp. 42-65). San Francisco: Jossey-Bass.

Merriam, S. B. (2002). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Miller, L., Lietz, P., & Kotte, D. (2002). On decreasing gender differences and attitudinal changes: Factors influencing Australian and English pupils' choice of career in science. *Psychology, Evolution, and Gender, 4*, 69-92.

Mucherah, W. M. (2003). Dimensions of classroom climate in social studies classrooms where technology is available (middle school students). *Dissertation Abstracts International Section A: Humanities and Social Sciences, 40*, 1451. Retrieved June 1, 2009, from ProQuest database.

Muir-Herzig, R. G. (2004). Technology and its impact in the classroom. *Computers and Education, 2*(2004), 111-131. Retrieved February, 2010, from Elsevier database.

Myers, R. E., & Fouts, J. T. (1992). A cluster analysis of high school science classroom environments and attitude toward science. *Journal of Research in Science Teaching, 29*, 929-937.

National Center for Educational Statistics (2005). *Computer technology in public school classroom: Teacher perspectives*. U. S. Department of Education: Institute of Education Sciences: NCES 2005-083. Retrieved March, 2010, from http://nces. ed.gov/pubsearch/pubsinfo.asp?pubid=2005083

National Center for Educational Statistics (2009a). *Teachers' use of educational technology in U. S. public schools: 2009*. U. S. Department of Education: Institute of Educational Sciences: NCES 2010-040. Retrieved April, 2010, from http://nces. ed.gov/pubs2010/2010040.pdf

National Center for Educational Statistics. (2009b). *Tables and statistics, 2009*. Retrieved January, 21, 2010, from http://nces.ed.gov.programs/digest/d09/

National Middle School Association. (2003). *This we believe. Successful schools for young adolescents.* Westerville, OH: Author.

National Science Foundation. (2010). *Women, minorities, and persons with disabilities in science and engineering.* Retrieved on July 11, 2010 from http://www.nsf.gov/statistics

Niemiec, R. P., & Walberg, H. J. (1989). From teaching machines to microcomputers: Some historical milestones in the development of computer-based instruction. *Journal of Research on Computing in Education, 21*(3), 263-276.

Norton, S., McRobbie, C. J., & Cooper, T. J. (2000). Exploring secondary mathematics teachers' reasons for not using computers in their teaching: Five case studies *Journal of Research on Computing in Education, 33*(1), 87-109.

Nunnally, J. (1967). *Psychometric theory*. New York: McGraw-Hill.

O'Bannon, B., & Puckett, K. (2007). *Preparing to use technology: A practical guide to curriculum integration*. Upper Saddle River, NJ: Prentice Hall.

Okolo, C. (1992). Reflections on the effect of computer-assisted instruction format and initial attitude on the arithmetic facts proficiency and continuing motivation of students with learning disabilities. *Exceptionality (3),* 255-258. Retrieved March, 2009, from EBSCO database.

Oliver, J. S., & Simpson, R. D. (1988). Influences of attitude toward science, achievement, motivation, and science self-concept on achievement in science: A longitudinal study. *Science Education, 72*, 143-155.

Osborne, J. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education, 25*(9), 1049-1079. Retrieved March, 2010, from libcat.tamu.edu.

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education, 25*(9), 1049-1079. Retrieved June 20, 2010 from EBSCO database.

Papa, R. (2003). *Integrating technology in the classroom: Challenges schools and classroom teachers face.* Retrieved on June 10, 2010, from Google Scholar database.

Park, H., Khan, S., & Petrina, S. (2009). ICT in science education: A quasi-experimental study of achievement, attitudes toward science, and career aspirations of Korean middle school students. *International Journal of Science Education, 31*(8), 993-1012. Retrieved May 26, 2010, from EBSCO database.

Patten, M. L. (2009). *Understanding research methods: An overview of the essentials* (7th ed.). Glendale, CA: Pyrczak Publishing.

Patton, M. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Plato Organization (2010). *Philosophy.* Retrieved June 10, 2010, from http://plato-apa.org/about/

Rehmann, R. (2005). The effect of earobics, TM step I, software on student acquisition of phonological awareness skills. *Dissertation Abstracts International, 66*, (07), 2533A. (UMI No. 3181124).

