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A study of technology integration in an all girls' school: the role of attitudes and beliefs of teachers

Patrick Kelvin Saidu
Louisiana State University and Agricultural and Mechanical College

A STUDY OF TECHNOLOGY INTEGRATION IN AN ALL GIRLS' SCHOOL: THE ROLE OF ATTITUDES AND BELIEFS OF TEACHERS

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Patrick K. Saidu

Diploma in Engineering, University of Sierra Leone, 1998
B.Sc. in Education, University of Sierra Leone, 1998
MNS, Louisiana State University, 2003
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Dedication

This dissertation is dedicated to my kids, Patrick Jr. and Patricia

And

To God be the Glory

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To God be the Glory

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Abstract

This study is primarily designed to address the relationships between teachers' beliefs, attitudes, anxiety, perceptions and barriers with respect to their use of technology in promoting students' learning. Unlike most previous studies of technology integration, this study is conducted at a gender specific, technology-rich, religious-based private school. In addition the study aims at identifying the various levels of technology adoption of teachers in this technology rich school environment and potentially suggesting "why or why not" the different levels are observed. Teachers in general nationwide have increased their technology integration and adoption over the past five years, although they still do not have access to technology they need to use technology fully in their instruction. However for the school currently under research, the technology integration trend goes as far back as a decade well before the enactment of the "No Child Left behind" (NCLB) act of 2001. While teachers in general nationwide continue to use traditional sources for their technology training, they also continue to perceive and experience moderate barriers that prevent their use of technology. Data collection for this study included surveys, interviews and document reviews for teachers and administrators. The results from this study indicate that the level of technology adoption by the teachers is inversely related to "barriers experienced when using technology" and "anxiety towards the use of technology." The study also revealed that both school support and school environment positively make an impact on the level of technology adoption by the teachers into their instructions.

Chapter One: Introduction

The No Child Left Behind Act (NCLB) of 2002 is arguably more ambitious than any previous federal legislation with regards to its focus on improving the quality of public education. NCLB can be traced back to the Elementary and Secondary Education Act (ESEA) of 1965. At that time, the nation was faced with the challenge of race integration, but by 2001 the nation's focus was on global competitiveness as enhanced through quality public education and rich curriculum infused with computers and other technology. Accordingly, NCLB's Enhancing Education Through Technology Act (EETA) includes the following purposes and goals:

1) To provide assistance to States and localities for the implementation and support of a comprehensive system that effectively uses technology in elementary schools and secondary schools to improve student academic achievement.

2) To encourage the establishment or expansion of initiatives, including initiatives involving public-private partnerships, designed to increase access to technology, particularly in schools served by high-need local educational agencies.

3) To assist States and localities in the acquisition, development, interconnection, implementation, improvement, and maintenance of an effective educational technology infrastructure in a manner that expands access to technology for students (particularly for disadvantaged students) and teachers. (Enhancing Education Through Technology Act (2001) (EETA), the NCLB Title II, Part D: Source: http://www.ed.gov/policy/elsec/leg/esea02/pg34.html. Last visited on August 30, 2009).

As a result of NCLB's EETA, there has been a strong push to get educational technology into the hands of teachers and students, to provide training for teachers and administrators, and to encourage and even mandate the use of technology in a wide range of classroom and other educational activities. According to most sources progress has been made, particularly with regard to providing access to technology (NCES, 2005). Most public and private schools have some level of access to computers and other technology. These resources are typically used for purposes of school management as well as for instructional purposes.

In comparison to increases in access to hardware and software, however, the level of integration of technology into the instructional environment of schools has shown considerable lag (Redmann & Kortrlik, 2009). The issue of technology integration as a potential problem area is reflected in a review of the guidelines of NCLB by Vavasseur and MacGregor (2008). They note that NCLB requires that a minimum of 25% of all funds spent on educational technology be allocated for high quality professional development; implying recognition of a need to train educators to effectively utilize technology. In addition, Vavasseur and MacGregor (2008) noted that the International Society for Technology in Education (ISTE) has developed standards for technology integration that have now been adapted or referenced by 90% of state departments in the United States. Finally, Vavasseur and MacGregor (2008) noted that the National Educational Technology Standards (NETS) identify the fundamental concepts concerning technology that should be mastered by teachers, students, and administrators (ISTE, 2000, 2007, 2002). The National Educational Technology Standards for Administrators (NETS-A) is very similar to the standards for students and teachers and identifies technological competencies that should be mastered by school administrators (ISTE, 2002). The NETS-A were built upon the previous Technology Standards for School Administrators (TSSA) according to Vavasseur and MacGregor (2008).

While research studies and sources of funding are growing to support technology integration, there is missing or incomplete research to document how teachers' attitudes and students' attitudes impact the use of computers, in particular, and technology in general. For example, Yuen and Ma (2002) studied how teachers feel about technology integration. They expressed concern that teachers are first responsible for teaching students how to pass tests "the old way" and that there is barely enough time for teaching students how to use computers to develop higher order thinking skills. They suggest that there is a positive relationship between teachers' perceptions of the usefulness of technology and their intentions and actual use of computers in the classroom. In addition, they noted that when a computer is perceived as easy to use, teachers tend to think it is useful and are more likely to use it in the classroom.

There is ample evidence to suggest that gender has played a role in attitudes towards computers and technology. For example, Bunderson and Christensen (1995) found that during the 1980s there was inequity related to the low level of female participation or persistence in computer courses and careers related to computer technology. DeBare (1996) reported that the percentage of women attaining degrees in computer science was consistently less than 20%. Further, she noted that women made up only 35% of the high-tech work force, and less than 11% of the top-tier executives in Fortune 500 computer companies at that time.

In the early 1980s to 2000, Bunderson and Christensen (1995) note that women were not perceived as serious students of computer science or in the field of computer technology. Young (2000) found that some of the factors associated with the attrition of women computer science majors were related to the higher education climate. Among other findings were the lack of female role models and the inability of women to be taken seriously as students according to Young. Bunderson & Christensen (1995) also reported that other problems were related to a lack of computer-related experience of women relative to their male classmates. Young suggested that the imbalance has its roots in earlier experiences of females.

In the same study, Young reviewed the educational research literature and found that the computer gender gap begins as early as children, teachers, and parents act on the perception of computers as a male domain. In that study, Young cited as evidence studies by Eastman & Krendl (1987); Jones (1987); Koohang (1989); Siann, MacLeod, Glissov, & Durnell (1990); and Wilder, Mackie, & Cooper (1985). She noted that several studies have reported a tendency for females to be unsure of their own abilities to use computers but that they also believe that women, in general, are as capable as men in their use (Sanders & Stone (1986); Siann et al.). In a similar finding related to self perceptions, Newman, Cooper, and Ruble (1995) found girls were less likely than boys to 'claim computers for their own group.'

According to Young, teachers' attitudes, were found to be one of the primary sources of the male domain stereotype. She goes on to state that "Positive and Negative teacher attitudes toward technology similarly affected student attitudes toward computers." Young summarized these studies saying that studies

have examined gender differences in confidence, teacher attitude, computer experience, and perceptions of computers as a male domain. After setting the stage that there is a difference in gender-based attitudes, perceptions and beliefs, Young then focused on gender-based differences related to self-report of computer skill level, total hours of computer use, hours of home computer use, student perceptions of teacher attitudes toward students as computer users and significant gender differences in male domain dimension on specific items.

The results from these studies all indicate that there are still unanswered questions related to the role of attitudes with respect to technology use and integration. It is worth noting that most studies were generated looking back over the previous decades (1980s to 1990s). During this period, i.e., the early 80's to 90's, computers were still new and adoption levels were different depending on teachers, teaching styles, students, students' openness (closeness) and computers at that time.

Current Practices in Technology Integration

Today's students were born into a world of digital technology. Children all over the world use computers and internet technology. An OECD (OECD, 2005) report in Israel, found that nine out of ten households with teenagers have at least one computer connected to the Internet. Harel-Caperton, (2003) refers to today's children as *Clickerati* and as the three X's generation. According to Harel-Caperton, this means that the three X's generation learn through bricolage by exploring, expressing and exchanging ideas using technological means. Shaffer and Clinton (2006) suggest that digital media pose challenges to educators because they encourage the development of mental actions that are not at the heart of schooling (as cited in Yifat Ben-David Kolikant, 2009, p. 132). According to Yifat Ben-David Kolikant (2009), when students enter school they encounter an institution that was designed before computer and Internet technology was envisioned and thus is based extensively on book technology.

Brown (2002) describes the shifts in learning brought about by the digital Internet medium, pointing out the differences between the form of learning used by the generation raised on books and that used by the

digital generation (as cited in Yifat Ben-David Kolikant, 2009, pp. 131-143). In addition, Brown claims that learning has shifted from being authority-based to being discovery based. According to Brown, teachers, although probably aware of students' affinity for technology, might be concerned about the possibility of error inherent in navigating confusing, complex realms of information with varying degrees of reliability. In contrast, Brown notes students, being used to and capable of navigating the Internet, may perceive the Internet as efficient, especially when working on a paper assignment. Papert (1998) strongly believes that students will try to make schools adopt their form of learning and refers to them as "an army for change."

Anything but a slow and deliberate pace describes how computer technology has made its way into classrooms nationally and internationally. As schools and classrooms gain access to a greater number of computers, more sophisticated software, and the Internet, teachers not only have become familiar with the challenges of infusing technology into lesson plans, courses and the overall curriculum, but they have also observed students grow in numbers each year as a result of the latest, greatest and newest technology (Abbott & Faris, 2000).

Survey results confirm that students are increasingly online both in school and at home. About four (4) years ago, 87 percent of U.S. students ages 12-17 reported using the Internet (Hitlin & Rainie, 2005); and almost half of students ages 8-18 reported going online in a typical day (Roberts, Foehr, & Rideout, 2005). In a 2005 survey of 7th graders in urban Connecticut middle schools and rural South Carolina schools, roughly one-third of the students reported that they were required to use the Internet for a school assignment at least once a week ,(Internet Reading Research Group & New Literacies Research Team, 2006).

According to Mardis, Hoffman and Marshall, (2008) research on educational technology use in learning environments has focused on barriers and gaps, a deficit approach centering on the lack of adoption and innovation, with rare applications of generally accepted or tested frameworks or theoretical foundations. Mardis, et al. (2008) note that the majority of studies of U.S. public schools are descriptive or inductive, collecting data from educational stakeholders and school settings, then suggesting emergent patterns of user

behaviors, attitudes, and adoption patterns. Mardis, et al. (2008) also reports that there are few studies which have incorporated models, frameworks, or theory from other social science disciplines despite actively assimilating other social science methods in the studies.

According to Mardis, et al. (2008), research on educational uses of information and communications technologies (ICT) in primary and secondary schools has a long history, with traditional approaches examining adoption and use from a user perspective, particularly through studies of teachers based on self-reports (surveys, interviews) or short-term classroom observations of teaching. Mardis, et al. (2008) reports that many recent critiques (for example: Bebell, Russell, & O'Dwyer, 2004; Becker & Ravitz, 1999; Cuban, Kirkpatrick & Peck, 2001) have noted that, such studies are typically theoretical, small-scale case studies that cannot easily be generalized or are focused on a particular innovation in a specific school setting. In addition, they noted that while larger-scale survey research provides a snapshot in time of typical uses, on the other hand, survey research does have little explanatory power in terms of processes of innovation and adoption.

Some recent studies (Bebell, Russell, & O'Dwyer, 2004; Wenglinsky, 1998; Becker, 2007) using large datasets and multi-level modeling are providing insights into the complex inner-relationships that shape the uses of ICT in schools, but each however, notes limitations when the datasets used were not designed for ICT research according to Mardis, et al. Furthermore, Mardis et al., report that all studies to date do show one general theme: schools remain relatively low-technology institutions where the dynamic ICT advances shaping other areas such as business and health care organizations remain illusory, despite high expectations by government agencies, educators, and parents. Mardis et al., state that because teachers are considered the 'gatekeepers' of the classroom, most studies cited above only examined differences in teacher usage of technology to understand school technology integration. In contrast, they note that when examining schools and student adoption and use, many studies have focussed on what is termed the 'digital divide' which was initially framed in terms of access, resulting in a number of policy initiatives in the 1990s.

These policy initiatives were meant to increase the numbers of computers in schools and connectivity to the Internet in classrooms. Mardis et al. (2008) also note that this early research had a technology-centric approach that differentiated between the computer "haves' and "have not's" primarily based on socioeconomic status, gender, and age. The further suggest that the technology access gap approach has proven to be an incomplete framework and guide to public policy.

Kotrlik and Redmann, (2009) suggest that schools are investing more in instructional technology for teachers' use. In their study Liu and Huang (2005) suggest that the most significant change in the classroom today is the increased availability of the Internet. According to the National Center for Educational Statistics (NCES), the number of public school instructional rooms with internet access has increased from 35% in 1994 to 94% in 2005. On the other hand, the ratio of students to instructional computers with internet access has considerably dropped from 12.1: 1 in 1998 to 3.8: 1 in 2005, (Wells & Lewis, 2006).

With increasing technological opportunities for instructional purposes and learning, instruction has moved from a local classroom setting to a global classroom via distance learning. This however suggests that teachers in these classrooms with the available cutting-edge technology resources should be prepared to welcome the rapid changing technologies and utilize them in the most effective way as to enhance learning. Notwithstanding the fact that the ratio of instructional computers with Internet access to students has increased in the past decade, it is worth noting that the speed with which individuals adopt change is related to whether they value the new approach when compared to their existing approach (Rogers, 2003). Fullan (2001) notes that the adoption of technological change is usually accomplished in three stages; adoption, implementation and continuation.

Fullan also stated that teachers need time to merge their improved knowledge into their instructional practice as a basis for the acceptance of innovations. As principals become more adept at guiding technology integration, more efficient and effective technology use should become prevalent in schools. The principals'

increased knowledge of the benefits and uses of technology should lead to more support of teachers' attempts to infuse technology into the teaching and learning model. The principals' improved technology skills should lead to increased use of technology tools thereby producing principals and teachers who are models of technology use (Dawson & Rakes, 2003).

Statement of the Problem

Technology integration into the curriculum of schools has become more important and received greater attention and publicity in the past decade. Researchers have commonly agreed that we live in a technology-rich and information driven society. In addition, researchers have found that attitudes (positive or negative) impact technology integration and computer use. While some schools are doing extremely well in meeting the needs and challenges of the 21st century in terms of technology integration, under the mandate of NCLB, still others are lagging behind and going at a slower pace.

While access to technology in schools has increased significantly over the past decade, integration of technology into the instructional processes of schools continues to lag. Current research suggests that in addition to training, preparation time, and access, a significant impediment to integration of technology into classroom instruction continues to be certain beliefs, attitudes and perceptions that classroom teachers hold about (a) their environment, (b) themselves, (c) their students, and (d) the essence of teaching and learning. Researchers have labeled the former (availability of technology, training, support systems, etc.) external barriers and the latter (self efficacy, perceived usefulness, motivation, etc.) internal barriers.

While external barriers continue to be a factor in some school settings, they are a less significant barrier in many others. This is true in part due to many state and federal initiatives, as well as leadership by school administrators who see great potential in technology. Among some private schools, the importance of external barriers is especially minimal compared to its relevance in the larger population. These settings may be awash with resources and may have building level policies with regard to hiring and evaluation of staff that mandate a high degree of technology integration.

Furthermore, in some such settings, there may even be a requirement that the entirety of the student population own a laptop computer, fully equipped with wireless Internet access and other software deemed essential by the instructional staff. Such schools may have a building level technology specialist who provides continuous training to staff and ensures that the technology available is current and perhaps cutting edge. In such "ideal" settings, it is not unreasonable to expect that the level of technology integration would be uniform and high. However, there are few empirical studies of such settings which have attempted to (a) systematically characterize the level of technology integration among teachers and (b) identify the role of internal, as well as external, factors in creating and sustaining variation in technology integration across teachers.

In this current study the primary focus was to identify the relationships between teachers' beliefs, attitudes, and perceptions and their use of technology to promote student learning. Unlike most previous studies of technology integration, this study is conducted at a gender specific, technology-rich, religious-based private school.

Purpose of the Study

This study was designed to address teachers' use of technology at a gender specific private school in the South. In this study the primary focus is on the relationship between teachers' beliefs, attitudes, and perceptions and their use of technology to promote student learning. The study further seeks to identify the extent to which teachers use technology for instruction based on a four-phase model developed by Redmann and Kotrlik (2004).

Significance of the Study

The study will be conducted at a private, gender specific, religious-based school that serves a primarily upper-middle class student population. Comparisons of these results with those from other studies will yield insights into the role of school context in the technology integration process. The study will seek to explicate the intraindividual and interindividual factors which explain how teachers move from the "Entry"

level to the "Transformative" level of integration. In addition, the results of this study will contribute to efforts to enable the instructional use of technology to achieve its maximum possible impact. The study has the potential to help school administrations in identifying areas of need for professional development for teachers based on identified negative attitudes, barriers to technology integration and anxiety experienced by teachers as they use technology in their instruction.

Research Questions

This study focuses on the following research questions stated below.

RQ1: What is the extent of technology exploration and experimentation by teachers in using technology?

RQ2: What is the extent of technology integration and adoption by teachers in using technology?

RQ3: What is the level of self efficacy exhibited by teachers in using technology?

RQ4: What is the level of technology anxiety amongst teachers when seeking to use technology?

RQ5: Do barriers exist that prevent teachers from using technology in their instruction?

RQ6: Do teachers' demographic (age, gender) and other personal variables (certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to technology integration) explain any variance in teachers' technology adoption?

RQ7: How does the level of school support influence teachers' attitudes toward use of technology in their instructions?

RQ8: What are the barriers that teachers encounter in their use of technology and how do they address these barriers in order to effectively integrate technology in their instructions.

Limitations of the Study

This slimitations to this study are as as follow:

a. Single sex gender (all girls) school.
b. High school teachers (9^{th} -12^{th} grades).

c. Private religious based catholic school.

d. The selected school is a Blue Ribbon School.

Considering the uniqueness of this school, the results of this study cannot be generalized to any other private school except one of very similar characteristics.

Definition of Terms

1. **Computer Technology**: This refers to computers, computer hardware, software, multimedia, courseware, course management systems and related technologies used in learning environments as tools to enhance learning.
2. **Technology integration**: The inclusion of technology as an integral part of the curriculum to enhance learning.
3. **Educational technology**: The design, development, implementation, evaluation and management of instructional processes and resources intended to improve learning and performance.
4. **Blue Ribbon Schools**: The Blue ribbon Schools program was established by the U.S. Department of education in 1982 to recognize outstanding public and private schools across the nation. Blue Ribbon Schools are honored for their excellence in leadership, teaching, curriculum, achievement and parent involvement.
5. **High Tech School**: A school that uses technology in most of its operations, including classroom instruction.
6. **ICT** : Information and Communication Technologies.
7. **Technology exploration**: Thinking About Using Technology. Teachers seek to learn about technology and how to use it.
8. **Technology experimentation**: Beginning to Use Technology. Physical changes start to occur in classrooms and laboratories. Instructors focus more on using technology in instruction by presenting

information using presentation software and doing a few instructional exercises using spreadsheets, databases, word processors, games, simulations, the Internet, and/or other technology tools.

9. **Technology adoption**: Using Technology Regularly. Physical changes are very evident in the classroom and/or laboratory with technology becoming a focal point in the classroom and/ or laboratory organization. Instructors employ presentation software and technology-based instructional exercises using games, simulations, spreadsheets, databases, word processors, the Internet or other technology tools as a regular and normal feature of instructional activities. Student-shared responsibility for learning emerges as a major instructional theme.
10. **Advanced Integration** - Using Technology Innovatively. Instructors pursue innovative ways to use technology to improve learning. Students take on new challenges beyond traditional assignments and activities. Learners use technology to collaborate with others from various disciplines to gather and analyze information for student learning projects. The integration of technology into the teaching/learning process leads to a higher level of learning.

Chapter Two: Literature Review

Introduction

As educators prepare students for the 21st century as well as schools and school districts aim to comply with the *No Child Left Behind* (2001) Act, it is important to understand the attitudes and perceptions of students in high schools, grade levels 9th to 12th. This information is important not only to high school (secondary school) teachers, but also to preservice teachers and to those who prepare them for teaching. Preservice teachers are teachers who are currently in a teacher training program. Teachers in general need to be confident in using computer technology to enhance learning. When teachers lack the confidence and competence to use technology in general, there is the tendency for such teachers to abstain from using the technology for the intended purpose, unless they get some help in that direction from colleagues or sometimes their students as the case may be. In the absence of such help or support from others, this situation can spiral down to negative impacts on students' attitudes toward using the specific technology in the classroom situation in particular.

In a recent research, Buckenmeyer (2007) concludes her study by stating that "If change is to occur in classrooms, it must begin with the teacher, not the technology." In this study also, the author recommends that "teachers' attitude toward technology is a consistently strong predictor of acceptance, adoption and use of technology," citing: Marcinkiewicz, 1994; Honey & Moeller, 1990; Craig, 2006 and McGrail, 2005.The author also states that given the above conclusion, in order to affect teacher beliefs, research needs to be conducted where teachers have first-hand experiences with technology, where teachers observe successful implementation, and where change occurs through professional learning communities, citing Ertmer (2005).

Theoretical Framework

This study derived its theoretical framework from the works of Crandall and Loucks (1982) ,Kotrlik and Redmann (2009) and Dawson and Rakes (2003). The respective titles of these three studies are; "Preparing facilitators for implementation: Mirroring the school improvement process:

A study of dissemination efforts supporting school improvements," "Analysis of teachers' Adoption of Technology for use in Instruction in Seven Career and Technical Education programs" and " The influence of principals' Technology Training on the Integration of Technology into schools." In the Crandall and Loucks study (1982), the authors theorized the following:

a) In general, an innovation does not fail because the innovation is flawed but rather, because of a flawed management or support by the school's administrators.

b) If teachers are to successfully implement an innovation, then the support o the principal is needed.

c) If the principal is to support teachers in their attempt to implement the innovation, then the principal must possess both the knowledge and skills required.

In that study, Crandall and Loucks criticized the continuing use of "Hello, good-bye, God Bless you" type of professional development workshops that are provided for teachers by schools and school districts. In that study, the authors cited research that supported their claims that when teachers are provided with one-shot workshops and left to implement an innovation, subsequent evaluations suggest that no real change takes place in the classrooms. Furthermore, the authors note that the primary outcome of implementing the innovation is frustration in both teachers and the principal. The authors posited that based on research and experience, there was the need for more sustained training for teachers that exceeds the one-shot workshops.

Crandall and Loucks in their study viewed the process used in preparing teachers to implement an innovation as a mirror image of the process used in preparing principals to support the teachers. Considering that fact that both teachers and principal are expected to adopt new practices, the researchers viewed their preparation for their respective roles as parallel procedures (Dawson & Rakes, 2003). Dawson and Rakes noted that as teachers are being asked to change certain instructional behaviors, the principal is also being asked to adopt new behaviors that will support the teachers in their new roles. According to Dawson and

Rakes, both the teachers and the principal are operating in very similar social systems, wherein they often act as loners.