Reid, N. (2006). Thoughts on attitude measurement. *Research in Science & Technological Education, 24*(1), 3-27.

Reiser, R. A. (2001). A history of instructional design and technology: Part I: A history of instructional media. *Educational Technology Research and Development, 49*(1), 53-64.

Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks, 7*(1), 68-88. Retrieved May 2, 2010, from Google Scholar.

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula, T. J. Buttery, & E. Guyton (Eds.), *Handbook of research on teacher education,* (2nd ed., pp. 102-119). New York: Macmillan.

Rubinson, F. (2007). Urban dropouts: Why so many and what can be done? In S. R. Steinberg & J. L. Kincheloe (Eds). *19 urban questions: Teaching in the city* (pp53-67). New York: Peter Lang.

Salomon, G., & Gardner, H. (1986). The computer as educator: Lessons from television research. *Educational Research, 15*, 13-20. Retrieved December, 2008, from EBSCO database.

Sandholtz, J. H. (2001). Learning to teach with technology: A comparison of teacher development programs. *Journal of Technology and Teacher Education, 9*(3), 349-374.

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology: Creating student-centered classrooms.* New York: Teachers College Press.

Scherer, M. (2009). 21-age of change. *Educational Leadership, 67*(1), 7.

Schibeci, R. A., & Riley, J. P. (1986). Influence of students' background and perceptions on science attitudes and achievement. *Journal of Research in Science Teaching, 23,* 177-187.

Scrimshaw, P. (2004). *Enabling teachers to make successful use of ICT*. Coventry, UK: Becta. Retrieved on June 9, 2010, from http://www.becta.org.

Sherry, L., Billig, S., Tavalin, F., & Gibson, D. (2000). New insights on technology adoption in communities of learners. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K., McFerrin, J. Price, et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2000.* (pp. 2044-2049). Norfolk, VA: Association for the Advancement of Computing in Education.

Simonson, M. R., & Thompson, A. (1997). *Educational computing foundations*. Upper Saddle River, NJ: Merrill.

Simpson, R. D., Koballa, T. R., & Oliver, J. S., & Crawley, F. E. (1994). Research on the affective dimensions of science learning. In D. White (Eds.), *Handbook of research on science teaching and learning* (pp. 211-235). New York: Macmillan.

Simpson, R. D., & Oliver, J. S. (1990). A summary of the major influences on attitude toward and achievement in science among adolescent students. *Science Education, 74*, 1-18.

Simpson, R. D., & Troost, K. M. (1982). Influences of commitment to and learning of science among adolescent students. *Science Education, 69,* 19-24.

Sivin-Kachala, J., & Bialvo, E. R. (2000). *Research report on the effectiveness of technology in schools*. Washington, DC: Software and Information Industry Association.

Skinner, B. F. (1954). The science of learning and the art of teaching. *Harvard Educational Review, 24*, 86-97.

Skinner, B. F. (1984). The shame of American education. *American Psychologist, 39,* 947-954. Retrieved June 10, 2010 from Science Direct database.

Slaughter-Defoe, D. (2002). Introduction: The Clayton lectures. Retrieved December 8, 2008, from www.urbanedjournal.org/archive/Issue%201/HomePage/guest.html

Snoeyink, R., & Ertmer, P. A. (2001). Thrust into technology: How veteran teachers respond. *Journal of Educational Technology Systems, 30*(1), 85-111. Retrieved February 22, 2010, from Metapress Baywood Publishing Company database.

Sorrell, C. A. (2003). Reading rate and comprehension as a function of presentation mode (computerized vs. traditional) and processing speed, *Dissertation Abstracts International, 65,* 107.

Soyibo, K., & Hudson, A. (2000). Effects of computer-assisted instruction on 11th graders' attitudes to biology and CAI and understanding of reproduction in plants and animals. *Research in Science and Technological Education, 18,* 190-199.

Staver, J. R. (2007). *Teaching science: Educational Practices Series-17*. Geneva, Switzerland. The International Academy of Education.

Steele, C. M. (2004). A threat in the air: How stereotypes shape intellectual identity and performance. In J. A. Banks & C. A. McGee Banks *Handbook of research on multicultural education* (2nd ed.), (pp. 682-698). San Francisco, CA: Jossey-Bass.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Suppes, P. (1967). On using computers to individualize instruction. In D. D. Bushnell & D. W. Allen (Eds.), *The computer in American education* (pp. 11-24). New York: John Wiley.

Talton, E. L., & Simpson, R. D. (1987). Relationships of attitude toward classroom environment with attitude toward and achievement in science among tenth-grade biology students. *Journal of Research in Science Teaching, 24*, 507-525.

Temple, L., & Lips, H. M. (1989). Gender differences and similarities in attitudes toward computers. *Computers in Human Behavior, 5*, 215-226.

Texas Education Agency. (2009). *Tables and charts*. Retrieved May 2, 2010, from http://www.tea.state.tx

Texas Education Agency. (2010). *Tables and charts.* Retrieved February 12, 2010, from http://www.tea.state.us

Thompson, S., Ransdell, M., & Rousseau, C. (2005). Effective teachers in urban school settings: Linking teacher disposition and student performance on standardized tests. *Journal of Authentic Learning*, *2*, 22-34.

Thorndike, E. L. (1911). *Animal intelligence*. New York: Macmillan.

Todman, J., & Dick, G. (1993). Primary children and teachers' attitudes to computers. *Computers and Education, 20*, 199-203.

Tucker, T. H. (2009). The relationship between CAI and alternative programs to enhance fifth-grade mathematics success on the TAKS. *ProQuest, LLC.* (AAT 3399459).

Uibu, K., & Kikas, E. (2008). The roles of a primary school teacher in the information society. *Scandinavian Journal of Educational Research, 52*(5), 459-480.

United States Congress, House Committee on Ways and Means (2000). *Overview of entitlement programs.* Washington, DC: U. S. Government Printing Office.

Vockell, E. L., & Rivers, R. H. (1984). *Computerized science simulations stimulus to generalized problem-solving capabilities.* Paper presented at the Annual Convention of the American Educational Research Association, New Orleans, LA. (ERIC documents, No. ED 253-397).

Volman, M. (2005). A variety of roles for a new type of teacher educational technology and the teaching profession. *Teaching and Teacher Education, 21*, 15-31. Retrieved February 22, 2010, from Elsevier SD Peragamon database.

Webb, M. E. (2005). Affordances of ICT in science learning: implications for an integrated pedagogy. *International Journal of Science Education, 27*(6), 705-735.

Weil, M. M., Rosen, L. D., & Sears, D. C. (1987). The computer phobia reduction program: Year 1. Program development and preliminary results. *Behavior Research Methods, Instruments, and Computers, 19,* 180-184.

Weinburgh, M. H. (1994). *Academic achievement, grade level, and gender as predictor of student attitudes toward learning*. Paper presented at the Distinguished Research Session of the annual meeting of the American Educational Research Association, April 7, 1994, New Orleans, LA:

Weinburgh, M. H., & Steele, D. (2000). The modified attitudes toward science inventory: Developing an instrument to be used with fifth grade urban students. *Journal of Women and Minorities in Science and Engineering*, *6*, 87-94. Retrieved June 22, 2009, from http://libcat.tamu.edu.

Wenglinsky, H. (2006). Technology and achievement: The bottom line. *Educational Leadership, 63*(4), 29-33. Retrieved May1, 2010, from www.ascd.org March, 2009, from EBSCO database.

Wilder, G., Mackie, D., & Cooper, J. (1985). Gender and computers: Two surveys of computer-related attitudes. *Sex Roles, 13*, 215-228. Retrieved May 6, 2010 from Web of Science database.

Wilder, L. K., & Black, S. (2001). *Integrating technology in program development for children/youth with E/BD*. Project PEGS: University of Georgia. Retrieved March, 2009, from EBSCO database.

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal, 39*(1), 165-205. Retrieved February 24, 2010, from Wilson Education Full Text database.