A careful reflection on the similarities of the social systems in which the Principal and the teachers operate, led Crandall and Loucks to the conclusion that the principal needs training very similar to that of the teachers if the principal is to facilitate implementation of an innovation. The Crandall and Loucks' study focused on investigating factors that should be considered in preparing facilitators for implementation of an innovation. The data gathering in that study included data from the principal, the teachers and central office staff from 146 school systems that were implementing new practices. The study revealed the following:

1. The preparation and interventions required by a teacher are determined by how much the innovations' implementation changes the teacher's classroom routine.
2. The teachers' commitment to the implementation is essential to successful implementation.
3. Training receive by teacher needs to address roles and skills that she or he will require in implementation of the innovation. Training should provide opportunities to practice the skills in the classroom as well as in the training environment.
4. Follow-up assistance and coaching for teachers is imperative. The teacher must be afforded the necessary equipment and supplies , must be helped in solving problems associated with the innovation's implementation , and must be emotionally supported so that commitment is maintained.

According to Crandall and Loucks, the role of the principals as a facilitator range widely in the skills and understandings needed to be successful. Thus the authors suggest that the preparation of the facilitators needs to start with the careful assessment of where they (facilitators) are and to what extent or how far each individual wants to go in with respect to changing roles and behaviors. This observation according to Dawson and Rakes suggests that principals require training that not only prepares them for their tasks as implementation leaders, but is also relevant to their specific needs. Commitment to the success of an innovation on the part of both teachers and Principal was considered very essential as noted by Crandall and Loucks.

They found that the more teachers were committed to an innovation, the more they practiced behavior that will promote success of the innovation. In addition, the authors found that teachers who returned to the classroom and routinely practiced the skills they had learned during training experienced more change and became more comfortable with the innovation than those who practiced the skills less often. The authors concluded that their findings could be applied in preparing the principal to become a facilitator of the innovation and noted that the principals' commitment could be fostered if the training he or she received provided tools, strategies and directed practice in his or her school setting. The authors finally recommended follow-up assistance in the individuals' (referring to the teachers) work environment so that he or she could practice the learned behaviors and receive non threatening feedback.

The purpose of the Dawson and Rakes' study was to investigate whether technology training received by principals influenced the integration of technology into the classrooms. The study examined the levels of technology integration into the schools' curricula with regards to the amounts and types of technology training received by K-12 school principals. In that study, the level of technology integration (dependent variable) was also examined with regard to the following demographics: age, sex, principals' years of administrative experience, school size and grade level (independent variables). In the study design, the dependent variable was examined to determine its relationship with the seven independent variables (age, sex, years of administrative experience, school size, grade levels of the schools, amounts of technology training and types of technology training received by the principals in the 12 months period preceding the study).

The participants in this exploratory design study included 389 K-12 principals from all over the United States of America. Participants in all 50 states were represented and only principals with internet access were included in the study, since the survey was also designed to be web based. The study results indicate Statistical significance found for amounts and types of technology training principals received, indicating that each principal can influence levels of technology integration into the curricula.

Furthermore, the data for the study revealed that the principals' age was also a factor that influences technology integration into the curriculum. The authors also stated that the data analysis of the responses in the study lead to the belief that had teachers participated in the survey, the comparison of their perceptions with the principals might add a worthy dimension to the study.

In the Dawson and Rakes study, the authors state that the resistance of teachers to converting from traditional teaching methods to computer – based ones is a fundamental reason for the lack of technological progress in schools. According to the authors, a degree of resistance on the part of the teachers is understandable and expected because such a conversion represents change. Change is a process that takes time and that change is a highly personal experience which requires developmental growth in both feelings and skills, according to Loucks and Hall (1979). The authors also posit that, without well-trained technology competent principals, the integration of technology into the school curricula will remain incomplete.

In their conclusion, based on the findings from the study, Dawson and Rakes noted that the more sustained the principal's training experiences and the more those experiences are tied to the schools' curricula and the principal's needs, the more progress the school is likely to make toward technology integration. Based on the findings from their study, Dawson and Rakes made the following recommendations for future research:

a) Researchers should determine what percentage of the United States principals are receiving training and what types of training are they receiving. In that regard also, the authors suggest that a portion of the research in the same direction or with similar objectives be conducted through interviews in order to obtain more in depth information.

b) Future study can also look at a longitudinal study design or case study that focuses on the principal's role in technology integration with particular attention on how and the extent to which principals actually support teachers and students in the integration of technology into the classroom.

c) Future study of the principal's influence on technology integration should include a teachers' component.

The findings and recommendations from the Dawson and Rakes study together with the Crandall and Loucks' study form in part the basis and framework of the current study. The third study that contributed a very significant role in the theoretical framework and design of the current study is the Kotrlik and Redmann (2009) study which is briefly described as follow:

The kotrlik and Redmann (2009) study addressed the utilization of technology in instruction by secondary career and technical education (CTE) teachers in seven program areas in louisiana. Stratefied sampling was used in this study and the sampling included 539 teachers using a survey. The data collected using the survey was determined to be representative of all CTE teachers in louisiana. Data from the study revealed that most CTE teachesrs used self-taught appraoches, workshops, conferences, and colleagues as technology training sources.

The study also showed that CTE teachers had substantially adopted technology for use in instruction,but were not making the maximum use of technology. The results of the study furthermore show that teachers were experiencing minor barriers and anxiety as they worked to incorporate technology in their instruction. The study also suggest an inverse relationship between technology adoption and technology anxiety and perceived barriers to technology integration. As technology anxiety and perceived barriers to technology integration in instruction increased, technology adoption decreased.In addition, technology adoption increased as technology availability increased. The study showed a significant difference in the level of technology adoption between business and marketing teachers , and the rest of the other teachers.

In the Kotrlik and Redmann study, the authors used a change process model as the conceptual base/theoretical framework. According to the authors, Rogers (2003) presented a change process model in which individuals adopted innovations if they were able to differentiate between the benefits of the innovation relative to what they were using. In the Rogers change process model, Rogers indicated that

perceived attributes such as observability, trialability, compatibility, and relative advantage were amongst attributes that might influence the rate of adoption. According to Kotrlik and Redmann, there are multiple models that exist which explain the use of technology and these models are based wholly or partially on the change process. Of these models that have been developed and are in use, Kotrlik and Redmann adopted three for their study and these are briefly described below as follow:

The first model (Sandholtz, Ringstaff, & Dwyer, 1997) incorporates a five phase evolving progression that teachers experience which include: 1- Entry, 2 – Adoption, 3–Adaptation, 4 – Appropriation and 5 – Invention. At the entry stage referring to this model, the teachers adapt to change within the physical environment created by technology. The second stage (adoption) involves the use of text based instruction supported by technology. At the adaptation stage, technology is integrated into the teaching process. At the appropriation stage, the teacher's personal attitude toward technology changes. The last stage (invention) is characterized by teachers becoming highly competent with technology and creating innovative learning environments.

The second model was adopted from the Russell (1995) model. In the Russell model, the author delineated six stages in the technology adoption process. In this model, the author proposed the following six stages in technology adoption using email as a foundation: 1) Awareness, 2) Learning the process, 3) understanding the application, 4) Familiarity and confidence, 5) adaptation to other contexts and 6) creative applications to new contexts.

The third model was adopted from the Kotrlik and Redmann (2004) study. The Kotrlik and Redmann model described a four-phase model for technology integration in instruction which was based on Rogers' change process, the Sandholtz et al.'s evolutionary process (1997) and the Russell's (1995) technology adoption stages. The four stages described in the Kotrlik and Redmann model include: exploration, experimentation, adoption, and advanced integration. According to Kotrlik and Redmann, the adoption phase of their model served as the foundation for the 2009 study.

Kotrlik and Redmann described the adoption stage as follow:

> Adoption – Using technology regularly. Physical changes are evident in the classroom and /or laboratory with technology becoming a focal point in the classroom and/or laboratory organization. Instructors employ presentation software and technology –based instructional exercises using games, simulations, spreadsheets, databases, word processors, the internet or other technology as a regular and normal feature of instructional activities. Student-shared responsibility for learning emerges as a major instructional theme (p.7).

In the Kotrlik and Redmann (2009) study, the authors described and discussed the variables that are related to technology adoption which include; technology availability and training, barriers too technology adoption, technology anxiety, gender and age, and teaching experience. The current study also uses the Kotrlik and Redmann (2009) as a conceptual foundation and more importantly, adopts the four phase technology adoption model developed by Kotrlik and Redmann (2004). Thus the literature review in this current study was designed to address and include the variables related to technology adoption as well as other factors that affect technology integration in general for teachers to impact students' learning and achievement.

Understanding the Context: Attitudes, Beliefs and Perceptions

Innovativeness by using computers in the classroom has been tied to teacher attitude (Truncale, 2008). Teachers' attitudes toward usage of computers and technologies have been the focus of federal and state technology initiatives for nearly the past twenty years. Although most classrooms in the United States have had computers available since the mid 1980s, their use varies (U.S. Department of Education, 2004). Attitudes, aligned with beliefs regarding technology and the teachers' self-efficacy steeped in experiences and exposure, are important to understand (Pajares, 1992; Fishbein & Ajzen, 1975). Fishbein and Ajzen (1975) and Pajares (1992), are the most often cited authors on teacher attitude. Pajares and Fishbein are frequently cited as those setting the groundwork for understanding the theories of beliefs and attitudes regarding education.

Behavior is intentional and controlled by the individual according to Fishbein and Ajzen (1975). Attitude toward behavior signals a person's intention to exhibit the behavior, according to the theory of reasoned action. Confusion arises when teachers verbally acknowledge the appropriate or expected response regarding their intentions toward technology use, but do not act as expected. Classifying these teachers' actions to understand their failure to implement intended behaviors was the purpose of Zemsky and Massy's 2003 study. This study, conducted at the University of Pennsylvania with the Thomson Corporation, explored another gap in the literature (Zemsky & Massy, 2004). Beginning in 2001, these authors reported their findings of "thwarted technology" in the area of e-learning. The authors study response trends of approximately 300 university administrators, faculty members, and their students over a 2-year period.

Factors were explored to determine what prevent e-learning from fulfilling its promise of changing what teaching and learning look like at the university level. The study revealed funding support waned over time. Faculty members were concerned about this. E-learning was also found to support traditional transmission practices of instruction rather than transforming the instruction. Students, it was determined, had several interests when it came to technology; communicating with one another, being entertained with technology, and being able to present themselves and their learning with the technology. Students did not, however, transfer this interest into their subject coursework (Zemsky & Massey, 2004).

Pajares pointed out the importance of identifying and exploring the particular topic that beliefs encompass (Ertmer, 2005). Thus understanding attitude development for new technologies is critical. While complex, understanding teacher's attitudes and how teachers develop attitudes toward technology is essential to understanding their technology implementation or lack of it (Ertmer, 2005; Sugar et al, 2005; Wozney et al., 2006). People's beliefs, attitudes, or opinions are shaped from a lifetime of experiences. Pajares' (1992) "messy construct" regarding teachers' beliefs supports the understanding that attempting to measure beliefs is inherently difficult (Ertmer, 2005). According to Ertmer (2005), there are four barriers to technology implementation. The first barrier, according to Ertmer (2005), is access to appropriate hardware and

software. A teacher must have convenient access, and the technology should be available inside the classroom (Lumpe & Chambers, 2001). Teacher access to computers is a key component of usage (Brinkerhoff, 2006; Ertmer, 2005; Judson, 2006), thus availability is the first barrier a teacher encounters. Teachers with computer access to five or more computers in the classroom, with strong technical knowledge, and with instructional pedagogy leading them to teach a smaller number of topics, were twice as likely to assign lessons using the computer (Becker & Ravitz, 2001).

The second barrier to quality technology implementation is adequate preparation. Staff development first focused on the basic skills of computer operation for teachers. Some teachers found it difficult to integrate these tools in their role as teachers (Lewis & Finders, 2002). It was realized by staff developers that these methods did not provide teachers the needed skill to integrate technology into their lessons. Multiple approaches of staff development were needed. Increased teacher collaboration was examined as a method to improve technology usage (Johnson, 2007). Schwab and Foa (2001) noted professional development opportunities should focus on how technology fits with teachers' beliefs about effective teaching. Training sessions should provide teachers their own computer, allowing each teacher to establish ownership of their learning.

Follow-up support after training is necessary for teacher success (Brinkerhoff, 2006), as was studied in a long term professional development academy. Upon completion of this training several themes were identified: perceived increase in technological skills, increased confidence, a reduction of fear toward technology, and lastly an impact for general change in teaching strategy overall. Support in the form of administrative structures continued to be important after the completion of the study.

According to Yesilyurt (2008), students' attitudes are positively impacted by computer-assisted instruction. Yesilyurt's study investigated the effects of tutorial and edutainment design of instructional software programs related to the cell division topic on student achievements, misconceptions and attitudes. Yesilyurt utilized an experimental research design including the cell division achievement test (CAT), the

cell division concept test (CCT) and biology attitude scale (BAS). Yesilyurt found that after the treatment, general achievement in CAT increased in favor of experimental groups. Instructional software programs also had the positive effect on the awareness of students' understanding to the general functions of mitosis and meiosis, according to Yesilyurt. However, according to Yesilyurt, the current study revealed that there were still some misconceptions in the experimental groups even after the treatment. Yesilyurt also noticed that only using edutainment software program significantly changed students' attitudes towards biology.

While access to educational technology tools has remarkably improved in most schools, there is still concern about instructional integration of computer technology to support student learning (Keengwe, 2008). Appropriate integration of computer tools constitutes a major change in people's lives; technology integration is a complex phenomenon that involves understanding teachers' motivations, perceptions, and beliefs about learning and technology (Woodbridge as cited in Keengwe, 2008). Although computer technology has a great potential to reform or even transform education, barriers come in the way of achieving success especially with student learning (Keengwe, 2008).

Students' learning interests and attitudes toward science have both been studied for decades, however, the connection between the two with students' life experiences about science and technology has not been fully addressed. Shu-Nu Chang and Yau-Yuen Yeung (2009) studied ninth graders' learning interests, life experiences and attitudes toward science and technology. They investigated students' learning interests and life experiences about science and technology, and also their attitudes toward technology. The Participants in the study included 942 urban ninth graders in Taiwan. A Likert scale questionnaire, which was developed from an international project, ROSE, was adapted to collect students' ideas. The results indicated that boys showed higher learning interests in sustainability issues and scientific topics than girls. However, girls recalled more life experiences about science and technology in life than boys. They found high values of Pearson correlation about learning interests and life experiences related to science and technology, and in the perspective on attitudes towards technology.

Liarakou, Costas and Flouri (2009) investigated knowledge, perceptions as well as attitudes of public that concern various aspects of environmental issues in Environmental Education. They utilized a survey, and investigated knowledge and attitudes of secondary school teachers in Greece towards renewable energy sources, particularly wind and solar energy systems. A questionnaire with both open and close ended questions was used as the main methodological instrument. The findings from this study revealed that although teachers were informed about renewable energy sources and well disposed towards these sources, they hardly expressed clear positions regarding several issues related to usage of technology to teach content. The authors noted that teachers' attitude could influence students' opinions toward content and technology.

Goldstein and Sadhana (2004) studied gender in technology-rich collaborative learning environments. Their study examined middle school students' attitudes towards technology and group work using questionnaires. They found that girls and boys are similar with regard to attitudes about computers and group work, but that during collaborative learning activities, girls may actually participate more actively and persistently regardless of the nature of the task (Goldstein & Puntambekar, 2004).

Morse and Daiute (1992) point out that much of the research on gender differences has involved the measurement of attitudes toward computer use in public schools. Many of these studies have painted a picture of large numbers of females fearful of using technology and, thus, potentially left behind in a technological age (Morse & Daiute, 1992). In addition, Morse and Daiute questioned the quantitative methods historically used to assess computing behaviors and attitudes of girls and women.

According to researchers, it is also necessary to understand how teachers and students are using technology (Bebell, Russell, & O'Dwyer, 2004). Fischer and Mitchell (2007) reported in a study on inquiry-learning with the use of WebLab to undergraduate students in a junior level course on microelectronic devices. The study used quantitative surveys and qualitative interviews for the ata gathering and both students and faculty reported that WebLab was an effective instrument of learning. WebLab allowed the students, to learn at their own pace and on their own schedules. It enabled them to use different processes of

learning (intuitive, visual, abstract), and it gave them an opportunity to link individual and collaborative effort in creative combinations.

According to Fischer and Mitchell, they found that WebLab enable students to use different processes of learning (intuitive, visual, abstract, brainstorming), and it gave them an opportunity to link individual and collaborative effort in creative combinations. They suggest that future study should focus on how teachers and students are using technology. On the otherhand, Sugar, Crawley, and Fine (2005) found that there was a negative relationship between high school teachers with additional resources and these teachers' commitment to technology adoption. This finding however, is in contradiction to most technology adoption studies. Teachers' home use of computers is a predictor positively correlated to the use of technology in the classroom (Jaber & Moor, 1999), as is access to computers in the school setting. Nonetheless, continued studies and skills training have provided teachers with the tools needed to breach these barriers.

Components identified, as needed for staff development by Bitner and Bitner (2002), included training in computer basics, allaying teachers fears of the computer through this training, providing ongoing support, and promoting personal use. Additionally, providing incentives to motivate teachers to use the technology in the classroom were considered essential. Groth, Dunlap, and Kidd (2007) reported on preservice teachers' needs in order to integrate technology. These same components provide the opportunity for teachers' success, as they do in an appropriate environment supporting teachers. Ertmer notes that teachers are using technology to meet their current needs. Preparing lessons, gathering information, and communicating with peers, parents, and administrators has been made easier with current technologies. According to Ertmer (2005), introducing teachers, to the basic skills of technology, is only a beginning. Teachers must move to a new level of understanding tha uses of technology for the enhancement of Students' learning (Cuban, 1991, 2001; Schwab & Foa, 2001).

A staff development program using a mentoring model was conducted in a technology partnership program between a University and a public school staff (Kariuki, Frankline, & Duran, 2001). In that study,

Technology graduate students paired with elementary classroom teachers and served as their mentors for 21 weeks. Occasionally assisting teachers, with the hardware issues that arose when using technology, the mentors were more often able to lead the classroom teachers through technology exercises, increasing the teachers' skills and confidence. The additional time needed to work with the mentor, outside the teacher's day, was kept to a minimum. Graduate students conducted most of their mentoring throughout the class day. The result of this program was such that, the barrier "lack of time" was diminished.

In a recent study by Brinkerhoff (2006), the researcher attempted to increase teachers' abilities and confidence in their computer usage in an Academy, conducted as a teacher preparation program. In this study which was conducted over a two year period, the Academy consisted of approximately 40 days of work training with teachers. The first training included basic skills in Microsoft Office, internet searching skills, and the use of digital tools including scanners. The teachers were exposed to virtual field trips, teleconferencing, and editing tools for video cameras. Teachers planned lessons for the school year, integrating technology into their instructional practices. Three themes emerged from the 2-year project. Participants perceived an increase in their skills, felt less fearful of using technology in the classroom, and felt their teaching had been changed. Brinkerhoff reported, however, that little had changed in these teacher's abilities to integrate technology and that the academy model needed more exploration.

In another study of a private training program, the Apple Classrooms of Tomorrow Project (ACOT), was conducted alongside a public school district's technology training initiative (Sandholtz, 2001). The primary goal of the ACOT program was to prepare teachers to become trainers of classroom peers. The public school's goal was to support teachers as they attempted to integrate technology into classroom instruction. A comparative case study method was employed. Administrative and campus support varied in both programs. The principals of the district focusing on a technology initiative were more comfortable supporting teachers in a culture of exploration and experimentation, they felt free to establish a similar culture at their sites (Sandholtz, 2001). The collegial teams, while supporting one another with technical and

teaching issues, found resistance from untrained faculty members. Sugar et al.(2005) examined the independent contributions of school types, teaching experience, number of workshops teachers attend, and their impact of recent adoption of new technology on teacher's beliefs was toward technology's future adoption. Using Ajzen's (1985) Theory of Planned Behavior, Sugar et al. reported attitude as the almost exclusive predictor for high school teachers' use of technology, but not so for middle and elementary school teachers. Teachers' beliefs regarding technology can be shaped, however, intentionally through staff development and by chance through collegial interaction (Kagan, 1992).

A factor linked to higher levels of technology integration is the teacher's style of instruction. Those teachers embracing constructivist practices have been noted to use computers more frequently with their students (Becker & Ravitz, 2001; Judson, 2006; Tartar, Roschelle, Vahey, & Peneul, 2003; Wozney et al., 2006). Classroom teachers comfortable with releasing control of learning to students appear more at ease with technology.

Lumpe and Chambers (2001) developed and tested an instrument for assessing teacher's context beliefs about technology noting teacher attitudes and behaviors form the foundation for technology implementation. The study involved teachers participating in a professional development program focused on technology integration. The instrument "Beliefs About Teaching with Technology" (BATT) used for this study revealed that teachers had positive beliefs about what needed to occur in order to effectively use technology. Administrative support, planning time, technical support, and time for students to use technology were factors assessed with the BATT instrument.

In the Lumpe and Chambers (2001) study, the results also indicate that teachers' context and self efficacy beliefs were significant predictors of teachers' reported use of technology – related engaged learning practices. It was concluded in the Lumpe and Chambers (2001) study that in the realm of technology school reform efforts, the assessment of context and self-efficacy beliefs is important so that teachers' belief patterns can serve as a needs assessment and program evaluation tools.

Educational Change Theory

Education is not traditionally known for systems thinking although it is usually labeled as a learning organization (Kozloski, 2006).

The most common word in the research over the last ten years about leadership is change. Specific topics include leaders as change agents, leaders as facilitators in the change process when it comes to their follower's ability to cope with change, a leader's ability to adapt to change, and a leader's ability in the face of chaos and change. Looking briefly back into the history of writing on this topic, Peter Senge's work in this area is most prominent.

Leadership for the 21st Century

Three prominent theorists in the area of leadership for the 21st Century are Michael Fullan, Margaret Wheatley and David Thornburg. They all relate closely to the ideas first introduced by Senge. Michael Fullan starts out his book with the following statement; "change is a double-edged sword.

Its relentless pace these days runs us off our feet. Yet when things are unsettled, we can find new ways to move ahead and to create breakthroughs not possible in stagnant societies" (Fullan, 2001, p. 1). Michael Fullan proposes that there are five key components to leading in a culture of change. They include: (1) moral purpose; (2) understanding the change process; (3) relationship building; (4) knowledge creation and sharing; and (5) coherence making.

Wheatley focuses more specifically on relationships and their development. Her focus on Leadership identifies that we need leaders, not bosses, who help us develop a clearer vision and shed light in the moments of dark confusion (Wheatley, 1999). Fullan and Wheatley have somewhat different approaches to the same idea: leading others by understanding, coping and creating new systems out of the chaos that is created by our ever-changing world. Research on educational change has been going on for decades. Many studies were conducted in the United States as early as the 1930's and many more studies were done over the

following twenty year period. Some of the most significant findings from these early studies were:

The time between innovation and institutionalization takes decades although there is a surge in the system when many schools adopt at the same time. Schools vary greatly in both their willingness and ability to adopt new practices. Interest groups both inside and outside of the school are critical elements in the adoption process.

The Teacher is the key. Teachers should be self motivated,collaborate and communicate with other teachers in schools and learning communities. Teacher should have access to other experts. A leading cause of failure is lack of interactivity. The creation of learning communities will help foster an environment where learners feel part of the experience and there is ample opportunity for active engagement by the learner. Cost can be less, the same or more depending on a variety of factors.

Costs can be less in terms of travel, substitute teacher costs, facilities, materials and consultants but initial costs for adequate technology can be expensive as well (Thorburn, 2004).