Wozney, L., Venkatesh, V., Abrami, P. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and Teacher Education, 14*(1), 173-207.

Yaworski, J. (2000). Using computer-based technology to support the college reading classroom. *Journal of College Reading and Learning, 31*(1), 19-41. Retrieved May 1, 201 from ERIC database.

Yildirim, S. (2000). Effects of an educational computing course on pre-service and in-service teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education, 32*(4), 479.

Yuen, A., & Ma, W. (2002). Gender differences in teacher computer acceptance. *Journal of Technology and Teacher Education, 10*, 365-382. Retrieved January 27, 2010, from Wilson Education Full Text database.

Zacharia, Z., & Calabrese-Barton, A. (2003). Urban middle-school students' attitudes toward a defined science. *Science Education, 87*, 1-27.

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40*(4), 807-840. Retrieved March 2, 2009 from Sage Journals Online.

APPENDIX A

OPEN-ENDED SENTENCE STEMS

1. My students appear to enjoy using *Study Hall 101* because....

2. This is evident because they....

3. Parts of the software that my students appear to enjoy the most are....

4. Parts of the software that my students appear to enjoy the least are....

5. I see that my students' motivation to learn science has improved/not improved since using *Study Hall 101* (as compared to earlier in the semester when the program was not in use.) Explain.

6. As a teacher, my favorite component of the program is....

7. The students who are using *Study Hall 101* now take a more active role in our science class discussions than they did in the beginning of the semester when the program was not in use. I know this because....

8. I would recommend this program to other teachers because....

APPENDIX B

FOCUS GROUP: QUESTION PROMPTS

1. Are there any computer glitches that need attention?

2. Do students sign-on with ease?

3. Approximately how long does it take for your students to log in and begin using the program?

4. Which screens appear to capture your students' attention the most? The least?

5. Do you think this particular software is an effective tool to engage students in learning science content?

6. Are there any components of the program that appear to bore the students?

7. Which components appear to capture students' attention the most?

8. Do your students look forward to using the program?

9. Describe students' expressions and comments while using the program.

10. In comparison to the first semester, how has its use affected your students' classroom behavior in science class?

11. Would you recommend this program to other teachers?

12. What are your thoughts, in general, about computer-assisted instruction?

13. Have they changed as a result of using this program?

14. Do you feel that your students have experienced an increase in their grades in science as a result of using this program?

15. Do you see a difference between boys' and girls' attention and enjoyment in the program?

APPENDIX C

TENTATIVE INTERVIEW QUESTIONS

1. What are your perceptions regarding *Study Hall 101* as an effective study tool for your fifth-grade science students?

2. Did your students' science grades appear to increase this semester as a result of its use?
3. Did your students appear to enjoy learning while using the software?

4. How do you feel your students' attitudes towards learning science have changed as a result of its use?

5. How do you feel your students' motivation to learn science has changed as a result of its use?

6. Have your students been more likely to participate in science class discussions as a result of its use?

7. Do your students appear more confident in their abilities in science as a result of its use?

8. How has its use affected classroom behavior among your students this semester?

9. Was *Study Hall 101* easy to use?

10. Would you recommend it to others?

APPENDIX D

MODIFIED ATTITUDES TOWARDS SCIENCE INVENTORY

(mATSI)

STUDENT CODE:___________________

*Teacher:*________________________ *Group* (circle one) Control / Experimental

Date:___________________________ *Time* (circle one) Pre /Post_____________

Demographic Data:

Please bubble in the answer to the following questions that tells us a little bit more about you.

1. Age

O 8 years old
O 9 years old
O 10 years old
O 11 years old
O 12 years old

2. Gender

O Male
O Female

3. Race

O African American
O Caucasian/White
O Asian American
O Hispanic
O American Indian
O Other___________

4. First Language

O English
O Spanish
O French
O Japanese
O Chinese
O Other______________

General Question

1. My parents/ guardians expect me to complete:
   a. Elementary school
   b. Middle school
   c. High school
   d. Trade/Vocational school
   e. 2-year college
   f. 4- year college

STUDENT CODE:____________________

Modified Attitudes Towards Science Inventory (mATSI)

DIRECTIONS:
The following statements are about the study of science. Please listen to, and read, each statement carefully. Use the following scale to show how much you agree or disagree with each statement.

If you STRONGLY DISAGREE		X	(2)	(3)	(4)	(5)
If you DISAGREE		(1)	X	(3)	(4)	(5)
If you are UNDECIDED		(1)	(2)	X	(4)	(5)
If you AGREE	(1)	(2)	(3)	X	(5)	
If you STRONGLY AGREE	(1)	(2)	(3)	(4)	X	

Please listen as your teacher reads these questions aloud. Think about each question and mark your answer by using the system you practiced above.

1. Science is useful in helping to solve the problems of everyday life.
(1) (2) (3) (4) (5)

2. Science is something that I enjoy very much.
(1) (2) (3) (4) (5)

3. I would like to do some extra or un-assigned reading in science.
(1) (2) (3) (4) (5)

4. Science is easy for me.
(1) (2) (3) (4) (5)

5. When I hear the word *science*, I have a feeling of dislike.
(1) (2) (3) (4) (5)

6. Most people should study some science
(1) (2) (3) (4) (5)

7. Sometimes I read ahead in our science book.
(1) (2) (3) (4) (5)

Remember, to mark your answer using this system.

If you STRONGLY DISAGREE	X	(2)	(3)	(4)	(5)
If you DISAGREE	(1)	X	(3)	(4)	(5)
If you are UNDECIDED	(1)	(2)	X	(4)	(5)
If you AGREE	(1)	(2)	(3)	X	(5)
If you STRONGLY AGREE (1)	(2)	(3)	(4)	X	

8. Science is helpful in understanding today's world.
(1) (2) (3) (4) (5)

9. I usually understand what we are talking about in science.
(1) (2) (3) (4) (5)

10. Science teachers make science interesting.
(1) (2) (3) (4) (5)

11. No matter how hard I try, I can not understand science.
(1) (2) (3) (4) (5)

12. I feel tense when someone talks to me about science.
(1) (2) (3) (4) (5)

13. Science teachers present material in a clear way.
(1) (2) (3) (4) (5)

14. I often think, "I cannot do this," when a science assignment seems hard.
(1) (2) (3) (4) (5)

15. Science is of great importance to a country's development.
(1) (2) (3) (4) (5)

16. It is important to know science in order to get a good job.
(1) (2) (3) (4) (5)

17. I like the challenge of science assignments.
(1) (2) (3) (4) (5)

18. It makes me nervous to even think about doing science.
(1) (2) (3) (4) (5)

19. It scares me to have to take a science class.
(1) (2) (3) (4) (5)

STUDENT CODE:______________________________

Remember, to mark your answer using this system.

If you STRONGLY DISAGREE	X	(2)	(3)	(4)	(5)
If you DISAGREE	(1)	X	(3)	(4)	(5)
If you are UNDECIDED	(1)	(2)	X	(4)	(5)
If you AGREE	(1)	(2)	(3)	X	(5)
If you STRONGLY AGREE (1)	(2)	(3)	(4)	X	

20. Science teachers are willing to give us individual help.
(1) (2) (3) (4) (5)

21. It is important to me to understand the work I do in science class.
(1) (2) (3) (4) (5)

22. I have a good feeling toward science.
(1) (2) (3) (4) (5)

23. Science is one of my favorite subjects.
(1) (2) (3) (4) (5)

24. I have a real desire to learn science.
(1) (2) (3) (4) (5)

25. I do not do very well in science.
(1) (2) (3) (4) (5)

VITA

Name:	Leanne Howell
Contact Information:	Department of Teaching, Learning, and Culture Texas A&M University Harrington Tower MS 4232 College Station, Texas 77843
Email Address:	LeanneLHowell@aol.com

Education:	Ph.D., Curriculum and Instruction Texas A&M University College of Education and Human Development College Station, Texas December 2010
	M.S., Education Psychology Baylor University School of Education Waco, Texas August 1992
	B.S., Education Baylor University School of Education Waco, Texas August 1989
Research Interest:	Teacher Education/Training in K-12