Social Distance Theory

In a study comparing functional distance and the attitudes of educators toward computers, Norris and Lumsden (1984) found that teachers are more accepting of computers when they are perceived to be at a distance. In other words, teachers may accept that computers are valuable for education in general, but they are not so accepting of computers in their own classroom. Their questionnaire was adapted from the Bogardus Social Distance Scale used to measure social distance regarding nationalities of people. As evidenced in a collection of studies reported by the Office of Technology Assessment (OTA), some non-technology-using teachers endorse the necessity of students' having access to information technology in the classroom. However, many of the teachers do not see why it should be in their classroom or what it offers them in pursuit of their instructional goals (U.S. Congress, 1995).

Stages of Adoption of Technology

In 1993, Hadley and Sheingold conducted a nationwide survey of teachers experienced at integrating computers in the classroom. In this study, the authors developed five profiles based on characteristics of the participating teachers based on an analysis of patterns. The five profiles include: (a) enthusiastic beginners, (b) supported integrators, (c) high school naturals, (d) unsupported achievers, and (e) struggling aspirers. In a related research study by Evans-Andris (1995) involving teachers whose schools had possessed computers for computers for atleast half a decade, the study revealed that teachers shape their interaction with computers through their style of computing. Three styles were shown to include almost all the participating teachers which included: avoidance (60%), integration (28%), and technical specialization (8%).

In another study, Cafolla and Knee (1995) presented Welliver's instructional transformation model describing stages that reflect the level of technology integration. The five stages identified include: (a) familiarization, (b) utilization, (c) integration, (d) reorientation, and (e) evolution. Russell (1995), also presented stages of technology adoption which were very similar to Welliver's stages according to Christensen (1998). From the research study conducted by Russell, the author suggests that adults learning new technology pass through six stages on their way to becoming confident technology users. The author further states that these learners may begin at any point and progress through at their own rates. The stages include: (a) awareness, (b) learning the process, (c) understanding and application of the process, (d) familiarity and confidence, (e) adaptation to other contexts, and (f) creative applications to new contexts.

Diffusion of Innovation

Research by Rogers (1983) has found that adoption of new innovations is an active process that involves much reinvention. Adopters must reinvent the innovation and make it their own if they are to continue using it. Similarly, in the education of teachers, teachers must be encouraged to reinvent activities and make them their own (Harris, 1994). Havelock (1973) identified three roles as predictors of adoption of

an innovation. Innovators are risk takers and are the first to adopt. Resisters are active critics of new innovations and are the last to adopt. Leaders size up the situation but will move ahead swiftly when they determine that the time has come. Although the leaders are the key to growth of any adoption, they are not usually in the first wave of adopters.

Based on an international study involving children, teachers, and computers, Pelgrum and Plomp (1996), described teachers as the main gatekeepers in allowing educational innovations to diffuse into the classrooms. Therefore one of the key factors for effecting an integration of computers in the school curriculum is adequate training of teachers in handling and managing these new tools in their daily practices (as cited in Collis et al., 1996). They found that the "degree of classroom computers was closely tied to extent of training in integration techniques" (Collis et al., 1996).

Assessing teachers' stages of adoption of technology allows the teacher educator to adapt the instruction to fit the learner's needs.

Technology Integration and Learning

Integration of technology will not occur until educational technology data is considered (Wargo, 2006). Certain studies have focused on the way that a technology-supported environment can support learners engaged in problem-solving activities (Papadopoulos & Demetriadis, 2009).

Accountability for information technology expenditures is an issue at the forefront of state and national educational policy deliberations (Cech, 2008). Probably no question is more frequently asked by those who fund computers in the K-12 environment than whether it can be demonstrated that the use of information technology in the teaching/learning process has a positive impact on student achievement (Christensen & Griffin, 2001).

In another recent research study, Yang and Huang (2008) studied high school English teachers' behavior, concerns and beliefs in integrating information technology into English instruction. They investigated the current trends and patterns of teachers' concerns and teaching behavior with respect to

technology integration. They reported that despite pressure on schools to increase the application of technology, the adoption of teaching and learning practices using new technologies has been limited in terms of teachers' (Yang & Huang, 2008). They found that teachers' concerns are generally oriented toward personal and informational issues. English teachers' technology-mediated English teaching behaviors are modest, and most teachers used technology to prepare their teaching activities instead of structuring higher levels of usage (Yang & Huang , 2008). As identified in the literature, higher levels of computer training, computer literacy, well-supported school environment, creative teaching practices and positive beliefs about technology integration among teachers result in higher task intensity, impact concerns and more technology-mediated teaching behaviors in the classroom according to Yang and Huang.

Even though computers are now available in most schools, not all preservice teachers see the value of using computers for instructional support (Smithey & Hough, 1999). Teachers and schools are not yet integrating newer computer applications into the curriculum, and gender differences in computer use and attitude exist (Thompson, Simon, & Hargrave, 1992; Whiteside, 1992). After the year 2000 and moving forward, researchers have continued to be interested in examining gender differences in attitudes toward computers. The importance and use of computers has increased dramatically over last two decades (Popovich, Gullekson, Morris, & Morse, 2008 as cited in Adem Uzun and Erhan Şengel, 2009). Rapid developments in technology have led people to use computers at home, school and workplace.
With the increased use of computers in teaching and learning, technology has become an integral part of education (Teo, 2008 as cited in Adem Uzun and Erhan Şengel, 2009).

Computers are providing individuals with a powerful means to transmit, access, and interpret an immense and growing body of information worldwide. In doing so, it is changing the way people live and work. For the students, computers can be powerful study tools, by providing general "clerical" support, for example: word processing, spreadsheets, databases, or by contributing to the subject area, e.g. via simulations in Physics, calculation and statistical packages in Mathematics, programming environments in

Computer Science and computer assisted language learning (Federico, 2000 as cited in Adem Uzun and Erhan Şengel , 2009). Computer based instruction and computers programs, tools providing much facilities and supports to students' educational life (İşman, Çağlar, & Dabaj, et al, 2004 as cited in Adem Uzun and Erhan Şengel, 2009).

The widespread use and ever changing nature of "Information Technology" (IT) has led to a need for understanding why people accept or reject the use of computers (Smith and Oosthuizen, 2006 as cited in Adem Uzun and Erhan Şengel, 2009). In response to this need, researchers have tried to investigate attitudes towards computers. Computer attitude has been defined as a person's general evaluation or feeling of favor or antipathy toward computer technologies and specific computer-related activities (Smith et al., 2000 as cited in Adem Uzun and Erhan Şengel, 2009). Computer attitude evaluation usually encompasses statements that examine users' interaction with computer hardware, computer software, other people relating to computers, and activities that involve computer use. Computer-related activities examined are either single instances of behavior or classes of behavior (Smith et al., 2000 as cited in Adem Uzun and Erhan Şengel, 2009).

Various computer attitudes scales have been developed (e.g. Loyd and Gressard 1984; Bear, 1987; Smith et al., as cited in Adem Uzun and Erhan Şengel, 2009). According to Uzum and Sengel , Loyd and Gressard's survey (1984) is one of the most often applied scales to undergraduate students. Uzum & Sengel noted that CAS can be analyzed into several intrinsic variables, such as computer anxiety, computer liking, perceived usefulness, perceived ease-of-use, self-confidence (SC) and perceived consequences for society.

Barriers to Technology Integration

As with educational change, there are many barriers that can cause any innovation to be less than substantially realized. Barriers were defined by BECTA (2003) as any factors that prevents or discourages teachers from using technology. Thus Technological change in this regard is no different. It is worth noting that for over several decades, the same barriers that have existed are still in existence and without much

organizational success in overcoming them. A typical example during the post world war II era is that of the Picture Film which became one of the world's most prominent technologies. During that era, this new technology was alleged to transform not only the way we lived but in the way students would learn at school. There were however, disappointments in how educators used film and there were some barriers to its implementation as a teaching tool. The new Barriers included: 1) finding the right match between the film resources and the curriculum; 2) inaccessibility of equipment; 3) cost of films and upkeep; and 4) lack of teacher skills in using the equipment and film. However today, more than fifty years later, the literature describing barriers to technology integration looks strikingly the same as before. For example, today's most commonly cited barriers are: 1) lack of time; 2) lack of access; 3) lack of resources; 4) lack of expertise; and 5) lack of support. Perhaps one of the reasons why the same barriers persist today is that these barriers have been dealt with in isolation.

Redmann and Kotrlik (2004) , found that technology experimentation, adoption and integration increased as barriers to technology integration decreased. Other studies have reported that teacher-level barriers included lack of self confidence in using technology, lack of time, lack of necessary knowledge (BECTA ,2003; Cruxall & Cummings, 2000; and Williams,2000). Redmann and Kotrlik also noted that administrative-level barriers included lack of technical support, equipment, up to date software and instructional support. The BECTA (2003) report was also supplemented by the Brinkerhoff (2006) study which indicated that teachers often fail to take advantage of technology's potential due to several barriers, including institutional and administrative support, attitudinal or personality factors , training, experience, and resources , according to Redmann and Kotrlik (2009). Park and Ertmer (2008) also discussed lack of knowledge and skills, unclear expectations and insufficient feedback as additional barriers that teachers encounter in using technology.

Teachers' Attitudes toward Computer Technology

Another aspect of culturally responsive teaching is the ability to build upon the strengths that

students bring to school (Darling-Hammond & Bransford, 2008). To capitalize on students' strengths, teachers need to be able to assess what knowledge and beliefs students bring to the classroom, evaluate how they learn in different domains, and structure conditions that will facilitate their academic achievement (Au, 1980; Mehan, Villanueva, Hubbard, and Lintz, 1996; Tharp, 1982). Students' learning is facilitated when teachers view them as learners who have experiences, ideas, and home and community resources that can be built upon to help them master new knowledge and skills (Moll and others, 1992; Moll and Gonzalez, 2004).

Educators have reported that integrating technology effectively has three positive potentials in particular for young learners which include the following:

1. Technology motivates students to delve deeper into a subject area.
2. Technology has an inexhaustible flexibility-mechanically and creatively. Students create, manipulate and individualize their learning artifacts.
3. Technology increases teachers' ability to meet the individual needs of all learners.

There are some beliefs and attitudes that are critical for teachers to be effective with all students, including respect for all learners and their experiences, confidence in their abilities to learn, a willingness to question and change one's own practices if they are not successful in a given case, and a commitment to continue seeking new solutions to learning problems (Delpit, 1995; Ladson-Billings, 1994, 1995; Gay, 2000; Irvine and Armento, 2001; Murrell, 2002; Tharp, Estrada, Dalton, and Yamaguchi, 19999; Villegas, 1991; Villegas and Lucas, 2002b). In a recent study "Teachers' Beliefs and Technology Practices: A Mixed-methods Approach," in the Journal of Research on Technology in Education (Summer, 2009), Palak and Walls concluded that technology integration relates to teachers' attitudes and beliefs.

The Palak and Walls study design called for equal integration of both quantitative and qualitative methods, using multiple variables and sampling techniques in selecting technology-using teachers who were trained via multiple models of longitudinal professional development programs. According to Palak and Walls, their explanatory mixed methods design (QUAN → QUAL) was followed by collecting quantitative

and qualitative data sequentially across two phases (Creswell, 2002; Teddlie & Tashakkori, 2006 as cited in Palak & Walls, 2009). Hignite and Echternacht, (1992) in their study examined the relationship between teacher attitudes and computer skills and in the conclusion of their study, they noted that it is critical for teachers to possess both positive attitudes and adequate computer literacy skills to successfully incorporate technology into the classroom. Similarly, other research has shown that both knowledge of computers and computer experience have a positive impact on teachers' attitudes (Dupagne & Krendl, 1992).

Gender Differences In Attitudes Toward Computers

Morse and Daiute (1992) point out that much of the research on gender differences has involved the measurement of attitudes toward computer use in public schools. Many of these studies have painted a picture of large numbers of females fearful of using technology and, thus, potentially left behind in a technological age (Morse & Daiute, 1992). In addition, Morse and Daiute questioned the quantitative methods historically used to assess computing behaviors and attitudes of girls and women. Gender differences in attitude toward computer use were also found to diminish with computer experience (Siann & Durndell, 1988). Furthermore, some previous studies have suggested that computer experience is positively related to attitudes toward and interest in computers; the greater the experience, the more positive the attitude (Arenz & Lee, 1990; Chen, 1986; Fann, Lynch, & Murranka, 1989; Loyd & Loyd, 1988). Boser (2006) studied selected instructional approaches in technology using seventh grade students. The study reported that girls expressed they felt that technology was more difficult and less interesting than the boys in the study. Boser found that boys held very stereotyped ideas about girls' ability with technology.

Fishman (1997) studied students' use of computer-mediated communication software - e-mail, UseNet news, and Notebook (a local listserv package). In this study, he found significant gender differences only in the male dominance in number of posted articles to news. Fishman found that girls read lots of articles on news but didn't feel a need to post as many as the males. According to Fishman, this is reminiscent of the male behavior exhibited in the early grades,with - boys forever raising their hands to

answer questions even if they don't know the answer. It is worth noting that most of studies that have been included in literature review focused on attitudes and technology use in the public school setting. The current study however aims at addressing the narrow research focus on public schools only by examining the attitudes and technology use in a single private school only.

Conclusion

As we strive to bring more computers into the classroom for both teachers' and students' use to enhance learning, it is worth noting that technology is rapidly changing at an alarming rate which also means that it is difficult to keep up with. Research has shown that for technology to be integrated as a foundational teaching practice, the role of the principal needs to change to that of technology leader. According to Kozloski (2006), to this date, the focus of leadership development for technology in education has been on the theories of supporting technology integration; theory of technology use, theory of change and combined theories of how one can help in facilitating a change in the other. Kozloski goes on further to state that, there are also studies which show that leaders who are immersed at using technology while they are studying theory are much more successful at understanding it and then placing it in the context of teaching and learning.

As teachers seek to use technology in their instructions to enhance students learning, it is not uncommon that they do encounter barriers in the integration process. These barriers could be in the form of personal barriers or institutional barriers as the case may be. However, some of the common barriers that teachers experience in their use of technology have been discussed in the literature and amongst which are: availability of training and resources, lack of technology support, fear and anxiety experienced by teachers when faced with using new or unfamiliar technology, lack of time, lack of access, lack of resources, lack of experience, lack of expertise and lack of support by the leaders (principals and other administrators). As suggested by Kozloski, Perhaps one of the reasons why the same barriers persist today is that these barriers have been dealt with in isolation.

Studies have suggested the important role of the school leadership in the successful implementation of technology adoption in the schools. Thomas (1999) states, “a strong link between educational technology and school leadership is necessary to support improvements in education” (p. 8). Additional studies and dissertations on this topic found that school principals influence technology integration and their role is very important. Thus as leaders, the principals must create supportive conditions to foster technology integration (Hope, Kelley & Kinard, 1999; Inkster, 1998; MacNeil & Delafield, 1998; Rogers, 2000; Yee, 1999). In addition, the Principals must also work collaboratively with the teaching staff to effectively lead the integration of technology in their schools (Becker, 1994, Senge, 1990). Thus in order to accomplish this lead in technology integration, principals must also be trained and continually supported on the use of technology (Heaton, 1999).

Some research has also shown that both knowledge of computers and computer experience have a positive impact on teachers' attitudes (Dupagne & Krendl, 1992). Also, although private schools which do not receive funds from the federal government are not subjected to the NCLBA, 2001 accountability standards, it is worth noting that very little or no research has focused on the level of technology integration in private schools as it relates to the attitudes of teachers and students in general.

According to Abbott and Faris (2000), future research that increases the depth and breadth of information about participant attitudes and beliefs associated with instructional technology and the integration of technology into learning and teaching would better inform teacher educators, administrators, and supervisors of ways to support preservice teachers as they use technology in public school classrooms. Thus the authors recommend that, future studies that include selective individual interviews may aid researchers and others in exploring specific attitudes and beliefs that support or detract from instructional technology integration. Thus, empirical research is needed in this area to shed more light on private schools with regards to their technology integration and utilization as it relates to the attitudes of students and teachers.

Chapter Three: Methodology

Introduction

This study was designed to reveal the extent to which teachers in an all girls, private high school in the South use technology in their instruction, and to identify reasons that explain within school variation among teachers as well as why the school stands out amongst other schools considered to be leading in Technology Integration in the city in which it is located. In particular, the study aimed at identifying the demographic characteristics of teachers, the various levels of technology use by teachers, teachers' anxiety towards the use of technology, perceived barriers toward technology integration, teachers beliefs and perceptions with respect to school climate and support for technology integration, teachers' self efficacy and how it relates to their level of technology integration, sources of technology training received by teachers and factors that influence the level of technology integration.

The study utilized both quantitative and qualitative methods in a mixed-method approach which involves using both qualitative and quantitative data to address the research questions of interest. The purpose of using quantitative data in the form of surveys and qualitative data, in the form of non-participant observations, interviews, open ended questions and document reviews, was to provide a deeper, inclusive understanding and explanation of the existence or absence of factors that explain the level of technology adoption and possible relationships between observed variables. The details of this mixed method approach is outlined below in the following sections: (1) research questions, (2) research design, (3) sampling plan, (4) data collection procedures, (5) data analysis, (5) reliability and trustworthiness, and (6) conclusion.

Research Questions

This study addresses and focuses on the following research questions:

RQ1: What is the extent of technology exploration and experimentation by teachers in using technology?

RQ2: What is the extent of technology integration and adoption by teachers in using technology?

RQ3: What is the level of self efficacy exhibited by teachers in using technology?

RQ4: What is the level of technology anxiety amongst teachers when seeking to use technology?

RQ5: Do barriers exist that prevent teachers from using technology in their instruction?

RQ6: Do teachers' demographic (age, gender) and other personal variables (certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to technology integration) explain any variance in teachers' technology adoption?

RQ7: How does the level of school support influence teachers' attitudes toward use of technology in their instructions?

RQ8: What are the barriers that teachers encounter in their use of technology and how do they address these barriers in order to effectively integrate technology in their instructions.

Research Design

a. Rationale for Methodology

This study used a mixed methods approach for data collection. The mixed method approach allows the researcher to include and combine both the strengths of quantitative and qualitative data. According to Palak and Walls (2009), their explanatory mixed methods design (QUAN → QUAL) was followed by collecting quantitative and qualitative data sequentially across two phases (Creswell, 2002; Teddlie & Tashakkori, 2006 as cited in Palak & Walls, 2009). Palak and Walls confirmed that their review of the literature indicates that previous research on the relationship between teachers' educational beliefs and their instructional practices confirms that the mixed methods approach is appropriate. The combination of mixed methods, sampling strategies, and multiple variables was chosen to minimize errors that may arise from a single technique, and maximize the meaning from results of data interpretation (Patton, 2002; Tashakkori & Teddlie, 2003).

Similarly, according to Johnson and Onwuegbuzie (2004), by utilizing both qualitative and quantitative data together, it produces a more complete knowledge that is necessary to inform both theory and practice. Furthermore, Creswell (2003) described this research method as one in which the researcher collects, analyzes, and integrates both forms of data into a single study or in multiple studies through a sustained program of inquiry. Thus, by adopting or utilizing a mixed method approach, the researcher was able to gather data from multiple sources and using different strategies, approaches, and methods in addressing the questions of "attitude differences of students and teachers as it relates to gender, age and grade level."

b. Role/Biases of Researcher

The primary role of the researcher was to collect and analyze quantitative data in the form of surveys and qualitative data in the form of observations, interviews and review of documents such as lesson plans and computer infrastructure already in use in the research site. In addition, the researcher's observation role was that of a non-participant observer. The researcher's educational background is deeply rooted in the physical sciences, in particular, Physics, Mathematics and Mechanical Engineering. With this background, the researcher believes that teachers with similar backgrounds and interest in high schools will be inclined to have a more positive attitude towards using computers simply because the computer happens to be a very useful tool that enhances and supports learning.

The use of computers in subject areas such as Physics, Chemistry, Biology, Astronomy and Engineering Science to name a few, helps bring abstract concepts to more concrete experiences which enhances learning. For example, teaching of concepts in science such as atomic structure, motion in space, gravitational attraction between bodies, flow of charges in electrostatics etc., to name a few, can seem very abstract to learners in the absence of computer simulations in particular and other forms of media presentation and tools in general. Thus it is the researcher's view and belief

that as teachers integrate technology into their instruction to support learning, the attitude and level of technology integration is closely influenced by course area(s) that is/(are) taught by the teacher. Hence, in subjects or course areas that are more likely to be associated with a specific gender, such as in Physics and math, attitudes towards use of computers in particular will tend to be more positive for both teachers and students compared to other subject areas.

In addition, the researcher also believes that attitudes toward use of technology in general, are tied to perceived usefulness, beliefs and appreciation of the technology as a learning resource. Furthermore, the researcher also argues and believes that access to technology is a driving force for developing positive attitudes toward computer use and promoting more interaction with the technology.

c. Sampling Plan

Purposeful sampling (Creswell, 1998) was used in this study since the study is bounded in time, place and setting and also, in line with the objectives or purpose of this research. The levels being sampled included school administrators, technology coordinator, and all teachers in 9th through 12th grades. More specifically, the intensity sampling technique (Patton, 2002) was used to illustrate or illuminate the characteristics of particular subgroups of interest, but not extremely.

The choice of the school for this study was primarily due to the following reasons:

a. Research constraints due to access for the researcher to conduct research.

b. Time bound constrains for data collection and analysis.

c. Uniqueness of school in terms of gender composition, (School "A" is an all girls' private school).

d. Convenience for the researcher to visit in terms of proximity.

e. Exceptionality of the school as regards its history of adoption of technology.

In the current study, sampling for the administrators included the technology coordinator/director and the school principal, because of their direct roles in technology integration. Teachers were sampled from 9th, through 12th grades. All survey responses by the teachers in each grade level were considered in the data analysis. From the researcher's prior experience with teachers in regards to completing surveys, it was anticipated that the response rate for teachers using surveys at that time of the year or semester would be very low without any compensation or incentives. Thus random selection of survey responses from teacher survey was very unlikely.

Data Collection Procedures

Data collection for teachers will include surveys, observations and interviews at the research site. Data collection for administrators only included interviews. In addition, all the data collection was done in the spring semester of 2010. The data collection process commenced with the administration of the survey, followed by observations (with the researchers' role as a non- participant observer) and interviews.

Quantitative Data Collection

The data collection specific to teachers was done using surveys. The surveys were administered to teachers in grades 9 through 12 in the school. The survey instrument used for measuring the extent to which teachers use or integrate technology into their instruction for this study included six open ended questions. The survey instrument used was a modified compilation from the "Kotrlik/Redman Technology Integration Scale (KRTIS©2005) and Technology Integration Scale (TIS© 2005). The "KRTIS© 2005 technology integration in the teaching-learning process instrument was developed by Professors Joe W. Kotrlik and Donna H. Redmann at the Louisiana State University. The survey instrument has been used for several studies and tested over and again for its proven high internal consistency reliabilities. The combined instrument (see Appendix-A) used for this study consists of 60 items rated on a likert scale. The only modifications done to the original instruments include; modification of demographic data collected, the

addition of anxiety and self efficacy scales and the inclusion of open ended questions. The survey instrument addressed the following scales:

a. Exploration of technology
b. Experimentation with technology
c. Adoption of technology
d. Advanced integration of technology
e. Self efficacy of teachers
f. Barriers to technology integration
g. Anxiety towards the use of technology.

For this study, the open ended questions included in this instrument by the researcher were formulated with great relevance to this study and in helping to fully address the research questions of interest. According to Bradburn (1983), open-ended questions produced fuller and deeper replies whereas structured or closed items produce more relevant and comparable responses. In addition, open-ended questions offer the respondents an opportunity to expand on their answers and express feelings, motives, or behavior quite spontaneously according to Campbell (1950).

Qualitative Data Collection

Qualitative data collection included interviews, observations at the research site, document reviews and open-ended questions as part of the surveys for both administrators and teachers.

Interviews and Observations

Qualitative interviews were conducted for a couple of teachers and administrators. The group of teachers selected for the interviews included teachers from various subject areas in general but also, they were teachers who participated in the survey. The various subject areas represented for this study included Physics, Chemistry, Biology, Math, Fine Arts, and Civics. The administrators interviewed include the

technology coordinator and the school principal. All interviews were conducted on the school campus and using interview protocols (Appendix B)

The observations conducted by the researcher were completely non-participant, with little or no intrusion, thus causing no significant behavioral changes in the research sites. The observations were primarily meant to focus on identifying the types of technology used by teachers in the classrooms and getting a contextual view and description of the research site. Multiple observations were done at different times of the day on different days of the week at the research site. The observation tools included taking field notes and using a digital photo camera when permitted.

Document Reviews and Open Ended Questions

Document reviews were directed towards inspection of lesson plans for teachers and the technology plan for the technology coordinator and or principal. The document reviews included statistics or inventory of computers and computer labs, including types of network infrastructure, identifying WIFI hotspots etc.

Open-ended questions were used to gather qualitative data from both administrators and teachers. The open ended questions not only provide respondents the opportunity to take or state positions, on issues for example, but also provide respondents with the opportunity to explain why the did or did not choose a specific response. Intensity of feelings, anger, arrogance, pride to name a few can be expressed using open ended questions which could otherwise not be easily tapped into using closed ended or structured questions. For example, in responding to the question about “the ease of using a computer to me”, a respondent using an open ended response might respond saying, “oh no! Computers suck and they are very difficult to use! I just can’t stand them.” On the other hand, using a closed ended question on the ease of using a computer, the most negative response on a five point likert scale anchor will be “I totally disagree” in response to the statement “computers are easy to use.” Thus, it is evident that one of the main advantages offered by open ended questions is the flexibility they give to the respondent to let his or her thoughts roam freely and spontaneously according to Gupta and Houtz (2001).

Gupta and Houtz further state that this allows the researcher to look for nuance of meaning that may not be revealed when the response options are more limited. Open ended questions generally produce more self revelations by subjects (Dohrenwend, as cited by Gupta & Houtz, 2001).

Understanding the School Context

The school described, School "A", in this study is an all girls private Catholic School established about two centuries ago. The school has three times been recognized as a Blue Ribbon School of excellence by the U.S. department of state and about eight years ago, the school was also given recognition as a school of technology excellence, one of only three nationwide by the U.S. department of state. The student enrollment currently in the school is about a thousand.

The School "A" is a college preparatory school and its curriculum is built on a technology immersion program designed and developed by one of the faculty about two decades ago. The school's mission is to educate young women as responsible and unifying members of the world community. The school strives for high standards of excellence in its academic program and its religious orientation within the Catholic tradition. The school believes in being responsive to the times while being faithful to the best that tradition has to offer. It affirms the principles of American democracy and especially attempts to foster responsible freedom. By the development of a critical understanding of society and its values, the school hopes to prepare students to serve as responsible citizens who will make positive contributions to society.

The school has a faculty of about seventy-six (76) teachers currently serving. The faculty recognizes parents as the primary educators who extend to and share with the school the responsibility for the education of youth. In this regard, the school views the home and family as the basic educational environment where values are communicated and character formation begins and continues. It recognizes the importance of the quality of relationships among students, teachers, administration and the staff of the learning community. As part of the school's philosophy, the faculty is concerned with learning that makes a difference, which makes

for more sensitive living with a greater range, variety and richness because of the underlying confidences of the student in her own self-worth and her ability to live life fully.

Furthermore, the faculty, parents and students of the school believe that those in the school are both capable of and responsible for creating a life-enhancing environment. They affirm the importance of giving attention to the quality of life for everyone in the school -- not just for the students, but for all who live there each day. They believe, finally, that striving to live the values of Jesus -- love, justice and service -- is truly the way to grow in the art of living.

Technology integration or use by teachers and students in particular, is an outstanding characteristic of this school. The school is locally identified as a Laptop school, with all students and staff provided with a Notebook or Tablet PC.

The Laptop program in this school has been ongoing for the past ten years. Every classroom is furnished with Audio visual equipment such as television, overhead AV projectors and screens, slide projectors, desktop, and or laptop. The school uses Moodle as its main course management system software. The school has both Local Area networks (LAN) and Wide Area Networks (WAN) , including Internet via "WIFI 802.11b, g & n" technology. Access to school networks and internet on the school campus is anytime, anyplace" and it is very common for both students and staff to walk the hallways or corridors on campus surfing the internet or text messaging.

Data Analysis

This study utilized both quantitative and qualitative methods in a mixed-method approach which involves using both qualitative and quantitative data to address the research questions of interest. The collected data were then analysed both using quantitative and qualitative techniques.

Quantitative Data Analysis

For this study, the data analysis include descriptive statistics, correlations and regression analysis.

Specific research questions, however, were addressed using the following statistical techniques:

i. RQ1: What is the extent of technology exploration and experimentation by teachers in using technology? This was addressed using descriptive statistics.

ii. RQ2: What is the extent of technology integration and adoption by teachers in using technology? This was addressed using descriptive statistics.

iii. RQ3: What is the level of self efficacy exhibited by teachers in using technology? This was addressed using descriptive statistics.

iv. RQ4: What is the level of technology anxiety amongst teachers when seeking to use technology? This was addressed using descriptive statistics.

v. RQ5: Do barriers exist that prevent teachers from using technology in their instruction? This was addressed using descriptive statistics.

vi. RQ6: Do teachers' demographic (age, gender) and other personal variables (certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to technology integration) explain any variance in teachers' technology adoption? This question was addressed using Pearson correlation and multiple linear regression.

Qualitative Data Analysis

Qualitative data analysis for this study focuses on the open ended survey questions, interviews and observations at the research sites. According to Creswell (2003, p. 19), a typical qualitative data analyses is described as follows:

a. preparing and organizing the data for analysis;

b. exploring the data;

c. describing and developing themes from the data;

d. representing and reporting the findings; and

e. validating the accuracy and credibility of the findings.

Field notes from multiple observations were compiled and summarized in a descriptive report. In taking field notes, coding schemes were generated whenever necessary to document categories and patterns of behavior which can be tallied based on frequency of occurrence. Responses to open ended questions were also analyzed by compiling a summary of all the key words and phrases that emerge in creating themes. These emerging themes were broadly used to describe the response to the specific items based on the frequency of occurrence.

The following research questions were addressed qualitatively using the qualitative data.

RQ7: How does the level of school support influence teachers' attitudes toward use of technology in their instructions?

RQ8: What are the barriers that teachers encounter in their use of technology and how do they address these barriers in order to effectively integrate technology in their instructions.

Reliability and Trustworthiness

Reliability, as described in Fraenkel and Wallen (2009), refers to the consistency of inferences over time, location and circumstances whilst validity refers to the appropriateness, meaningfulness, and usefulness of inferences researchers make based specifically on the data they collect. In this study, the survey instruments used have been tested and widely used in many other studies which have helped to establish both their reliability and validity. In addition, the explanatory mixed method approach used for this study helps to address the issues of validity and reliability.

Creswell (2003) defined credibility as the degree in which inferences of the phenomena match the realities of the phenomenon. The purpose of this study was to identify and establish a rich, thick description that would allow others to get an understanding of the extent of technology integration in this technologically-rich, school community and explanations for why, how and what is going on in. The multiple observations at the site at different times and on different days helps in establishing the trustworthiness of the data collection.

Chapter Four: Research Results

Survey for Teachers

This study was designed to reveal the extent to which teachers in an all girls, private high school in the South use technology in their instruction, and to identify reasons that explain within school variation among teachers as well as why the school stands out amongst other schools considered to be leading in technology integration in the city in which it is located. Data collected for this study consisted of surveys administered to teachers in grades 9 through 12, interviews with selected teachers and school administrators, structured observations at the school site and reviews of school documents. This chapter presents results from the surveys administered to classroom teachers. Basic descriptive statistics are presented first, followed by results for each of the research questions addressed with survey data.

Instrumentation

The scales in the instrument included technology exploration, experimentation, integration, adoption for use in instruction, barriers to technology integration in instruction, technology anxiety experienced while attempting to use technology in instruction and self efficacy. The technology exploration, experimentation, integration and adoption scales included 5, 9, 4 and 16 items respectively. The scale for barriers, self efficacy and anxiety included 9, 7 and10 items respectively. The internal consistency reliabilities for the scales using the data for this study were as follows: Adoption: $\alpha = 0.931$; Integration: $\alpha = 0.818$; Experimentation: $\alpha = 0.955$; Exploration: $\alpha = 0.80$ Anxiety: $\alpha = 0.903$; Self efficacy: $\alpha = 0.821$; Barriers to technology integration: $\alpha = 0.903$ The Cronbach's alpha reliability coefficients for the scales as shown above were exemplary according to Robinson, Shaver and Wrightsman (1991). Similar results for the internal consistency reliabilities were reported by Kotrlik and Redmann (2009) trend studies, investigating Technology Adoption in Teaching-Learning Process by Secondary Agric Science Teachers. In that study, the scale internal consistency reliabilities were as follow: Adoption: $\alpha = 0.95$; Anxiety: $\alpha = 0.94$ and Barriers to technology integration: $\alpha = 0.80$.

Quantitative Data Analysis

As noted above, data analysis from the quantitative survey included descriptive statistics (means, modes, sample size and standard deviations), bivariate correlations between constructs, and multiple linear regressions. Qualitative data from the open-ended items on the survey are also presented in this section. The results of this study are reported as follow in two sections based on the type of data (quantitative and qualitative) collected.

A total of 50 teachers/faculty responded to the survey which was administered to all faculty, approximately 80 in total. The survey was web based and participants were free to opt out at anytime or willingly participate without any incentives.

Demographic Characteristics of the Teachers

Age and gender were the two most important demographic characteristic that were included in the survey for faculty/teachers. The ages of the teachers ranged from 19 to over 50 years. The ages of the respondents were grouped as follow: Age 19 – 29, Age 30 – 39, Age 40 – 49, and Age 50 and over. Out of the 50 respondents, the age distribution was as follow:

Age 19 – 29; 10 (20.4%), Age 30 – 39; 14 (28.6%), Age 40 – 49; 12 (24.5%) and Age 50 and over; 13 (26.5%). The age group 30 –39 reported the most teachers while the age group 19 – 29, included the least number of teachers. These results are shown in the Table 4.1.

Gender: The ratio of male to female teachers included in this study is roughly about 1 to 9. From the total of 50 responses, four (4) were identified as males and forty six (46) were females.

Other variables or characteristics examined in this study include teachers' certification status, years of teaching experience, and sources of technology training. Seventy percent (70%) of the teachers indicated that they were certified compared to thirty (30%) who were uncertified. Thirty two percent (32%) of the teachers indicated having 20 plus years of teaching experience compared to twenty six (26%) with under 5 years experience, twenty six (26%) with 6 – 10 years experience, and sixteen (16%) with 11 – 20 years of

teaching experience. These results are included in Tables 4.2 and 4.3.

Table 4.1 - Age Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Age 19 - 29	10	20.0	20.4	20.4
	Age 30 - 39	14	28.0	28.6	49.0
	Age 40 - 49	12	24.0	24.5	73.5
	Age 50 and over	13	26.0	26.5	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

Four major sources of technology training for teachers identified include; self taught, workshops/conferences, college courses, and colleagues. Other sources of technology training for teachers as suggested by the survey results include students, professional development by the school, friends, family members and training from high school computer classes/courses. Seventy eight percent (78%) of the teachers stated that they got their technology training by teaching themselves (self taught), whilst about the same proportion (76%) of teachers claim that they received their technology training from workshops/conferences and colleagues.

Table 4.2 - Teacher Certification Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Not Certified	15	30.0	30.6	30.6
	2 Certified	34	68.0	69.4	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

Table 4.3 - Teaching Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 5 Years	13	26.0	26.5	26.5
	11 - 15 Years	4	8.0	8.2	34.7
	16 - 20 Years	4	8.0	8.2	42.9
	20 + Years	16	32.0	32.7	75.5
	6 - 10 Years	12	24.0	24.5	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

RQ1: What is the extent of technology exploration and experimentation by teachers in using technology?

The exploration and experimentation scales were used to measure the extent to which teachers explore and experiment with technology in their instructions. The exploration and experimentation scales included five (5) and nine (9) items respectively using an anchored scale. The scales are anchored from "1 = Not like me", "2 =Very little like me", "3= Somewhat like me", "4 = Very much like me", and "5 = Just like me." The anchors for both scales range from; "Not like me = 1.0-1.49", "Very little like me = 1.5-2.49", "Somewhat like me = 2.50-3.49", "Very much like me = 3.50-4.49", and "Just like me = 4.50-5.0." The scale mean for the experimentation scale is M= 1.68 and the standard deviation (SD) = 1.049. Thus the group mean can be identified as "very little like me" which suggests that the teachers are not experimenting with technology as much." The lowest rated item on the experimentation scale was "I am just now considering incorporating technology into my classes," (M=1.54, SD=0.968). The highest rated item on the experimentation scale was "I am just beginning to use technology to involve students in games or simulations," (M=1.72, SD =1.077).

Table 4.4- Experimentation Scale Descriptive Statistics

	N	Mean	Std. Deviation
I am just now considering incorporating technology into my classes.	**48**	**1.50**	**.968**
I am just beginning to use presentation software to teach lessons (e.g., PowerPoint, Corel Presentations, etc.)	**47**	**1.68**	**1.270**
I am just beginning to use the Internet to find information or materials for my lessons.	**47**	**1.57**	**1.264**
I am just beginning to use instructional exercises that require students to use the Internet or other computer programs.	**47**	**1.60**	**1.173**
I am just beginning to use technology to involve students in games or simulations.	**47**	**1.72**	**1.077**
I am just beginning to experiment with ways to use technology in the classroom.	**47**	**1.62**	**1.153**
I am just beginning to rearrange my classroom or laboratory to accommodate technology.	**49**	**1.63**	**1.035**
I am just beginning to require my students to use the Internet to complete some of their assignments.	**47**	**1.68**	**1.304**
Experimentation Scale	**48**	**1.68**	**1.049**
Valid N (listwise)	**46**		

The exploration scale mean is 3.17 and the SD = 0.903. This is shown in Table 4.5. The scale mean suggests that teachers are more likely seeking to learn how to use technology than using it (experimentation). The lowest item scored on the exploration scale was "I purchase books or other materials that can help me to integrate technology in my teaching", (M=2.41, SD=1.273). The highest rated item on the exploration scale was "I talk with my principal or fellow teachers about using technology in my instruction", (M=3.77, SD=0.805).

RQ2: What is the extent of technology integration and adoption by teachers at School A in using technology?

The level of technology integration was measured using the technology integration scale (Table 4.8) which comprised four (4) items on an anchored scale. The scales are anchored from "1 = Not like me", "2 =Very little like me", "3= Somewhat like me", "4 = Very much like me", and "5 = Just like me."

The anchors for this scale range from; "Not like me = (1.0-1.49)", "Very little like me = (1.5-2.49)", "Somewhat like me = (2.50-3.49)", "Very much like me = (3.50-4.49)", and "Just like me = (4.50-5.0)."

Table 4.5 - Exploration Scale Descriptive Statistics

	N	Mean	Std. Deviation
I want to take a course to learn how to use technology in the teaching/learning process.	**49**	**3.18**	**1.131**
I talk with my principal or fellow teachers about using technology in my instruction.	**49**	**3.69**	**.796**
I talk with my principal or fellow teachers about using technology in my instruction.	**48**	**3.77**	**.805**
I attend conferences or workshops on how to integrate technology in my teaching.	**49**	**3.08**	**1.205**
I purchase books or other materials that can help me to integrate technology in my teaching	**49**	**2.41**	**1.273**
Exploration Scale	**50**	**3.17**	**.903**
Valid N (listwise)	**48**		

Technology Integration: To what extent are teachers integrating technology in the school?

The technology integration scale mean and standard deviation were respectively M= 2.89 and SD=0.984. The lowest item mean score on the integration scale was "I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals or at other locations (other classes, other schools, other states or countries, etc.)" with a mean of M=2.47 and SD=1.276. The item "I often require my students to use e-mail to complete their assignments" was rated with the highest mean score of M= 3.49 and SD=1.102. These results suggest that the teachers are reaching out to their students more via the web.

Table 4.6- Technology Integration Scale Descriptive Statistics

	N	Mean	Std. Deviation
I encourage students to design their own technology-based learning activities.	49	3.06	1.281
I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals or at other locations (other classes, other schools, other states or countries, etc.).	49	2.47	1.276
I often require my students to use e-mail to complete their assignments.	49	3.49	1.102
I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals in other disciplines.	49	2.55	1.226
Integration Scale	49	2.89	.984
Valid N (listwise)	49		

Technology Adoption: To what extent are teachers adopting technology in the school?

The teachers' level of technology adoption was measured using the technology adoption scale (Table 4.7) which comprised of sixteen (16) items on an anchored scale. The scales used are as follow: "1 = Not like me", "2 =Very little like me", "3= Somewhat like me", "4 = Very much like me", and "5 = Just like me." The scale interpretation is as follow: "Not like me = (1.0-1.49)", "Very little like me = (1.5-2.49)", "Somewhat like me = (2.50-3.49)", "Very much like me = (3.50-4.49)", and "Just like me = (4.50-5.0)." The Technology Adoption scale mean and standard deviation were respectively M= 3.81 and SD=0.884 which the teachers indicated as "very much like me." The lowest mean item score on the integration scale was "I am more of a facilitator of learning than the source of all information because my students use technology" with a mean of M=3.52 and SD=0.992. The teachers indicated this item mean as "very much like me." The item "I expect my students to use technology to enable them to be self-directed learners" was rated with the highest mean score of M= 4.17 (very much like me) and SD=0.724. For this scale, the teachers indicated every item mean as "very much like me." The results suggest that teachers are adopting technology into their instructions more than exploring and or experimenting with technology.

Table 4.7 - Adoption Scale Descriptive Statistics

	N	Mean	Std. Deviation
I discuss with students how they can use technology as a learning tool.	49	3.82	1.054
I have made physical changes to accommodate technology in my classroom or laboratory.	49	3.71	1.118
I emphasize the use of technology as a learning tool in my classroom or laboratory.	49	4.06	.876
I assign students to use the computer to do content related activities on a regular basis.	48	4.04	1.071
I use technology based games or simulations on a regular basis in my classroom or laboratory.	48	3.65	1.246
I use technology to encourage students to share the responsibility for their own learning.	48	4.02	.838

Table 4.7 - Adoption Scale Descriptive Statistics

I expect my students to use technology to enable them to be self-directed learners.	48	4.17	.724
I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities.	48	4.15	.772
I regularly pursue innovative ways to incorporate technology into the learning process for my students.	47	3.83	1.070
I expect my students to fully understand the unique role that technology plays in their education.	48	3.88	.959
I design learning activities that result in my students being comfortable using technology in their learning.	48	3.85	1.031
I expect students to use technology to such an extent that they develop projects that are of a higher quality level than would be possible without them using technology.	48	3.94	1.019
I am more of a facilitator of learning than the source of all information because my students use technology.	48	3.52	.922
I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students.	48	4.00	.968
I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.	49	3.61	1.057
I often require my students to use Internet web sites to complete their assignments.	49	3.69	1.176
ADOPTION SCALE	50	3.81	.884
Valid N (listwise)	47		

RQ3: What is the level of self efficacy exhibited by teachers in using technology?

The level of self efficacy was measured using the Self Efficacy scale (Table 4.8) which comprised four (4) items on an anchored scale. The scales are anchored from "1 = Strongly disagree", "2 =Disagree", "3= Undecided", "4 = Agree", and "5 = Strongly Agree" The anchors for this scale range from; "Strongly disagree = (1.0-1.49)", "Disagree = (1.5-2.49)", "Undecided = (2.50-3.49)", "Agree = (3.50-4.49)", and "Strongly Agree = (4.50-5.0)."

The Self Efficacy Scale mean and standard deviation were respectively M= 3.598 and SD=0.578. The lowest mean item score on this scale was "The other teachers in my school would say that I am one of the best teachers at this school" with a mean of M=3.33 and SD=0.625. The item "I am highly effective in

teaching the content in my courses" was rated with the highest mean score of M= 4.24 and SD=0.560.

Table 4.8 - Self Efficacy Scale Descriptive Statistics

	N	Mean	Std. Deviation
I am among the very best teachers at my school.	49	3.65	.723
I am highly effective in teaching the content in my courses.	49	4.24	.560
My students would rate me as one of the very best teachers they have ever had.	49	3.57	.736
The other teachers in my school would say that I am one of the best teachers at this school.	49	3.33	.625
All of my students would evaluate my courses as excellent.	49	3.47	.739
I am a role model for other teachers in my school	49	3.47	.710
My principal would say that I am one of the best teachers at this school.	49	3.45	.679
Efficacy Scale	49	3.598	.475
Valid N (listwise)	49		

RQ4: What is the level of technology anxiety amongst teachers when seeking to use technology?

The anxiety teachers feel when they think about using technology in their instruction was assessed using the Technology Anxiety Scale. The anxiety scale included 9 items (Table 4.9) using an anchored scale (1=No Anxiety, 2=Some Anxiety, 3= Moderate Anxiety, 4=High Anxiety and 5= Very High Anxiety) which the teachers responded to.

The teachers experienced some anxiety as they integrated technology in their instruction. The scale mean (Scale M=1.896, SD= 0.643) and all item means were in the some anxiety range. The highest level of anxiety was recorded for item "How anxious do you feel when you avoid using unfamiliar technology?" with a mean of M=2.37and SD=0.929. The lowest anxiety levels were reported for the items "How anxious do you feel when you are faced with using new technology?" and "How anxious do you feel when someone uses a technology term that you don't understand?" with item means M=1.73 and SD= 0.785.

Table 4.9 - Anxiety Scale Descriptive Statistics

	N	Mean	Std. Deviation
How anxious do you feel when you cannot keep up with important technological advances?	49	2.00	.935
How anxious do you feel when you fear you may break or damage the technology you are using?	49	1.76	.855
How anxious do you feel when you avoid using unfamiliar technology?	49	2.37	.929
How anxious do you feel when you try to understand new technology?	49	1.80	1.19
How anxious do you feel when you try to learn technology related skills?	49	1.86	.816
How anxious do you feel when you think about your technology skills compared to the skills of other teachers?	49	1.80	.763
How anxious do you feel when you are faced with using new technology?	49	1.73	.785
How anxious do you feel when you are not certain what the options on various technologies will do?	49	1.94	.747
How anxious do you feel when someone uses a technology term that you don't understand?	49	1.73	.785
Anxiety Scale	49	1.896	.643
Valid N (listwise)	49		

RQ5: Do barriers exist that prevent teachers from using technology in their instruction?

The barriers to integrating Technology in Instruction Scale was used to measure the perceived barriers that may prevent teachers from integrating technology in their instruction. The teachers responded to nine items using an anchored scale (Table 4.10): 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier and 4 = Major Barrier. The scale interpretation ranges are as follow: Not a Barrier = (1.00-1.49), Minor Barrier = (1.50- 2.49), Moderate Barrier = (2.50-3.49) and Major Barrier = (3.5-4.0).

The teachers experienced minor barriers in integrating technology into their instruction. Teachers experienced minor barriers on the items "Availability of technology for the number of students in my classes", "Availability of technical support to effectively use instructional technology in the teaching and learning process" and "My ability to integrate technology in the teaching and learning process." The barrier

that was rated the lowest was a minor barrier –"Availability of technology for the number of students in my classes" (M = 1.10, SD = 0.467). The results suggest that although the teachers acknowledge that they experience some minor barriers in using technology in their instruction, the availability of technology for students' use was considered insignificant.

Table 4.10 - Perceived Barriers Scale Descriptive Statistics

	N	Mean	Std. Deviation
Enough time to develop lessons that use the internet , computers, or other technology in the teaching/learning process.	**49**	**2.35**	**.969**
Scheduling enough time for students to use the internet, computers or other technology in the teaching/learning process.	**49**	**1.53**	**.915**
Availability of technology for the number of students in my classes.	**49**	**1.10**	**.467**
Availability of technical support to effectively use instructional technology in the teaching and learning process.	**49**	**1.20**	**.499**
Administrative support for technology integration in the teaching and learning process.	**49**	**1.18**	**.565**
My ability to integrate technology in the teaching and learning process.	**49**	**1.63**	**.727**
My students' ability to use technology in the teaching/learning process.	**49**	**1.22**	**.468**
Types of courses i teach	**49**	**1.73**	**.811**
Availability of effective instructional software for the courses i teach	**49**	**1.63**	**.809**
Barriers Scale	**49**	**1.51**	**.411**
Valid N (listwise)	**49**		

RQ6: Do teachers' demographic (age, gender) and other personal variables (certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to technology integration) explain any variance in teachers' technology adoption?

This research question was addressed by using a forward regression method to determine if selected variables explained variance in technology adoption (Hair, Black, Babin, Anderson, & Tatham, 2006). The dependent variable for this analysis was the mean of the Technology Adoption scale. Potential explanatory

variables included age, certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to technology adoption. Gender was originally considered to be a potential explanatory variable for technology adoption but was dropped from this analysis since there were only four male participants in this study in comparison to forty six females.

The data for the regression analysis was examined for multicollinearity. Hair et al,(2006) stated, "The presence of high correlations (generally, 0.90 and above) is the first indication of substantial collinearity" (p.227). The results of this analysis suggested no collinearity for the selected independent variables after examining the "tolerance and variable inflation factors (VIF)."

The regression analysis showed that only two variables (Table 4.11) i.e., Barriers to Technology Integration and Technology Anxiety were significant predictors in explaining the variance in Technology Adoption (Total $R^2 = 0.40$). The regression model suggested that Technology Adoption increased as teachers experienced low barriers to technology integration and moderate anxiety levels towards technology integration. The ANOVA table for the regression analysis is shown in Table 4.12. The regression model coefficients are shown in Table 4.13.

Table 4.11- Model Summary for Forward multiple Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.517[a]	.267	.252	.60451
2	.632[b]	.400	.374	.55301

a. Predictors: (Constant), Mean Item Barrier

b. Predictors: (Constant), Mean Item Barrier, Anxiety Scale

Table 4.12 - ANOVA Table for Forward Multiple Regression Analysis of Technology Adoption

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.269	1	6.269	17.156	.000[a]
	Residual	17.175	47	.365		
	Total	23.445	48			
2	Regression	9.377	2	4.688	15.330	.000[b]
	Residual	14.068	46	.306		
	Total	23.445	48			

a. Predictors: (Constant), Mean Item Barrier

b. Predictors: (Constant), Mean Item Barrier, Anxiety Scale

c. Dependent Variable: Mean Adoption

Table 4.13- Regression Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5.179	.323		16.034	.000		
	Mean Item Barrier	-.762	.184	-.517	-4.142	.000	1.000	1.000
2	(Constant)	5.763	.348		16.575	.000		
	Mean Item Barrier	-.655	.172	-.445	-3.817	.000	.962	1.040
	Anxiety Scale	-.404	.127	-.371	-3.188	.003	.962	1.040

a. Dependent Variable: Mean Adoption

Qualitative Data Analysis of Survey Questions

Qualitative data analysis for this portion of the study focused on teachers' responses to the open ended questions included in the teacher surveys. As noted, earlier these questions were developed for the purpose of gaining a deeper understanding of the technology integration issues and process at the school. A total of six questions were developed:

1. What are the reasons that you use technology to support your instruction?
2. Describe an example(s) of how computer technologies have enhanced your students' learning. Why do you think it was effective?

3. What important computer competencies do you believe teachers in your subject area should posses?
4. What are some of your beliefs and perceptions about other teachers' use of technology in your school?
5. What are some of the expectations (if any) of your school administrators with regards to your level of technology integration
6. How do school leaders/administrators ensure compliance with technology integration requirements (if any) for teaching?

Q1. What are the reasons that you use technology to support your instruction?

There were 44 responses to this question. The responses to this question were briefly summarized based on a coding scheme identified by the researcher in the context of this study as shown below in Table 4.14. The data was then analyzed using descriptive statistics.

From the frequency distribution shown in Table 4.14, the top five ranked reasons "why teachers use technology to support their instruction "included the following:

1. Convenience, time saving and comfort.
2. Technology provides more learning sources and opportunities.
3. Technology enhances learning.
4. Technology is relevant and it is the future trend.
5. The use of technology is a school culture (promoted and encouraged by school).

The least rated reason why teachers use Technology to support their instruction was identified as "Technology provides up to date information." The second least rated reason was "Technology facilitates and promotes interaction." The unedited survey responses to the question "Q1" are included in Table 4.15 of the supplementary data in Appendix D.

	Table 4.14 – Reasons Teachers use Technology to Support Instruction	
Code #	Reason	Frequency
[1]	{convenience, time saving and comfort}	14
[2]	{facilitates, promotes interaction}	4
[3]	{Promotes and enhances communication}	7
[4]	{Provides more learning Sources and opportunities}	14
[5]	{Supports different Learning styles}	8
[6]	{provides up to date information}	3
[7]	{School culture and practice}	8
[8]	{Enhances learning}	14
[9]	{Makes learning fun and interesting}	6
[10]	{Relevance and It is the future!}	10

Q2. Describe an example(s) of how computer technologies have enhanced your students' learning. Why do you think it was effective?

This question was aimed at addressing whether teachers do believe that computer technology enhances learning and further substantiating or giving reasons why the technology used was considered effective. A total of forty-eight (48) teachers out of the fifty (50) sampled t responded to this question. All responses to this question suggested that the teachers believe that the use of technology to support instruction does enhance students' learning. The results also further suggest that the teachers do agree or believe in the effectiveness of the technology that was used. The types of computer technologies used to enhance learning as revealed in the teachers' responses include; Presentation software, Word processing software, data processing software, Internet and Intranet, Course management systems, WIFI technology, Social networks, Whiteboards etc.

Some of the ways Technology has enhanced students' learning as identified from the teachers' responses include the following:

a. Promotes interaction,
b. Promotes more research opportunities,
c. Access to more information,

d. More options, opportunities and learning resources

e. Time savings on activities

f. Improves quality of report writing

g. Accommodates different learning styles

h. Provides enhanced learning via virtual labs, simulations, online tours etc.

Q3. What important computer competencies do you believe teachers in your subject area should posses?

Important computer competencies:

The results suggest that teachers were interested and or recommended the following: Proficiency in using calculators, internet search tools and engines, Word processing tools, presentation tools, Online Collaboration tools, Emails, Course Management tools, Web development tools, Blogging, Twitting, knowledge of Operation Systems like Windows, Data Acquisition and Analysis software (Microsoft Excel, SPSS, SAS, etc.). The unedited responses to this question are included in Table 4.16 in Appendix – D.

Q4. What are some of your beliefs and perceptions about other teachers' use of technology in your school?

This question was aimed at addressing the beliefs and perceptions of teachers with respect to the use of technology by other teachers in the school. The results revealed in the unedited responses shown in Table 4.17 of Appendix –D are are summarized as follow:

a. The level of technology integration for teachers varies for individual teachers based on relevance, differing interests, courses taught or subject specific areas, comfort levels, skilled levels, anxiety levels and more. [Responses: 1- 10]

b. Some teachers use technology on a regular basis whilst others don’t, some use technology as a tool and others use it as a means to an end, some don’t use as much technology on daily basis but use it in more interesting ways, some use technology in very creative ways and are committed to using it to serve its intended purpose and some use it more effectively and appropriately. [Responses: 11-20]

c. Some teachers accept that there are advantages and disadvantages for using specific technologies; technology integration needs vary with departmental requirements; some older veteran teachers are still very resistant to change in use of technology; some teachers believe or think that the school should not focus resources on technology integration but rather on other areas; some teachers believe that the different levels of technology use can be associated with different comfort and proficiency levels.[Responses :21-30]

d. Some teachers believe that in the absence of benchmarks or standards for the level of technology adoption in the school, this will result in some other teachers making no efforts to embrace changes in technology. As one teacher puts it; "Technology cannot replace authentic student teacher interactions. It is a tool that must be used judiciously so that the technology remains a means to the learning process, not the end of it." Because there are no mandatory standards and benchmarks for holding teachers accountable for the level of technology integration in the school, one teacher expressed concern in that regard by saying "I know quite a few teachers are completely on-board with using technology, while others don't find it very useful for their subject area. I've even heard a small few say it does more harm than good." [Responses: 31-42].

Q5. <u>What are some of the expectations (if any) of your school administrators with regards to your level of technology integration?</u>

This question was aimed at identifying the expectations of the school administration with respect to the teachers' use of technology in their instruction. The responses as shown in Table 4.18 of Appendix D, suggest the following:

a. School administration highly expects teachers to use technology as often as possible on a daily basis and when relevant and necessary.

b. The school administration clearly supports and promotes use of technology by teachers that works to enhance students learning.

c. The school provides all teachers and students with Tablet Notepad laptops.
d. Technology integration is highly expected but there are no mandatory standards to ensure compliance.
e. Teachers' technology integration needs are met with great support by the administration and other faculty members in the school.
f. Teachers are expected to keep up with the growing technological changes and needs of the students and some say, this is kind of difficult for them to accomplish because of varying personal interests for example; use of blogs, Facebook, Twitter etc.
g. Teachers are expected to on a regular or daily basis use email, Moodle and its resources, electronic assessments, electronic submission of assignments, web resources, interactive tutorials, computer-based laboratory experiments in science, etc.
h. Technical support for technology integration is excellent and as a result, teachers are expected to seek help from the technical support department or other teachers with more proficiency and capabilities.

6. How do school leaders/administrators ensure compliance with technology integration requirements (if any) for teaching?

This question was aimed at addressing and identifying the ways in which the school administration ensures compliance for technology integration by teachers in the classroom. The unedited responses to this question are shown in Table 4.19, Appendix D. The results from the responses to this question reveal the following:

a. There is no mandatory compliance standard for Technology integration for teachers.
b. The school administration, however, gets feedback on the level of technology integration from the following sources:

i. Feedback Students

ii. Feedback from other teachers

iii. Use of Moodle

iv. Informal classroom observations

v. Professional development sessions

vi. Teacher Reports and evaluations

Chapter Five: Qualitative Data Analysis

This section of the study includes data analysis related to interviews and field observations and in particular, addressing the qualitative research questions (RQ7 and RQ8) as stated below:

RQ7: How does the level of school support influence teachers' attitudes toward use of technology in their instructions?

RQ8: What are the barriers that teachers encounter in their use of technology and how do they address these barriers in order to effectively integrate technology in their instructions.

Research questions RQ7 and RQ8 were both addressed by the interview questions 4 and 3 respectively. Qualitative data were collected to inform and confirm the quantitative findings. Therefore, interviews of six teachers, the technology director/coordinator and the principal were conducted. Interviewees were chosen from different subject specific areas in Physics, Chemistry, Biology, Math, Fine Arts, and Civics. The interviewees were selected taking into account the following:

a. They were participants in the survey.
b. Time constraints for the researcher in particular and the teachers in general to avail themselves for the interview due to course load and schedule conflicts.
c. Inclusion of a broad spectrum of subject specific area teachers.

The interviews were scheduled for fifteen (15) minutes each and also based on interviewees' availability. The purposeful sampling, defined as a non-random method of sampling where the researcher selects information-rich cases for in-depth study, formed a group of eight individuals: 6 females and 2 males. The group consisted of two school administrators (Principal and Technology director) and six school faculty members (teachers). In addition, these individuals represent a range of teaching experience from 2 years to over 20 years.

Qualitative Data Collected

All interviews were conducted at the convenience of the interviewees. The questions from the

Interview Protocol (Appendix B) were asked during the interview. Prior to the start of each interview, the interviewer informed the interviewees that the interviews will be recorded and asked for verbal consent to do so for each interviewee. During the interviews, the interviewer took notes in addition to the recordings as a backup strategy and data collection source.

Each interview provided valuable information and lasted approximately between 8 to 15 minutes. The responses provided by the interviewees together with the interviewer notes and recordings were used for data analysis. All interviewees agreed to participate without anonymity but however, no real names were used in this report.

Interview Participants

The eight interview participants were identified in terms of the subject areas (Biology, Physics, Math, Chemistry, Fine Arts and Civics) that they teach.

Physics Teacher (Miss Mayfia)

The Physics teacher is a veteran teacher with over 25 years of teaching experience in Physics, Chemistry and Math subject areas. She has prior experience teaching at this school before in the mid 80's but left and rejoined the teaching faculty again since 1999. To her, teaching the abstract concepts in Physics using technology to girls is a pleasure because of the "ah ha" expressions on their faces. She takes great joy and pride in teaching Physics to the students in high school.

Chemistry Teacher (Miss JJ)

The Chemistry teacher is one of the youngest teachers (aged between 19-29) on the faculty in this school. She has less than 5 years of teaching experience and is a recent graduate from a teacher preparation program. She is very interested and enthusiastic about using technology in her instruction in every bit, shape or form. She indicates her main sources of technology training to include students, self-taught, workshops and colleagues.

Biology Teacher (Miss Ampere)

The biology teacher is a certified teacher with 6-10 years of teaching experience. Miss Ampere is a 10th grade Science teacher who received her technology training from multiple sources including college courses, colleagues and teaching herself. Miss Ampere teaches five biology classes with a class size of about 22 including 1 environmental science class with class size of 27.

Civics Teacher (Mr. Teeman)

The civics teacher is a certified male teacher with 6-10 years of teaching experience. He is one of the first teachers in the school with a leading, cutting-edge multimedia capable classroom. He teaches civics in the 9th grade for the current spring semester, 2010. Mr. Teeman indicates that most of his technology training comes from teaching himself and attending workshops.

He is very enthusiastic and passionate about using technology in his instruction and everyday life.

Fine Arts (Ms. Ranger)

The fine arts teacher is a female teacher with 11 – 15 years of teaching experience. She currently teaches courses in grades 9, 10, 11 and 12. She clearly expresses her appreciation and desire for using technology to enhance learning in her classroom.

Math Teacher (Ms Danielle)

Danielle is a female teacher with 6-10 years of teaching experience. She is a certified teacher and she currently teaches 9th and 10th grades. Danielle indicates that her major sources of technology training include the following: self taught, colleagues, training workshops and college courses.

Qualitative Findings

The interviews were analyzed within the context and research framework for this study to substantiate the findings from the survey analysis. The emergent themes from the interview data were noted and categorized appropriately based on the specific interview question asked. The use of an interpretive approach (Gall, Borg, & Gall, 1996) was adopted in categorizing the emerging themes and constructs from

the interview data. The emergent themes from the data with respect to the specific question asked are as follow:

1. <u>As a teacher and from your perspective, how significant is the role of technology integration in teaching and learning and how does this impact teacher performance evaluations?</u>

In response to this question, all the teachers interviewed responded with a "very significant or implied significant role" of technology integration in teaching and learning. The emergent themes from these responses could be categorized as Relevance, beliefs and or perceptions about technology integration for instruction:

In response to this question, JJ the Chemistry teacher said this:

> Well integrating technology into my teaching is very- very important! We use technology everyday and everywhere and so that is just the way the world is going. Technology is the way and the trend. I mean there is just no way you can teach these days without using technology. I just don't see that happening!

Miss Mayfia the Physics teacher responded to this question by saying:

> Well I'll put it to you this way! Every year, just about the end of the year we fill out an evaluation form on technology and the question is that "how would it feel if they discontinue the technology program" and my response has always been the same .I will not go back and teach it without technology. I think it impacts the way I teach and it also impacts the way the kids learn.

Responding to this question, Mr. Teeman the Civics teacher in a very calm and confident voice said;

> I mean I use it every time and without technology, I could not do half as much the things I do. I mean just having the technology available for everybody in the class is awesome, I don't have to leave the class to go to the library. We can just look up things while sitting in the class --- I mean it is very significant.

The fine arts teacher response to this question was that she could not teach her class without using technology. She continued by saying that her class uses the internet everyday and that she often uses PowerPoint slides with an overhead projection to teach the students. In addition, she noted that they [both teacher and students] work from Moodle everyday and the students accessed the PowerPoint slides from Moodle. Amongst some of the activities that the students engaged in included online tours overseas. Ms.

Ranger noted that this made it possible for the students to make these virtual tours without physically travelling to the locations. She went on further stating:

> So without this I'll have to probably have 4 textbooks so the impact is just too significant. Definitely technology plays an important role and I can say that since I started teaching here, my teaching performance has increased significantly or becomes better compared to when I started in 1999.

As for the role of Technology integration in teacher evaluations, she added "we do everything openly and the students don't even have to open books or sometimes write because we browse pages together." Both the Math and Biology teachers tendered their similar support or agreement for technology integration playing a very significant role in the teaching and learning situation.

2. Can you discuss some of the factors in the order of importance to you, which you take into consideration for technology integration into your teaching activities?

Responding to this question, this was what the Biology teacher had to say: "Yeah, I look for things that make what I am teaching more real to the kids. A lot of times, in biology, I am teaching microbiology …. That's not something they can necessarily see." Summing it up, the biology teacher was suggesting relevance of the technology in question for its intended purpose as top of her priority list for consideration in integrating technology in her teaching activities.

The Physics teacher's respond to this same question was straight to the point. She said that she uses technology everyday. She explained that she uses moodle for passing information unto the students, but generally she continued, "I'll have them open interactive physics simulations. I sometimes use interactive simulations to teach labs. We use vernier software." The Physics teacher's response to this question not quite clear in order of importance however suggested that technology should be relevant and appropriate for its intended purpose and audience.

JJ the chemistry teacher also had this to say in response to this question. "From a science perspective, use of all these new software such as Vernier, Lab pro that the students have to use."

JJ noted that in some classes it is not important but in some it is, refereeing to the use of software. She went on further to say that " but across the board, what is really important is graphing in excel, because even if you are a business major, you still need to know how to graph and a lot of them don't know how to do that. So that's something I'll like to do as often as possible." JJ also added that navigating or browsing the web, to find resources, knowing how to use Wikipedia etc., were amongst other important considerations for her in integrating technology in her teaching activities. Mr. Teeman, the Civics teacher also gives a similar response to this question like Ms JJ and Mayfia.

According to Mr. Teeman, Technology is everything from the time the kids work in the class to when they leave. He further supports his claim by saying that, "We use the TV, the internet to research, PowerPoint, and Everything I use is really electronic. I have not given them a piece of paper since the beginning of this year. I use Moodle a lot and Moodle testing." Mr. Teeman also said that the students use Moodle a lot, in particular to download PowerPoint lecture notes and they also take all their quizzes via Moodle and which gives the students immediate feedback. He concluded his response to this question by saying that the use of Moodle in particular makes his work easier and enables him to cover a lot more in less time.

The Fine arts teacher's response to this question in few words was, "Most important to me is the use of the internet. For example, looking at art works, virtual tours, and need for students to know how to backup their files and folders everyday." Her response also to this question suggests relevance and appropriate use of the technology as major considerations for integrating technology into her teaching activities.

3. <u>What are some of the major barriers that you encounter in integrating technology? Please explain</u>.

JJ's first response to this question was, "I don't know of anything .The administration is very open to anything with technology." However, she added further by saying, "But personally, basic stuff using the computer everyday which I was not used to prior to when I started teaching here." JJ was also quick to point to the fact that there were a whole lot of other things such as control key commands in Microsoft office and windows operating systems that she did not know how to use until she started teaching in this school. She concluded by saying that "There is a lot of stuff that I still don't do because I feel insecure and uncomfortable to do but I am still learning."

Mayfia the veteran Physics teacher responded to this question by considering administrative barriers and personal barriers. Considering administrative barriers to technology integration into her teaching, Mayfia's response suggested that there was none and in fact that the administration was very supportive to teachers' use of technology for teaching. Mayfia in her conclusion said this: "I really have not had any because they are forthcoming anytime I asked for it , I get and besides the man who was here before in charge of technology , was my former student but he knew that if I asked for it, then I will use it. And pretty much if you can explain how it fits into the curriculum, she let you have it."

Mr. Teeman' response to this question was: "None, none whatsoever. I am just into technology and whatever they can give me. I just make the best use of it and make it work in my class. Whatever that is needed, we get the support to use it."

The Fine arts teacher's response to this question was: "sometimes the internet speed can be slow which I don't consider a barrier at all but this can be frustrating." The math teacher also expressed similar concerns about network speeds both intranet and internet but also rated this as a minimal or insignificant barrier. However, she expressed concerns and noted that some texts that are in current use do not incorporate technology whilst there are some that come with supplementary materials such as CDROMs. She also further noted that sometimes there are minor barriers experienced with computer hardware issues but they usually get addressed in a timely manner by the technology support team (help desk) when notified.

4. Do you perceive the school environment (other teachers, technology support team, administrative staff etc.) as providing the amount of support that enables you to integrate technology more effectively into your teaching/learning?

All the teachers who took part in the interview indicated clearly the enormous support they receive from the school administration as it relates to technology integration. In addition to the support of the administration that the teachers expressed their satisfaction about, they also gave the researcher the

impression that the school support played a very important and motivating role in their various uses of technology to support instruction. Responding to this question above, here is what the teachers had to say;

> "They really treat me well and provide support for what is needed. They just installed a new Promethean active board a couple of days ago in my class and I am working my way through that and it's just awesome to work with. You can stop by my class and see it when you get a chance anytime," Says Mr. Teeman.
>
> "Yes definitely!" says JJ. JJ talked extensively about the schools' support in providing software and hardware that is needed to do the job .She made special references to the use of virtual lab software and the web link "http://eduweblabs.com/," which she said, she has used before but had to buy the software or pay for online access. However she continued, "When I started teaching here at SJA, the school bought it for me to use. With these, you can do all your graphs online and it creates a virtual lab environment. It's really cool."

Miss Mayfia on the other hand responded by saying: "For me personally, I don't really have a problem because when it is something that I want to know I play around with it until I figure it out but I still think we all lack in supporting first time teachers sufficiently in using the tools that they are unfamiliar with as far as holding their hands until they are comfortable in using it. I have already expressed my concerns in this regard to the administration and so they already know my stands or feelings about this."

The fine arts teacher Miss Ranger had this to say: "I think this school has offered us so much technology and competence such that we are willing and ready to take on anything technology related." Ranger continued, "we do curriculum mapping and cross comparing contents and curricula in different parts of the world. For instance I can see how they are teaching Fine Arts in other parts of the world. Also, we do a lot of training during the summer."

Miss Danielle the Math teacher also responded by saying, "They almost require it so they definitely give us the tools and support to make sure we use it. We definitely get the training that we need.

When there are workshops outside the school, you ask to go, they support you."

Miss Ampere in very few words had this to say: "Yes, I don't have any problems. If there is something new or a new technology such as a program, I know exactly who to go to, or there are people I can go to for help."

5. Technology is rapidly changing as we know! Do you consider yourself adequately prepared to meet the challenging needs for technology integration in the future?

While all the interviewees indicated their varying levels of preparedness in meeting the challenging needs for technology integration in the future, some also cautioned that technological changes are very dynamic and as such, this makes it difficult to keep up with. However, another message that emerged from their responses in spite of keeping pace with technological changes was the overall willingness to learn and use new technologies relevant to the teaching/learning situation as they unfold. Listed below are some of the responses to the above stated question.

JJ, the young enthusiastic chemistry teacher replied by saying, "Well I can say I am adequately prepared because you know it is difficult to keep up with every new technology but however, I can say that I am very willing to learn the new technology as it relates to my teaching and learning situation.

Miss Mayfia while maintaining her appreciation for the use of technology clearly makes the point that to her, technology should be used as a relevant tool for its intended purpose and "not for the sake of technology as she put it." In her response, here is what she had to say.

> You know as it comes from all corners, I don't have to look too far in the future as I am close enough to retirement. You know my students tease at me that I don't have a cell phone and I don't have a cell phone because I don't want to be carrying a cell phone. So why would I want to be carrying a cell phone so that people could be calling me all day and I don't have time for that. If I want to talk to somebody, I'll call them. I am not on face book and no social network so why do I need a cell phone. So my students find it funny that I play with all these technology in class but then I don't have a cell phone. To me technology is a very good tool and my computer is an excellent tool and it makes my life much easier and I don't have to deal with paper no more. Mr. Teeman in a very calm and confident voice said, "I just try to embrace technology as much as possible and whatever works, I try to keep it while I look forward to new technologies."

Miss Ranger responded by saying, “I think the school has provided us with enough background to be able to learn any software and to do a whole lot of things such as backing up our materials on the network drive, downloading and installing hardware such as printer drivers, how to transfer files and more. So we just continue advancing in technology every year.”

Miss Danielle in a very excited state responded by saying, “Bring it on! I am ready for it! Yea I am ready every day. They just got a new Promethean board upstairs and I said to them, the next one should go right in my classroom! It is a multimedia projector with interactive touch screen capabilities.”

Miss Ampere the biology teacher said that she was very prepared and has always been willing to play with a new program or something and just play with it. She continued, “I know that is the only way you can ever get to know how to use a new program.

Qualitative Research Questions

RQ7: How does the level of school support influence teachers’ attitudes toward use of technology in their instructions? From the teachers’ responses to the interview question-4 in the preceding section, there is evidence suggesting the following:

a. School support plays an important and influential role in teachers’ attitudes toward use of technology in their instructions to enhance students’ learning. The results reveal that when teachers are sure of support from the school administration in their use of technology, they are more inclined to use or integrate technology into their teaching compared to when there is a lack of support in any shape or form.
b. School support also leads to influencing teachers attitudes positively to use technology for teaching and learning and in the absence of school support, some teachers potentially use this as a barrier for not using technology.
c. School support in the form of providing the needed technology infrastructure, hardware and software, training and just in time technical support are very critical to the successful and effective technology integration.

d. All the interviewees admit to the fact that the school takes significant steps to meet their needs as a group and also at the personal level when brought to the attention of the administration.

RQ8: What are the barriers that teachers encounter in their use of technology and how do they address these barriers in order to effectively integrate technology in their instructions?

The results from the interview question-3 suggest the following:

a. Teachers do experience moderate barriers that can be characterized as internal or personal barriers such as anxiety and comfort level in using a specific technology for the first time, different learning styles, and issues that have to do with the individuals themselves.
b. External barriers experienced by teachers as noted in the interview mainly point towards technical and operational issues with regards to hardware and software uses, which are expected as some do acknowledge.
c. However, with the exception of one teacher who voiced concern about how to bring new and inexperienced teachers onboard in effectively using technology, most teachers seek help from colleagues and the help desk as needed or they know exactly where to go for help. The teacher, who expressed her concern for the way other new and inexperienced teachers are treated, takes the position that it is a collective responsibility by both staff and school administration in general to ensure that new and inexperienced teachers get the necessary help to be able to effectively integrate technology into their instruction. While she was not suggesting that these newly welcomed inexperience teachers were not getting support at all, she was just expressing her passion about wanting to see other teachers get onboard the technology integration train as fast and safe as possible with less anxiety and stress.

Interview Report for the Principal

The interview protocol (Appendix-B) for the school principal included five questions. The school principal is also the school technology team coordinator. The principal's response to the interview questions are listed below as follow:

1. Can you please comment on the role of technology integration in the recruitment of teachers in your school?

The principal was very brief and precise in responding to the questions asked. With regards to the first question, the principal explained that the school administration rewrote the school curriculum to include technology as a tool. The principal noted that as new teachers are recruited, they are mentored by other veteran teachers who have been in the classroom for a reasonable period of time and posses the experience working with technology in the classroom and the curriculum in general. She further explained that in the recruitment process for teachers, the teachers are asked during an interview about their comfort levels with technology and their willingness to learn and partake in training programs. The principal states that the willingness on the part of teachers to learn and take part in technology training sessions or programs was considered more important than skills already acquired. In her word she states that, "We encourage them to find what works for them and use it. Basic skills are important, but the desire to incorporate is more important."

2. What role does technology integration play in the teacher performance evaluations?

Responding to this question, the principal had this to say. "We expect our teachers to use technology and in a performance evaluation we ask what works for them. Each teacher uses technology different and we want effective use."

3. In your opinion, do you think technology integration does have any impact on students' achievement? Please explain.

The principals' response to this question clearly indicates that she not only believes that technology integration has a positive impact on students' learning but also, the overall performance of the school reflects that view and belief. In her response, here is what she had to say. "Our students excel because they have technology as a tool to support their learning. They are comfortable and encouraged to use what works for them. We hear stories about when they go to college or university they often help others who do not know

simple things like Moodle, Excel, Turnitin, etc. Yes - it can't be measured but it makes a difference."

4. Can you please comment on any barriers in relation to technology integration and how you go about addressing these barriers if any?

The principal clearly acknowledges that barriers do exist which prevent teachers from integrating technology into their instruction. She also makes the point that the use of technology plays a significant role in addressing various learning needs. The principal clearly identifies teachers' fear and anxiety towards the use of technology as a potential barrier that can be seen as resentment. In her words, she said, "Teacher fear that can be seen as resentment. We feel that we all have different learning styles - the tablet enables a student to write or type, draw. I have a teacher who does not want students to use computers to take notes. I have students upset because they type faster than they write - students need options to learn best. We address individual issues as they come up."

5. What are your future plans for technology integration at your school?

In response to this question, the Principal had this to say; "We like to stay on the cutting edge - that is why we have tablets - we will look at what comes next and see how it fits with our situation."

Interview Report for Technology Coordinator

The interview with the technology coordinator was the last interview in a series of interviews conducted at the research site. The interview was conducted using an interview protocol that comprised of five questions which were open ended in format to give the interviewee the opportunity to give more in depth responses necessary in further explaining and understanding the reasons for the observed levels of technology integration by teachers in the school. The interview lasted for about 30 minutes. The technology coordinator is a male teacher and administrator in his late 40's with atleast 10 years of experience teaching and serving the school in this capacity as a technology team leader. Mr. Barnard, the technology coordinator was very willing, enthusiastic and excited to participate in the interview. The responses to the interview questions are included below.

1. Do you have adequate technology support staff to meet the needs of both teachers and students?

   In responding to this question, the technology coordinator, Mr. Barnard first of all gave an overall description and composition of the technology staff and team. The technology team he said comprised of a network administrator, an applications manager, applications specialist, help desk manger, help desk assistant manager and technology coordinator ,all playing different and key roles in this whole process. As head of the technology team, Mr. Barnard described his role as follows: "My job is overseeing all these departments and in particular making sure how all this technology fits into the curriculum, and how we manage all the IT across the campus." So back to your question he continued, "Yes, we do have a working staff and team with enough support."

2. With respect to your job responsibility as a tech coordinator, what are the most significant and least significant problems that you encounter with teachers in their use of technology?

   Amongst some of the problems that Mr. Barnard discussed included the following:

   a. Lack of Confidence on the part of some teachers in learning to use technology as a tool. Mr. Barnard said that although this was really not a very major barrier, it however does affect teachers in their use of technology. In his words he had to say this; "I will say the lack of confidence in learning these tools. Anyone comfortable with using tools knows that new tools come out daily and if you are not comfortable using these tools, then that is a huge problem."
   b. Mindset of teachers and the old school thinking: Mr. Barnard stated also that another problem encountered with regards to teachers' use of technology is "the Mindset of the teachers." Explaining this further he added, there are some teachers (so called "old school") that are resistant to change or have the tendency to resist change! He went on further to explain that changing that mindset of "why do I have to change my old ways when it is/was working" can also be partly explained by lack of confidence to try new tools. He maintained that for those teachers who are still living in their own world of 20th century technology, their roles as teachers still lends itself to a more teacher centered

learning environment as opposed to a 21st century classroom where in the teacher should play the role of an enabler , while the students take more control of their learning.

c. Internet Security Issues: Mr. Barnard stated that although this was far less significant or on a small scale, Virus control was amongst issues that were encountered with teachers' use of technology. He said the students in comparison to the teachers have more security awareness and take greater responsibilities for fixing their own problems in this regard. However, some teachers on the other hand fail to respond appropriately to security threats on the internet without the intervention of tech support in the school.

d. Data backup problems: backing up data as a security or safety measure for teachers and students is a huge problem as described by Mr. Barnard. However, this problem was more prevalent amongst teachers compared to students. Addressing this issue, Mr. Barnard stated "We teach the students how to image their drives and backup their files. We put the onus on them to take control of what they are doing. This is not the same for teachers." He continued by saying that administrative privileges or rights were given to both students and teachers to manage their own laptops or Tablet notebooks but while students did very well at this, teachers he said did not do as much. He added, "Backing up is a huge problem on the network. Students generally value the importance of this and so they use other means such as jump drives , USB drives , External drives ,SD cards etc ., but again, teachers generally don't." we can't afford to have everybody store all their files on the network for legal reasons and for storage constraints, he said.

Mr. Barnard ended the discussion by saying, "The one thing we try to preach to the teachers is that we are very lucky to have these kids who know how to use these programs and we try to use the students as part of the system for the teaching process."

3. <u>With respect to your job responsibilities as a technology coordinator, what are the least and most significant problems that you encounter with students in their use of technology?</u>

Mr. Barnard's response to this question is as follow: "Students I think probably multitasking is the biggest thing to keep an eye on and if multitasking is defined by doing many things at one time, then they can multitask, but are they learning at the same time is our responsibility and concern." Mr. Barnard expressed the concern that while multitasking is encouraged, however there was the concern about measuring the usefulness or effectiveness of the tool. He summarized this by saying that, "trying to make sure that the educational software packages work in conjunction with everything else that the students are doing out there is very challenging."

Another problem he highlighted was that of the great challenge involved in meeting the care needed for most of the equipment, hardware and software that are used which run into couple of thousand dollars , for example the Tablet notebooks. With specific reference to the Tablet notebooks, Mr. Barnard said that these cost roughly between $1500.00 to $2000.00 per unit. He went on further to say that considering a network of about 1200 users with tablets and other PC's, taking care of the network operations was very challenging in itself.

Mr. Barnard also stated that there was a sudden surge in problems reported at the help desk every time following most celebrated holidays such as Mardi Grass, Christmas break etc. He said it was not unusual for one to see about a 100 or more students showing up with computer related problems immediately following the break after Mardi grass for example. He concluded by saying that, meeting these unusual demands during such times is very challenging on the technology team in general and the tech support staff in particular.

4. What is/are your perception of teachers' use of technology in this school to enhance teaching/learning?

In discussing his perceptions about teachers' use of technology in the school, Mr. Barnard noted that more teachers were seeking out teaching positions in the school than the school looking out to recruit teachers.

In other words, he was suggesting that there was an influx of teacher applications in comparison to the limited number of faculty positions that the school had to offer.

"With an increasing number of younger teachers graduating from college and with better technology integration skills, they are kind of more attracted towards this school because of the technology resources that we offer. Also with the newer teachers, they are generally more receptive to the new technologies and so we spend less time in training them as long as we are available to help them when they are in need of help," said Mr. Barnard.

He continued by saying that, that was the trend that is seen in new teachers. He further noted that with older teachers, the school spends about 80% of the time helping the same teachers (about 1 or 2) over and again. The same old teachers he was making reference to, he said, had been identified a very long time back. He went on to further state that," while there is the feeling that all teachers at this time in the school are using technology like they should, there are a few who like other teachers in other schools that are just not doing enough or as expected. The primary reason he said associated with that is due to fact that these teachers might have been teaching the same courses over and again for decades and as such, they see no need to change their old ways.

Nevertheless he said, "We do have a great majority of our teachers who are on board." For those few teachers who are resistant to change or otherwise, "we can't throw them out! We only have to deal with them in a different way. "For the rest of the teachers, we try to hold them accountable to the same standards."

He also added that Professional development is the hard part. "I don't want to teach every teacher the same skills but rather focus on the individual needs of each teacher and this is done through classroom observations. That way we don't waste resources in time and money teaching what some of the teachers already know," he said.

5. <u>What are your future plans concerning the use of technology in this school?</u>

Going forward Mr. Barnard said that they (the school administration) are looking at various learning styles for their students and that is the primary focus this year. He suggested that the different learner characteristics and learning styles require different needs and ways to address those needs. He added that how they can use the different learning styles to apply back to the classroom situation was very important. For example he said, "We feel like teachers now, a lot of students now like to listen to their iPods." Last year

he said, we had several of our teachers (about 5 teachers) suggested recording their lessons and podcasting these lessons so the students use their iTunes to download the Podcasts unto their iPods.

Moving on from this point he suggested, the trend is to tap into the useful potential of Social networking sites as this is the place where the kids as well as adults hang out. There are security and legal issues associated with the use of the Social networking sites but at this point, has anyone one thought about teaching the kids the dangers of using social networking sites and so on he asked. He argued that although he does not expect lectures or lessons meant for the classroom to be delivered via Face book or MySpace and other networking sites, he believes that the kids are sharing common interests and information using these media channels. So my point is, he said, "why not look into this for its learning values for the kids?"

Mr. Barnard after this long conversation left the interviewer with the overall impression that "technology integration is here to stay and is all about the learners, meeting their learning needs and used as a tool by the teachers to enhance learning.

Summary of Interview Findings

The interview results indicate that most teachers do believe that technology does play a significant role in teaching and learning. With regards to the impact of technology integration on teacher performance evaluations, some teachers do agree that their rate or level of technology integration does influence their performance evaluations while others do not because they consider technology integration as non mandatory.

Addressing the question factors that teachers take into consideration for technology integration into their instruction, the emergent theme resulting from the interview data clearly points in the direction of "relevance and appropriateness of the technology to enhance students learning." In all responses to this question, none of the responses whatever suggested that teachers wanted to use or integrated technology just because it is available.

In relation to barriers faced or encountered by teachers when they start to use technology in their instruction to support students' learning, all the responses clearly suggest that teachers individually

experienced moderate barriers toward technology integration. However, most of the barriers described or identified were considered to be personal barriers and not institutional barriers. The teachers overwhelmingly acknowledged that they do enjoy or have the full support of the administration for technology integration.

On the question about teachers' perception of the school environment as providing the amount of support that enables them to more effectively integrate technology into their teaching and learning, the responses again clearly suggest a very supportive working environment. Most of the teachers also indicated that they received a lot of support from colleagues and some said that they learnt a whole lot and received support from the students. The teachers were all in total agreement about the 100 percent support that they receive from the school administration with regards to technology integration.

All the teachers from their responses indicated varying levels of preparedness for meeting the needs for technology integration in the near future. However, one thing that clearly stood out or emerged from this discussion is that, the teachers are very willing to meet the challenging needs of technological changes and more importantly ready to learn how to integrate new stuff that will enhance students' learning.

The interview with the principal suggested the following:

- The school administration believes that appropriate use of technology enhances students' learning.
- The school encourages and promotes the use of cutting edge technology that works and enhances students' learning.
- Support for teachers to use technology as a tool for as much as possible for the purpose of enhancing students learning.
- School environment is very student centered.
- The principal is aware and acknowledges the presence of moderate barriers that impact technology integration for teachers into their instruction.

- Feedback on teachers' use of technology comes from multiple sources such as students, colleagues, informal observations and teacher performance evaluations.

According to the technology coordinator, there is adequate technology support staff in the school to address the technology needs of the school. The technology support team comprised of the technology director, technology integration specialist, technology projects manager, applications specialist and help desk supervisor.

With respect to the tech coordinator's job responsibility, the most significant and least significant problems that are encountered with teachers in their use of technology include the lack of confidence by some teachers in using technology, security issues with regards use of technology, data backup problems and resistance to accept changes (mindset of some teachers).

There are definitely problems experienced in relation to students' use of technology. The significant problems listed included ways of determining the usefulness and effectiveness of the technology tool used as it relates to impact on students learning and maintenance or tech support issues for running the technology program in general.

About the perception of teachers' use of technology to enhance learning, Mr. Barnard believes that a great majority of the teachers in the school are using technology as expected notwithstanding the personal barriers that they experience. In addressing the question of the schools' future plans for technology integration, Mr. Barnard strongly believes that the answer to this question should be viewed in the light of relevance, appropriateness and above all, what works best in the interest of the students.

Field Observations

The researcher made multiple visits to the research site on different occasions and different times. As part of the research agenda for the qualitative data collection process, the researcher visited the research site for direct field observations. The field observations were focused on observing teachers' use of technology in the classrooms for instructional purposes. It is important to note that not all teachers and classrooms were a

part of the field observation. The selection of teachers for the observation was purposeful and it only included teachers that were interviewed.

Each teacher was observed twice at different times for a fifteen minutes period. The observations were done following the interviews on different schedule days for each teacher. The role of the observer in the research setting was absolutely a non-participant role. Prior to the two 15 minute observation sessions in each of the selected classrooms, the observer also made preliminary classroom observations to familiarize himself with the classroom locations and more importantly to establish an informal acquaintance with the students. The researcher considered the preliminary visit a necessary move in order to prevent any distractions to students in subsequent visits.

Findings of Classroom Observations

The findings of the classroom observations are listed below.

- In all the classrooms, all the students had a tablet notebook that they used for note taking. In some classes, some students worked into the classroom with their IPod headphones plugged into their ears. Although nearly all students had pens and pencils for writing, the observer did not find any students using a pen or pencil for note taking.
- The observer also discovered that Moodle was the main course management system in use by all teachers in the school. Most of the teachers upload lecture notes on Moodle for the students to access in class or at home. PowerPoint presentation was the most popular mode of note and information presentation in all classrooms.
- In the civics class, the observer witnessed two sets of students in different civic classes take a quiz via the internet on American citizenship. All the information and instruction for the quiz was hosted on Moodle. After the students completed taking the quiz, the teacher then continued with his normal lectures using the newly installed Promethean active board. The teacher for illustration purposes briefly demonstrated some of the features of the Promethean active board.

- In the hallways, it was not uncommon for the students to work around, playing or using their tablets, iPods and Iphones. Students were seen texting in the hallways or using their phones.
- In the physics and chemistry labs, the kids were using interactive software like Vernier Pro and some other interactive websites for their data analysis. The teachers in these classes absolutely played the roles of facilitators.
- In all the classes observed, the researcher noted that all the teachers were no longer using paper copies of lesson plans. In one of the classes, the teacher told the observer that with present day technology, there was no need for teachers to be working around with binders of lesson plans. The teacher went on to say that this was an obsolete way of doing things when it can be done using Moodle or PowerPoint for example. The teacher finally confirmed what he was saying by showing me the lesson plan which was previously used in a PowerPoint format.
- All classrooms were equipped with AV equipment such as televisions, slide projectors and overhead projectors.

Chapter Six: Discussions and Conclusions

This study was designed to address teachers' use of technology at a gender specific private school in the South. The main goals of the study included identifying the extent to which teachers use technology to promote student learning in the school and also examining the relationship between teachers' beliefs, attitudes, perceived barriers to technology integration, anxiety towards use of technology, self efficacy and overall use of technology. The study also sought to identify the demographic characteristics of teachers in the school and further get an understanding of reasons for the observed levels of technology integration.

In addition, this study aims to contribute to the current body of knowledge pertaining to successful technology integration practices in technology-rich private schools in general. The study has the potential to help school administrations in identifying areas of need for professional development for teachers based on identified negative attitudes, barriers to technology integration and anxiety experienced by teachers as they use technology in their instruction.

The research within this study employed mixed- method (the use of both quantitative and qualitative data) in order to provide a variety of data to analyze. The results from this analysis allowed the researcher to draw conclusions based upon these findings and to offer future researchers with suggestions for additional research in this area. This chapter will address and include: (1) discussion of the research findings, (2) research questions revisited, (3) recommendations for similar school settings (4) implications for future research, and (5) conclusions.

Research Findings

Throughout this study, relevant data were gathered in order to assist with addressing the proposed research questions. The survey provided quantitative data that mainly addressed and illuminated the descriptive demographic characteristics of the teachers as well as identify the different levels of technology integration.

The data suggested that both the teachers and school administrators do believe that the use of technology does have an impact on students' learning and they both understand the importance of using technology to enhance students' learning. Although the demographic statistics indicate that atleast 90 percent of the teaching staff are females, this study did not consider gender as a factor in determining the extent of technology adoption by teachers. Both the qualitative and quantitative results suggest that teachers experienced very moderate barriers and anxiety in their use of technology which impacted their level of technology adoption. However, the barriers to technology integration experienced by the teachers were mainly identified as personal barriers.

Vannatta and Fordham (2004) found that the commitment of time to teaching, the willingness to change, and the amount of technology training are the best predictors of technology use. With regards to technology adoption, the results of this study indicate that both the teachers and the administrators recognize the important role of the willingness on the part of teachers in promoting technology integration for enhancing students' learning. The principal stated that the willingness on the part of the teachers to learn new skills for technology integration was of more importance to her and also played a very significant role in the teacher recruitment process. In other words, she was suggesting that "willingness to learn new technology skills" by teachers was more important to her than "already acquired technology skills."

Technology Availability and Training

Kotrlik and Redmann, (2008) identified the availability of Technology and Training as one of the variables related to technology adoption. Research has shown that adult learners, when properly trained on how to use technology are highly motivated learners that are capable of absorbing both the content and technological skills necessary to succeed. (Source: http://ic.sjsu.edu/mjportfolio/found/AdultLearnersAndTechnology.pdf).

The results from this study show support for the above statement. A great majority of the teachers in this school received their technology training from multiple sources including, workshops, colleagues,

self-taught and college courses. The results show that with the proper level of training in using specific technologies, the teachers are quite confident and motivated in the use of technology as a tool for enhancing students' learning. As suggested by both the teachers and the administration, the school as part of its priority and obligation provides teachers with the necessary support with regards to availability of resources and training in general.

Technology Culture and Integration

The study also indicates that technology integration has been a part of the school culture for the past 15 years. Asked, what are some of the reasons that you use technology to support your teaching, one teacher responded saying, "I teach at a laptop school. The use of intensive technological integration has been emphasized here for the last ten years or more." Another teacher responded to the same question saying, "It is part of our school culture. It cuts down on wasting paper and it makes life easier for me and the students." Responding to the same question, another teacher said, "This is the main way that the students understand the world today - I am only trying to reach them on their own level in a manner that they are comfortable."

Thus the technology culture of the school also suggests a potential reason or explanation for the level of technology adoption by the teachers and their attitudes towards the use of technology. New teachers are welcomed on board with the mindset and expectation that the school is a technologically- rich environment and as such, that notion stays within them as a driving force for the use of technology into their instruction to enhance students' learning. This also helps in part to explain why the teachers maintain or develop positive attitudes toward the use of technology to support learning.

Basic Needs and Skills

The data for this study suggests that all the teachers' basic needs and skills were all addressed in a timely and appropriate manner that reflected their overall satisfaction in relation to the school support system for technology integration. Most of the individual needed skills by teachers were addressed on a personal basis by the technology support team, colleagues and students as the case may be. Both the school principal

and the technology coordinator/director recognized the individual needs and skills of the teachers but also expressed support for these teachers in the form of one-on-one training sessions, mentorship from colleagues and training workshops. Professional development on a large scale is adopted whenever a new innovation or technology resource is introduced for mandatory use by all teachers. According to the school administration, such large training sessions are often scheduled in summer and or done in phases with multiple groups of teachers.

Teaching Experience and Technology Skills

Kotrlik & Redmann (2005), noted that today's teachers leaving teacher training programs, are often uncomfortable with technology, unable to effectively integrate it into their teaching, and thus not providing students with the positive experience and exposure they desperately need. Mumtaz (2000) reported that a lack of teaching experience with technology was a factor that resulted in teachers avoiding the use of technology. Analysis of the data in this study indicate that teachers aged between 19 and 29 with less than 5 years of teaching experience adopted or used technology less on a regular basis compared to those aged (30-39) with 11-15 years of teaching experience. This result is consistent or supported by an NCES study reported by Smerdon et al., (2000). The NCES (2000) study reported that teaching experience was related to the extent to which technology was integrated into schools. Thus this study illuminated the different levels of technology integration by teachers in the school and in particular, the difference in technology adoption by teachers based on teaching experience.

Research Questions Revisited

This section of the study focuses on the conclusion of the research questions based on the findings. Demographic characteristics of the teachers include the following:

Gender: The data suggest that 8% of the teachers were males and 92 % females.

Age: The ages of teachers in the school ranged from 19 to 70 years. Most of the teachers were aged between 30 and 39. The age distribution is shown in Table 4.10.

Teaching Experience: The distribution of the teachers' years of experience is shown in Table 4.11. Most of the teachers (32%) reported 20 and more years of teaching experience followed by 26% with under 5 years of teaching experience. Twenty four percent (24%) of the teachers also reported having 6-10 years of teaching experience.

Teacher Certification Status: The study revealed that approximately 69 % of the teachers are certified while 31% are uncertified.

Sources of Technology Training: the study identified 4 major sources of technology training for teachers which include; self taught, workshops/conferences, college courses, and colleagues. Other sources of technology training for teachers as suggested by the survey results include students, professional development by the school, friends, family members and training from high school computer classes/courses. Seventy Eight percent (78%) of the teachers stated that they got their technology training by teaching themselves (self taught), whilst about the same proportion (76%) of teachers claim that they received their technology training from workshops/conferences and colleagues.

Research Question 1: What is the extent of technology exploration and experimentation by teachers in using technology?

The exploration and experimentation scales included five (5) and nine (9) items respectively using an anchored scale. The scales are anchored from "1 = Not like me", "2 =Very little like me", "3= Somewhat like me", "4 = Very much like me", and "5 = Just like me." The scale mean for the experimentation scale is M= 1.68, SD= 1.049 (Table-4.1a) which described the group as "very little like me." The lowest rated item on the experimentation scale was "I am just now considering incorporating technology into my classes," (M=1.54, SD=0.968). The highest rated item on the experimentation scale was "I am just beginning to use technology to involve students in games or simulations," (M=1.72, SD =1.077). The exploration scale mean is (M=3.17, SD =0.903), (Table 4.10b). The lowest item scored on the exploration scale was "I purchase books or other materials that can help me to integrate technology in my teaching", (M=2.41, SD=1.273). The

highest rated item on the exploration scale was "I talk with my principal or fellow teachers about using technology in my instruction", (M=3.77, SD=0.805).

Research Question-2: What is the extent of technology integration and adoption by teachers in using technology?

The level of technology integration and adoption were measured using the technology integration and adoption scales (Table 4.2a & 4.2b) respectively. The scales comprised four (4) and sixteen (16) items respectively on an anchored scale. The scales are anchored from "1 = Not like me", "2 =Very little like me", "3= Somewhat like me", "4 = Very much like me", and "5 = Just like me." The anchors for this scale range from; "Not like me = (1.0-1.49)", "Very little like me = (1.5-2.49)", "Somewhat like me = (2.50-3.49)", "Very much like me = (3.50-4.49)", and "Just like me = (4.50-5.0)."

The integration scale mean and standard deviation were respectively M= 2.89 and SD=0.984. The least item mean score on the integration scale was "I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals or at other locations (other classes, other schools, other states or countries, etc.)" with a mean of M=2.47 and SD=1.276. The item "I often require my students to use e-mail to complete their assignments" was rated with the highest mean score of M= 3.49 and SD=1.102.

The Technology Adoption scale mean and standard deviation were respectively M= 3.81 and SD=0.884 which the teachers indicated as "very much like me." The least mean item score on the integration scale was "I am more of a facilitator of learning than the source of all information because my students use technology" with a mean of M=3.52 and SD=0.992. The teachers indicated this item mean as "very much like me." The item "I expect my students to use technology to enable them to be self-directed learners" was rated with the highest mean score of M= 4.17 (very much like me) and SD=0.724. In addition, for this scale, the teachers indicated every item mean as "very much like me."

Research Question-3: What is the level of self efficacy exhibited by teachers in using technology?

The level of Self efficacy was measured using the Self efficacy scale (Table 4.4) which comprised four (4) items on an anchored scale. The scales are anchored from "1 = Strongly disagree", "2 =Disagree", "3= Undecided", "4 = Agree", and "5 = Strongly Agree." The anchors for this scale range from; "Strongly disagree = (1.0-1.49)", "Disagree = (1.5-2.49)", "Undecided = (2.50-3.49)", "Agree = (3.50-4.49)", and "Strongly Agree = (4.50-5.0)."

The mean and standard deviation for this Scale were respectively M= 3.598 and SD=0.578. The least mean item score on this scale was "The other teachers in my school would say that I am one of the best teachers at this school" with a mean of M=3.33 and SD=0.625.

The item "I am highly effective in teaching the content in my courses" was rated with the highest mean score of M= 4.24 and SD=0.560.

Research Question-4: What is the level of technology anxiety amongst teachers when seeking to use technology?

The anxiety teachers feel when they think about using technology in their instruction assessed using the Technology Anxiety Scale which included 9 items (Table 4.5) using an anchored scale (1=No Anxiety, 2=Some Anxiety, 3= Moderate Anxiety, 4=High Anxiety and 5= Very High Anxiety). The results indicate that teachers experienced some anxiety as they integrated technology in their instruction. The scale mean and standard deviation (Scale M=1.896, SD= 0.643) and all item means were in the some anxiety range. The highest level of anxiety was recorded for item "How anxious do you feel when you avoid using unfamiliar technology?" with a mean of M=2.37and SD=0.929. The least anxiety levels were reported for the items "How anxious do you feel when you are faced with using new technology?" and "How anxious do you feel when someone uses a technology term that you don't understand?" with item means M=1.73 and SD= 0.785.

Research Question-5: Do barriers exist that prevent teachers from using technology in their instruction?

The barriers to integrating technology in instruction scale was used to measure the barriers that may prevent teachers from integrating technology in instruction. This anchored scale comprised of 9 items (See

Table 4.4). The anchors include: (1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier and 4 = Major Barrier). The scale interpretation ranges include: Not a Barrier = (1.00-1.49), Minor Barrier = (1.50- 2.49), Moderate Barrier = (2.50-3.49) and Major Barrier = (3.5-4.0).

Overall, the teachers experienced minor barriers in integrating technology into their instruction as suggested by the results (M=1.51, SD = .411). Teachers experienced a wide range of minor barriers on the items "Availability of technology for the number of students in my classes", "Availability of technical support to effectively use instructional technology in the teaching and learning process" and "My ability to integrate technology in the teaching and learning process." The least rated minor barrier was –"Availability of technology for the number of students in my classes" (M = 1.10, SD = 0.467). The most rated barrier was, -"Enough time to develop lessons that use the internet, computers, or other technology in the teaching/learning process (M=2.35, SD=.969)." These results were also supported by the findings from the interview data.

Research Question-6: Do teachers' demographic (age, gender) and other personal variables (certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to technology integration) explain any variance in teachers' technology adoption?

This research question was addressed by using a forward regression method to determine if selected variables explained variance in technology adoption (Hair, Black, Babin, Anderson, & Tatham, 2006). The dependent variable for this analysis was the mean of the Technology Adoption scale. Potential explanatory variables included age, certification, teaching experience, training sources, anxiety, self efficacy and perceived barriers to Technology

The regression analysis showed that only two variables (Table 6a) i.e., Barriers to Technology Integration and Technology Anxiety were significant predictors in explaining the variance in Technology Adoption (Total $R^2 = 0.40$). The regression model suggested that Technology Adoption increased as teachers experienced fewer barriers to technology integration and less anxiety levels towards technology integration.

The interpretation of the R^2 is that 40% of the variance in the dependent variable (Technology Adoption) can be explained by a combination of the anxiety towards use of technology and perceived barriers to technology integration.

Research Question-7: How does the level of school support influence teachers' attitudes toward use of technology in their instructions?

The results from this study indicate that teachers' level of technology integration is greatly influenced by the level of support received from the school administration and other teachers in general. Although the teachers expressed minor barriers towards their use of technology, they however did express their satisfaction with regards to the role of the school support they receive for the use of technology in their instruction.

Research Question-8: What are the barriers that teachers encounter in their use of technology and how do they address these barriers in order to effectively integrate technology in their instructions?

All the teachers expressed that they do experience minor barriers which are characterized more as personal barriers than institutional barriers. Barriers relating to technical support and availability of resources were considered to be very insignificant and teachers addressed those by seeking help directly from the school support system and their colleagues.

Recommendations for Similar School Settings

Based on the results of this study, the following summarizes the recommended practices to ensure that teachers in particular and administrators continue to obtain the skills necessary to be effective users of technology in order to enhance students' learning:

1. Technology training and availability should be based on a needs assessment system which should be done say about three times a semester to provide administrators with the kinds of feedback necessary to address technology needs of the teachers.

2. School administrations should endeavor to provide and equip every classroom with basic teaching multimedia technology tools so that teachers don't walk into a classroom without the relevant tools which gives them the scope to make excuses for not using technology to support their instruction.
3. Technology support staff or teams should always be provided or available during school hours. This is very necessary in order for teachers to be confident in using the available technology with less fear or anxiety that any failures or breakdowns of the technology tools will not lead to the destructive interruption of their lessons as planned.
4. School administrators should be able to not only provide the technology tools required for teachers to adopt or make use of, but they should be also capable of demonstrating the competence and willingness to use these technologies themselves.
5. The school administration should clearly establish and communicate a collaborative technology vision for their school and establish a learning community at their school which supports and promotes learning communities that nurture the use of technology in the educational setting to enhance students' learning and overall productivity.

Implications for Future Research

As this study moved beyond research on current technology skills and levels of integration of teachers in a religious all girls' private school setting, further research is needed to investigate the role of gender and attitudes as it relates to teachers' level of technology integration in a mixed private school setting. Clearly from the results of this study, the study did not take gender into consideration as a factor that relates to the level of technology adoption because less than 10% of the teaching staffs were males.

Another interesting direction to look at for future research is to compare the level of technology adoption across different age groups and teaching experience backgrounds using a one way ANOVA test. Research addressing these questions of differences in the level of technology adoption by age groups and years of teaching experience can help shed more light on what specific target groups of teachers that need

help in the form of technology training or professional development. In addition, future research in the same direction might want to consider different levels of technology adoption between groups of teachers based on different subject specific areas.

Additional insight into addressing the perceived barriers to technology integration using a more qualitative research approach in future research will also be very helpful in order to increase the level of technology adoption by teachers.

Conclusions

Technology is rapidly changing everyday and gradually making its way into our classrooms. With the power of the internet and social networking sites slowly creeping into the classrooms, teachers must take advantage of these innovative technologies to reach the students in ways that will enhance students' learning. As technology in this school has been ongoing for over a decade, teachers should continue to not only use existing technology but be more willing to learn how to use new technology making its way into the classroom to enhance students' learning. On the part of the school administration, administrators should continue to support teachers' training needs and provide relevant technology needed by teachers for the effective use of technology in the classrooms. Furthermore, the results of this study suggest that training needs of teachers can be formally identified by doing a needs assessment evaluation atleast twice per semester period. This study thus provides a springboard for future research and an insight on the level of technology adoption by teachers in this school.

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Appendix A
Survey Instrument

Survey Instrument

Levels of Technology Use (TIS©2005

The purpose of this survey is to determine how instructors are using technology in the teaching and learning process. In this survey:

- **Teaching / Learning Process** is defined as "The Implementation of instructional activities that result in student learning."
- **Technology** Is defined as "Instructional high-tech media such as computers (e-mail, internet, listservs, CD-ROMs, computer based software, laser disk players, interactive CDs) and digital imaging (digital cameras, Scanners and digital video).
- **Technology Integration** is defined as "Employing technology to support, enhance, inspire and create learning."

1. **Exploration- Thinking about Technology** (Options; (1) Not Like me at all, (2) Very little like me, (3) Somewhat like me, (4) Very much like me, (5) Just Like me)
   (1) I want to take a course to learn how to use technology in the learning /teaching process.
   (2) I talk with my principal or fellow teachers about using technology in my instruction.
   (3) I read about how I can use technology in my teaching.
   (4) I attend conferences or workshops on how to integrate technology in my teaching.
   (5) I purchase books or other materials that can help me integrate technology in my teaching.

2. **Experimentation – Beginning to use technology**
   (1) I am just now considering incorporating technology into my classes
   (2) I am just beginning to use presentation software (eg., PowerPoint) to teach lessons.
   (3) I am just beginning to use the Internet to find information or materials for my lessons.
   (4) I am just beginning to use instructional exercises that require students to use the internet or other computer programs.
   (5) I am just beginning to use technology to involve students in games or simulations.
   (6) I am just beginning to experiment with ways to use technology in the classroom.
   (7) I am just beginning to rearrange my classroom or laboratory to accommodate technology.
   (8) I am just beginning to require my students to use the internet to complete some of their assignments.
   (9) I am just beginning to assign students to use technology to do content related activities.

3. **Adoption – Using Technology Regularly**
   (1) I discus with students how they can use technology as a learning tool.
   (2) I have made physical changes to accommodate technology in my classroom or Laboratory.
   (3) I emphasize the use of technology as a learning tool in my classroom or laboratory.
   (4) I assigned students to use the computer to do content related activities on a regular basis.
   (5) I use technology based games or simulations on a regular basis in my classroom or laboratory.
   (6) I often require my students to use internet web sites to complete their assignments.
   (7) I use technology to encourage students to share the responsibility for their own learning.
   (8) I expect my students to use technology to enable them to be self directed learners.
   (9) I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities.

(10) I regularly pursue innovative ways to incorporate technology into the learning process for my students.
(11) I expect my students to fully understand the unique role that technology plays in their education.
(12) I design learning activities that result in my students being comfortable using technology in their learning.
(13) I expect students to use technology to such an extent that they develop projects that are of higher quality level than would be possible without them using technology.
(14) I am more a facilitator of learning than the source of all information because my students use technology.
(15) I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students.
(16) I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.

4. Integration – Innovative Use of Technology

(1) I encourage students to design their own technology based learning activities.
(2) I often require my students to use email to complete their assignments.
(3) I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals or at other locations (other classes, other schools, other states or countries etc.)
(4) I incorporate technology into my teaching to such an extent that my students use technology to collaborate with individuals in other disciplines.

5. **Barriers to the Integrating Technology** *[1) not a barrier, 2) Minor barrier, 3) Moderate barrier, 4) Major barrier]*

(1) Enough time to develop lessons that use technology
(2) Scheduling enough time for students to use the internet, computers, or other technology in the teaching/learning process.
(3) Availability of technology for the number of students in my classes.
(4) Availability of technical support to effectively use instructional technology in the teaching /learning process.
(5) My ability to integrate technology in the teaching/ learning process.
(6) My students' ability to use technology in the teaching / learning process.
(7) Types of courses I teach
(8) Reliability of the internet at my school.*
(9) Access to the internet at my school.*
(10) Availability of effective instructional software for courses I teach.

6. Self Efficacy – Teachers Perceptions of Their Own Teaching Effectiveness.

(1) I am among the very best teachers at my school.
(2) I am highly effective in teaching the content in my courses.
(3) My students would rate me as one of the very best teachers they have ever had.
(4) The other teachers in my school would say that I am one of the best teachers at this school.
(5) All of my students would evaluate my courses as excellent.
(6) I am a role model for other teachers in my school.
(7) My principal would say that I am one of the best teachers at this school.

7. **Technology Anxiety**: Please circle the response that best represents your level of technology anxiety for each statement (No anxiety, Some anxiety, Moderate anxiety, High anxiety, Very High anxiety.)
   (1) How anxious do you feel when you think about technology?
   (2) How anxious do you feel when you are not certain what the options on various technologies will do?
   (3) How anxious do you feel when you are faced with using new technology?
   (4) How anxious do you feel when you think about your technology skills compared to the skills of other teachers?
   (5) How anxious do you feel when someone uses a technology term that you don't understand?
   (6) How anxious do you feel when you try to learn technology related skills?
   (7) How anxious do you feel when you try to understand new technology?
   (8) How anxious do you feel when you try to use technology?
   (9) How anxious do you feel when you fear you may break or damage the technology you are using?
   (10) How anxious do you feel when you avoid using unfamiliar technology?
   (11) How anxious do you feel when you cannot keep up with important technological advances?
   (12) How anxious do you feel when you hesitate to use technology for fear of making mistakes you cannot correct?

Teacher Information

Instructions: Please check the appropriate blank or provide other information as requested.

1. Your Age: _____Years
2. Gender_____Male _____ Female
3. Years of Tecahing Experience: _____
4. Do you have internet service at home? _____Yes _____ No
5. Sources of technology training (check all that apply)
   (1) Self Taught ____
   (2) Workshops/conferences _____
   (3) College courses_____
   (4) Other (please specify)_____
6. Do you have an office in school? ___Yes ____No.
7. Does the school provide you with a computer connected to the internet in your office? ____Yes _____No.
8. How much anxiety do you feel when you think about using technology in your instruction?
   (1) _____ No anxiety
   (2) _____ Some anxiety
   (3) _____ Moderate anxiety
   (4) _____Very High anxiety
9. Are you a certified teacher? ____Yes _____ No.
10. What is the Educational level of students you are teaching this year?
    (1) _____ All high school
    (2) _____ All middle or junior high school students.
    (3) _____ A mix between high school and middle school.

Open Ended Questions For Teachers' Survey

1. What are the reasons that you use technology to support your instruction?
2. Describe an example(s) of how computer technologies have enhanced your students' learning. Why do you think it was effective?
3. What important computer competencies do you believe teachers in your subject area should posses?
4. What are some of your beliefs and perceptions about other teachers' use of technology in your school?
5. What are some of the expectations (if any) of your school administrators with regards to your level of technology use or integration?
6. Are there mandatory technology integration requirements for teaching and if so, how do school leaders/administration ensure compliance with these mandates or requirements?

Appendix -B
Interview Protocol for Technology Integration

Appendix -3

Interview Protocol for Technology Integration/Use at SJA

For Principal

1. Can you please comment on the role of technology integration in the recruitment of teachers in your school?
2. What role does technology integration play in the teacher performance evaluations?
3. In your opinion, do you think technology integration does have any impact on students' achievement? Please explain.
4. Can you please comment on any barriers in relation to technology integration and how you go about addressing these barriers if any?
5. What are your future plans for technology integration at your school?

For Teachers

1. As a teacher and from your perspective, what role does technology integration in teaching/learning play in the teacher performance evaluations?
2. Can you discuss some of the factors in the order of importance to you, which you take into consideration for technology integration into your teaching activities?
3. What are some of the major barriers that you encounter in integrating technology? Please explain.
4. How do you perceive the school environment (other teachers, technology support team, administrative staff etc.) as providing the amount of support that enables you to integrate technology more effectively into your teaching/learning?
5. With technology rapidly changing by the second as we know, what are your considerations in preparing yourself to meet the challenging needs for technology integration in the future?

Technology Coordinator or Director

1. What is the composition (number, gender, experience, training etc) of your technology support staff in meeting the needs of both teachers and students?
2. With respect to your job responsibilities as a technology coordinator, what are the least and most significant problems that you encounter with teachers in their use of technology?
3. With respect to your job responsibilities as a technology coordinator, what are the least and most significant problems that you encounter with students in their use of technology?
4. What is/are your perception of teachers' use of technology in this school to enhance teaching/learning?
5. What are your future plans concerning the use of technology in this school?

Appendix C
Permission to Use Survey

Permission to Use Survey

Kotrlik/Redmann Technology Integration Scale (KRTIS)©

Permission is hereby granted to the undersigned Licensee(s) to use the **Kotrlik/Redmann Technology Integration Scale (KRTIS©)**, a scale designed to measure the level of technology integration in the teaching-learning process, owned by Joe W. Kotrlik and Donna H. Redmann, on the following terms and conditions:

1. The wording of items and scale names in the instrument cannot be modified in any way unless authorized by the authors. The Licensee may add items to any of the subscales as long as none of the items in the **KRTIS©** are deleted or modified.
2. After collecting data, you must provide an electronic copy of your complete data set in a Microsoft Excel Spreadsheet file, SPSS data file, or Microsoft Access database file to the authors in a timely manner, no later than 90 days after the completion of data collection. We will not publish from your data, but may use your data to document the quality of our instrument in journal articles, research conference presentations, and technical manuals.
3. We require that you allow us to review your planned research procedures/methodology prior to collecting data. The purpose of this request is to both help you improve your study and to make the resulting data set more valuable to you and to us. We will only make recommendations that clearly address research design errors or omissions.
4. The license is granted only for the use of the **KRTIS©** in research to be undertaken by the Licensee as specified below. Any use of the **KRTIS©** for other purposes is strictly prohibited.
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6. Any discussion or presentation of the **KRTIS©** will accurately reflect the composition of the instrument and will use only the original scale names, scale definitions, and item groupings. The data will not be reported in a manner that would identify individuals or their organizations without written permission of the individual or organization. In the case of university faculty or graduate student research, the Licensee must secure approval of the research proposal from their university's Institutional Review Board.
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Researcher(s) name(s): Researcher(s) job title(s): Researcher(s) address(es): Researcher(s) phone number(s): Researcher(s) e-mail address(es):	**Patrick Saidu, Doctoral Student, LSU** **Eugene Kennedy, Professor, LSU** psaidu1@tigers.lsu.edu 225 806-0125 ekennedy@lsu.edu	
Brief purpose and description of research study, including a description of the research subjects and study location:		
Time period when research will be conducted:		
Other conditions and Royalty Payment Required:	N/A	
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Signatures of **KRTIS©** authors:	Joe W. Kotrlik: Donna H. Redmann:	Date: Date:

Appendix D

Supplementary Data Table 4.15

What are the Reasons You Use Technology to Support Your Instruction?

Table 4.15

What are the Reasons you use Technology to Support Your Instruction?

1. convenience, student exploration, communication **[1]**
2. It fits perfectly with my area of teaching and study, it makes learning fun for the students, and it is using their **[8,9,10]**
3. It is an interactive device to communicate with the students. **[3]**
4. helpful online audio & video resources ,high internet usage in my classes - reinforces material taught to students ,more efficient/less paper, endless research opportunities for students **[4,8,]**
5. It is great for them. It helps not to be boring. **[9]**
6. readily available information that is current and up to date **[6,4]**
7. as a learning tool to present a new topic or prove a theorem **[8]**
8. Grade online, save paper, papers turned in on time, word count, turn it in, maps, web search **[1]**
9. It is encouraged by the school. **[7]**
10. Technology allows students to be more fully engaged in lessons. Presentation software provides a visual for lectures and the internet provides a whole world of information for the students to research. Also, students of this age are very comfortable using technology because they have grown up with it. They seem to respond better to technology based lessons than pen and paper assignments. **[1,2,8]**
11. lecture, lab **[8]**
12. It broadens student resources and gives me a variety of methods with which to present material. **[4,5]**
13. required, easy access, ease of use, latest info, communication **[10, 1,3,7]**
14. way for students to explore material in a different or new way - more visual at times and auditory aspect improves retention **[3,4,5]**
15. note taking in word or PowerPoint; on-line tutorials to support further understanding of a topic; YouTube or teacher tube to show videos on a specific topic; use of excel in making tables, charts or graphs to compile data from a lab; use of on-line textbook to assign problems for homework so the students don't have to carry home a textbook; vernier software to aid in gathering data from a lab **[1,2,3,4,5,8]**
16. Reach the different learning styles, make it interesting for the students and reduce my amount of work [1,5,9]
17. It is available, it is effective, the students enjoy it, and the students grow from its use. [7,8,9,10]
18. faster, easier, more convenient for students [1]
19. Makes students more responsible for their own learning. Creates a richer and broader learning environment. Enables use of visualization tools that enhance learning promote understanding of difficult concepts [2,5,8]
20. Easier, Keeps me organized, So much information available [1,4]
21. It is highly available and helps the girls to relate to the topic. [7,10]
22. To access my students to current sources that are not in the standard texts in our classroom. I also want them to have a sense of the variety of information available online and how to locate "best possible" sources, texts. [4]
23. convenience, materials available, support, speed [1,4]
24. It is a tool that my students are so familiar with that they become very much comfortable with the content. [1]
25. Easier for the students, gets you on the student level & with what they are comfortable with using [1]
26. Technology is such an integral part of our school environment that I would be crazy not to use it. We have amazing resources as well as plenty of opportunities for training that have made it very easy for me to integrate technology. It breaks up the monotony of instruction for the students and also allows accommodations for

different student learning styles. [7,4,9,5]

27. It is part of our school culture. It cuts down on wasting paper and it makes communication with the students easier [7,1,3]
28. The students need the exposure to the technology that they will be using in the workplace. The possibilities are endless as well. [4,10]
29. The students use the tablet constantly, they are highly curious for new applications. [7,6,10]
30. breathe of information[4,6]
31. innovative approach; to develop independent and higher order thinking skills in students; to inspire independent learning **[5,8]**
32. efficient, quick **[1]**
33. I like the different options for all the students. **[4]**
34. It is the future. **[10]**
35. To avoid using textbooks, to expand the thinking of my students, to train them on proper ways of using technology and the Internet **[4,8,10]**
36. - To use all resources available to me to make effective learning happen for my students.
    - To prepare my students for exposure to technology outside of school. **[4,10]**
37. Technology is the tool I love to use increase enthusiasm for, inspire curiosity about and appreciate the importance of history in the lives of the students. **[3,8]**
38. I teach at a laptop school. The use of intensive technological integration has been emphasized here for the last ten years. **[7]**
39. Just makes teaching an learning so much more interesting. **[9]**
40. My classes are designed to teach computer graphics, so "not" using technology isn't an option. **[10,8]**
41. give the students an opportunity to learn visually , audibly**[5]**
42. This is the main way that the students understand the world today - I am only trying to reach them on their own level in a manner that they are comfortable. **[2,1,8]**
43. Geometry is a visual! math and Sketchpad allows me to make it very visual **[8,10]**
44. To expose students to things I cannot in the classroom, To supplement my curriculum.
    To organize myself and my students, To communicate with my students. **[3,4,8]**

Appendix D
Supplementary Data Table 4.16
Important Computer Competencies Teachers Should Posses

Table 4.16

Important Computer competencies teachers should posses to effectively integrate technology

1. interactive exploration tools
2. In an effort to teach the students to fully utilize skype, we actually stumbled into a collaborative service project with students and teachers in Mexico and Nicaragua.
3. Computer technology enhances students' learning through projects.
4. we often use Google Earth to locate and discuss French speaking countries around the world & look at their landmarks. We do a lot of online research about topics covered in class but not to great extent in the textbook (for example, we are studying Quebec & its culture - have found most of our info online)
5. They will feel part of the class.
6. Examples of samples of concepts on YouTube. My students all search and watch YouTube so it is a means of instruction that they can relate to.
7. the programs used in my concentration allow for a more broad picture of the content
8. doing their own work, extra reading, instant Google to questions, review games, color, movies, YouTube clips integrated into the notes, paint art
9. Students can interact with the technology rather than just sit and watch. It's sometimes effective, but often they use their computer as a crutch.
10. Students can use the internet to research for projects instead of having to book time at the library. They can still obtain reliable sources and learn how to sift through the not-so-reliable sources. Students have also used computer technology to take notes in class and complete and submit assignments. It helps the class get through more material in a shorter amount of time because we don't have to pause so much for pen and paper note taking. This leaves time for more activities which enhance the lesson.
11. Simulated lab
    Some labs are too dangerous or long to do in class. Doing a simulated lab enables them to experience the lab, but does not put them in harm.
12. PowerPoint’s to give information. Effective because of visual aspect.
13. keeping logs, readily finding an answer to a question, communication
14. online grammar exercises in Spanish give immediate feedback and increases opportunity for a dialogue between the student and teacher which therefore improves learning and understanding
15. I have used on-line tutorials. I think they give excellent visuals that aid in understanding of atoms, molecules, and other types of matter that we cannot see with the naked eye. These abstract concepts are hard for students to grasp, but when they can actually visualize it on a larger scale in the tutorials, it helps give them a better understanding.
16. Searching on the web will help my students to find Spanish websites and learn more about the culture
17. Reading out of a book or discussing in class doesn't work for every situation. I often use interactive PowerPoint presentations that incorporate visuals that help to clarify certain ideas. This way, students are able to see, hear, write, speak, contemplate individually and share. They use all of their senses, which seem to be very effective because it holds the students' interest and it also reaches all students with various learning styles.
18. Enhanced?? maybe more breadth, but less depth

19. The ability to create multimedia presentations, specifically videos, regarding their faith journey and experience was especially useful in the theology curriculum. Not only did they learn the skill of making a film, but they edited it and refined it over the period of a semester, making it highly effective.
20. Students will often, on their own during a discussion class, Google the topic of discussion or a term that is used during the discussion. In this way, students become more involved in the learning process and have a greater control over what they learn. It also makes the class discussion much more interesting.
21. Student writing/reports have improved because they are now able to shift things around and correct mistakes easily.
22. Moodle, DyKnow...it is very accessible and helps the girls to comprehend and feel a sense of ownership in their work.
23. Learning to write fluently is definitely enhanced by the plethora of tools, samples, and learning opportunities that are available in multimedia formats. Needless to say, the writing/revising process is incredibly faster and more efficient.
24. current events, testing, return of assignments, presentations
25. One thing they have learned is that there are lots of opinions out there on many different websites so you really have do your research on what is the actual information and not just believe the first website you read.
26. faster, much more info available, able to communicate with people all over the world, get info quickly
27. I use screen casts on a regular basis to explain topics students are having a hard time with. I also have them make podcasts so that I can see how well they understand a topic.
28. It allows me to give them more resources to supplement the lesson.
29. They have more examples and can focus on learning the material and not copying it down from the board.
30. When researching art, they can look up websites of museums for virtual touring. We can experiment with images before completing a piece, by photographing it before proceeding with color or detail.
31. Learning is more student driven and they take more responsibility for their learning. The teacher is more of a facilitator.
32. Allows students to demonstrate their research to other students
33. ability to visit cathedrals of the world, compare and contrast architecture...very effective
34. it helps them organize; stay up to date with the latest scientific information; they can do virtual lab activities they would not normally be able to do
35. The information we are looking for is readily available without leaving the classroom or checking out books from the library.
36. It has given my students an excellent source for more involved activities.
37. Online testing. Preparing them for college and beyond.
38. To research examples of art related to the specific artistic style being taught.
39. Using technology provides the students the opportunity to practice their knowledge in a hands-on way. I can also provide them when quicker feedback.
40. Pod Casting lectures - if students are absent, they can download the lecture to their iPod and

catch up with the same exact lecture that the students in class had. Also, students can listen to the lecture again, if they are unsure about a topic for clarification before the test.

The Jeopardy history class games inspire confidence.

41. The Google searches inspire curiosity.

The primary source readings from the net expand students frame of reference.

42. (Despite the obvious bias in the question) Students have access to a wide range of information; exposure cannot help but make them better and more informed learners.

43. They now "discover" principles of physics through simulations and hands on activities.

After the students learn how to use Photoshop or in design as a way to make graphic design

44. images, they can use this to enhance other projects that they may work on. They also learn to how to teach themselves how to use new software.

45. interaction

46. Their projects are much more detailed and visually appealing.

47. It makes shapes dynamic

48. Using podcasts reach my students that need both visual and auditory repetition to learn material.

Appendix D
Supplementary Data Table 4.17
Some Beliefs and Perceptions about Other Teachers' Use of Technology in the School

Table 4.17

Some Beliefs and Perceptions About Other Teachers' Use of Technology in the School

1.	Some use just to say they're using -- technology for it's own sake is often a priority over technology for education's sake.
2.	I believe about 40% of teachers are pushing the envelope while 60% are still hesitant to fully jump into the kool-aid. They need more time for professional development.
3.	I believe that the students do not fear new innovations of technology because they witness the use of technology so much with faculty in the classroom.
4.	very extensive, very competent and well versed in many different programs
5.	Don't know
6.	I think that I am not the strongest computer user but not the weakest either.
7.	the teachers abilities range from very skilled to very ignorant of the uses of technology
8.	Some are very proficient, most average, some scared.
9.	I think some courses are better suited for the integration of technology in the classroom and teachers of these courses are more successful for it.
10.	I think most teachers in our school use technology on a daily basis. We are fortunate to have laptops issued to both teachers and students that they may use in class every day. Most teachers feel comfortable with the technology but some are hesitant when we get new software or start using new programs.
11.	All teachers use some technology at some point and I think each teacher uses technology in a way that is comfortable and effective for their class.
12.	Some are more adept than others.
13.	it has both its benefits and downfalls.
14.	Most teachers agree that we are in a world where an understanding of technology is very important. It is where the future is going, and if we don't prepare our students to use technology effectively, they will struggle in the future.
15.	They are comfortable with technology because it is surround them every day and they receive as much help as they need to become expert with the technology that they school provide
16.	I think it varies. Some teachers don't seem to use much of it, but others use it in very interesting ways.
17.	Learning suffered because we went too overboard. Forgot it was a tool. To some it was an end in itself.
18.	I believe that most teachers at our school make regular use of technology as an instructional tool. I do not believe this is true at all schools.
19.	I think most teachers use it effectively and appropriately.
20.	I have been very impressed by the improvisation and inventive determination of teachers in my school.
21.	Most teachers ---if not all----use technology in some capacity....and the majority incorporate it very well depending on subject. I believe that some misinterpret its advantages. I also believe that some use it much more efficiently than others.
22.	Each department uses the technology that best meets the needs of their curriculum and student needs. Other teachers are a good source of different programs and technology available. We have a good environment to share ideas.
23.	Trying something new is often hard especially for those teachers who have done it the "old way" for so long. It is not an overnight learning process. Baby steps and changes. They will get there.
24.	Teachers know how to use them and implement them in class when needed. How not to overuse them and have a class too computer based and not enough student/teacher based, and basically, we have most of the

	best teachers ever!
25.	Some teachers (not many and usually older ones) tend to be set in their way and do not like to adopt new practices. Many of them may feel the school should focus on expenditures in other areas rather than technology.
26.	I think that some use it more than others. It is a tool.
27.	They are not open to new ideas involving technology.
28.	Like the students, other teachers have links and websites they constantly hit to look a word up, to get facts. Academically I feel the tablet enhances the learning. It is not so much for studio art.
29.	Subject matter in other classes would benefit more from technology than my class
30.	they are better at it than I am
31.	I believe we have all different levels of usage. Those that are comfortable and competent are always ready to do and try more and new things. Those that are not barely, skim the surface or do not use it at all. If there are no requirements or forced benchmarks imposed by an administration, there can be no progress made by those who are hesitant.
32.	Other teachers use technology at a higher level.
33.	Everybody uses technology to their own extent. It depends on how comfortable they are
34.	They are all using technology to some extent because we work in a laptop environment.
35.	Some are way ahead of me in their use of technology while others are way behind and need to be more willing to catch up.
36.	I believe the fearless use of technology is essential for teaching/communicating with today's students so as to prepare them for prospering in the midst of a technological revolution.
37.	Technology cannot replace authentic student teacher interaction. It is a tool that must be used judiciously so that the technology remains a means to the learning process, not the end of it.
38.	Some do and some do not but no one seems to put any demands on those not using it.
39.	I know quite a few teachers are completely on-board with using technology, while others don't find it very useful for their subject area. I've even heard a small few say it does more harm than good.
40.	they are afraid of trying and only a handful use technology in the classroom
41.	Most of the teachers have become proficient.
42.	I believe that most of us at some point in our classes use technology, however some more than others.

Appendix D
Supplementary Data Table 4.18
Expectations of School Administrators with Regards to level of Technology Integration by Teachers

Table 4.18
Expectations of School Administrators with regards to level of Technology Integration by Teachers

1.	Same as above- some want tech for its own sake, others are more reasonable -- but they provide plenty of resources.
2.	To keep pushing the envelope and to continue to inspire others
3.	The administration holds the faculty with high regards to integrate technology into the classroom.
4.	Teachers should incorporate technology into their daily curriculum & encourage and guide students to do much research themselves
5.	They will love for everyone to use it.
6.	They expect me to get the help I need to succeed. If I need help I am to let them know so I can be successful.
7.	Everyone should be incorporating technology to the level of their ability and should want to learn more
8.	we should at least keep up with the students levels, always changing, always improving new, faster skills
9.	They want it to be an asset and a tool that is beneficial for students. I think sometimes it's hard to find a balance with teenagers who are more interested in email and Facebook than using the computer as a tool for education. The challenge isn't always with the teacher! it's the unmotivated or untrained student. I think the administrators do a great job of supporting faculty and offering opportunities to help them, but I think that there needs to be a broader spectrum of training for the computers and programs made available.
10.	The administration has high expectations for teachers and use of technology since we are a technology based school. We are encouraged to use technology every day for taking attendance, grading, posting assignments, taking notes, etc.
11.	Use technology in some way
12.	We are expected to incorporate technology in our instruction.
13.	We have the opportunity to use the latest technology out there and are given the freedom to use what is best for our students in our class.
14.	They expect us to use the computer too much and too often. being a technology school should be based on the building of skills over the 4 years they attend high school- not so much using a computer daily in the classroom -
15.	They strongly encourage use of technology.
16.	The expectation is that you try first the technology in you classroom. If it works, keep using it. Otherwise, continue with what it best works for your class
17.	Since our school has a strong technological background, the expectation of teachers to use technology is very high. Dyknow was a big push for awhile, but now it just seems to be more of a generalized push.
18.	High A+
19.	Expectations are high, as we have a one-to-one laptop program, however, these expectations are realistic for me as someone who is familiar with and accustomed to rapidly changing technologies.
20.	Regular use of email, Moodle and its resources, electronic assessments, electronic submission of assignments, web resources, interactive tutorials, computer-based laboratory experiments in science ,etc.
21.	We are expected to be competent with technology integrations and in many areas to lead the way.
22.	The technology is widely available; therefore, it is expected to be used as often as possible.
23.	Expectations are always clear. The initial administrator who instigated the transition to laptops saw the integration of technology as a necessary part of the vision for our school preparing the students for the world they will join. Since those first steps we have added different school wide usage---Blackboard, Moodle. I feel that the school goes overboard in trying to please everyone and accommodate their anxiety. There are always ample opportunities for support

24. To use technology for the sake of the subject and student learning, not for the sake of just technology. It is a means to an end...not the end.
25. We do have certain standards that we have to follow, but it has never been shoved down our throats and we have always been given training.
26. I think that the admin pushes certain programs, such as Dyknow, because they have purchased it b/c a few teachers liked it. Not all liked it or felt it was worthwhile and don't want to use it because it stops students from speaking up in class. Listen more to all the teachers & not the Mayfias. In the end, most did not use the Dyknow anyway
27. They expect us to use the technology we've been given, whether it's laptops, projectors, speakers, whiteboards, etc.
28. We are expected to use our laptops as a tool to enhance the students learning.
29. Use it on a regular basis to enhance learning.
30. In a formal observation I was asked how I would use technology. And I did it for that particular day, but may only suggest using it. It is not required. The students want a break from the computer, which is why they took a studio art.
31. We are expected to integrate technology into our teaching. It is a tool for learning and not what the class instruction is geared around.
32. Always pushed to integrate more and learn more
33. they support technology integration
34. It is left up to the individual teachers.
35. We are expected to use the tools if it enhances learning and we think it is the right thing to do.
36. Our admistrators expect all faculty to use technology for grading, assignments and soon for testing.
37. Use it to the best of your potential.
38. To use the technology resources we have available.
39. We are expected to use our tablets as daily learning aid.
40. All teachers should be incorporating technology daily, should be diligent with their e-mail, and should be using Moodle with their students.
41. The school expects us to be able to integrate into our classes some aspect of every technological benchmark they introduce.
42. Laptop school for the last ten years -- we use it every day and learn new software etc. as required.
43. Say they expect it but not much follow-up.
44. Our administrators would like us to use technology as a way to enhance our curriculum. For those who are hesitant, they only ask that we try one new tool at a time until we are comfortable.
45. high expectations
46. We use technology on a daily basis. Administration expects us to use technology to enhance the learning experience. If there is no real purpose, then we are not expected to put it in use.
47. We are highly encouraged to use technology
48. I believe they expect us to be able to use and integrate technology and supply us with the resources to do so.

Appendix D

Supplementary Data Table 4.19

How do School leaders/Administrators Ensure Compliance with Technology Integration Requirements for Teaching?

Table 4.19 How do school leaders/administrators Ensure Compliance with Technology Integration Requirements for Teaching?
1. Classroom visits, full access to all electronic courseware (Blackboard, Moodle)
2. We have faculty meetings and small group meetings to allow the faculty and administration to share and update what is happening in each discipline.
3. I don't know
4. Everything is done using technology.
5. We do not have any type of compliance regulation at our school
6. professional development, classroom observations
7. in service days
8. Observation.
9. Observations - both formal and informal.
10. there are no requirement that I am aware of
11. They offer technological assistance (from tech assistance team) and keep us up-to-date with tech issues and innovations through our faculty meetings.
12. Treat you as professionals - ask you to do or use something and expect you will
13. not sure - but when you try to ensure compliance the administration loses the trust of the teachers. if you hire teachers who are competent and willing to try new things, then ensuring compliance shouldn't be necessary
14. The administrators are open to purchasing new software and various other types of technology if they feel the students will greatly benefit from it.
15. We are always asked to share our experiences, and the teachers who often use technology and share their experiences are the ones who are recognized and highlighted. There is also a technology integration component on our formal observation forms.
16. Monitoring, overseeing, sharing with faculty, and professional development.
17. Observations. Teacher reports.
18. Administrative and department supervision
19. Again, the technology is widely available and administration is always open to new ideas.
20. I guess they check individually, but I am not sure.
21. Administration shows confidence that each teacher uses the technology that best meets the needs of the student and the subject. There is an atmosphere of professional trust rather than a checklist of compliance. I believe their trust is justified. The administration also offers workshops and updates.
22. I think admin respected that the teachers knew what was best for their students. Some teachers have moved beyond and are using more technology and others are using what they are comfortable with using,
23. I do not know of any requirements. However, when I was a younger teacher and was being evaluated, the only comment I had on my evaluation was that I could have used certain software the school had bought that year and was encouraging us to use. The teachers, who did use this in their observations, received good marks and the rest of us were told we could have used it.
24. Laptops are supplied to all faculty and students.
25. Evaluations in the classroom
26. We have certain sites which are blocked. I don't see the need for teachers to be blocked, and there are

	ways to unblock them for teacher access, I just have not needed it. I can visit Hotmail and facebook at home. I use my work computer for work.
27	We are trained more than any other school in the area
28.	ongoing faculty development
29	It is left up to the individual teachers, however it is expected that teachers, in our one to one laptop environment, incorporate technology into their curriculum.
30.	Any technology can be requested and the school will find a way to get the instructor the soft ware and the training.
31.	no requirements
32.	We are required to use online mapping for our curriculums, Moodle for course content, testing and teaching.
33.	Observations and word of mouth.
34.	Classroom visits, formal observations, conversations with teachers.
35	Benchmarks are checked partially through communication with the students. If a teacher chooses not to integrate technology into the classroom. Students will suffer & often complain. Teachers are often rewarded for technological benchmarks by the administration by being chosen to share with the faculty their frustrations & ultimate successes at faculty meetings (Ex: Moodle testing). This inspires me to try the new option for my students. We are also asked to attempt each benchmark at least once during the year.
36.	We are past the stage of "requiring integration" -- we are integrated.
37.	Setting required benchmarks and making them a condition for continued employment.
38	They do come by for informal observations, other than that I'm not sure since they know I use technology on a daily basis due to the nature of my class.
39.	Observations and professional development
40.	Technology has become such an integral part of our daily lives here that I don't think they have to check on its integration.

Appendix E
Doctoral Research Study Consent Form

Doctoral Research Study Consent Form

1. Consent Form

The primary purpose of this study is to establish the relationship between teachers' beliefs, attitudes,perceptions and use of technology to promote student learning.

Subjects may choose not to participate or withdraw from the study at anytime without any penalty.

I understand that if i have any further questions about this study, i may direct these questions to the Principal investigator Mr.Patrick k Saidu (psaidu1@lsu.edu). In addition, any questions about subjects' rights or concerns should be directed to Dr. Robert C. Mathews (Chairman, Institutional Review Board) at 225-578-8692 or irb@lsu.edu.

This survey will take about 25 minutes at most. The results of this survey may be published and shared with the school administration but no names or identifying information will be included in any publication. By responding to this survey, i do agree to participate in this study.

Consent Form

1. **Study Title**: A study of Technology Integration in an All Girls School: The Role of Attitudes and Beliefs.
2. **Performance Site**: St. Josephs' Academy, Baton Rouge, Louisiana.

3. **Investigators**:
   Patrick K Saidu is the Primary Researcher, supervised by Dr. Eugene Kennedy. For any questions pertaining to this research, you can reach Mr. Patrick K Saidu at 225-806-0125 (cell), 225-578-6523 (office) and email: psaidu1@lsu.edu or Dr. Eugene Kennedy via email @ ekennedy@lsu.edu. Time: M-F, 8:00 a.m. - 4:30 p.m.

4. **Purpose of the Study**:
   The primary focus of this study is on the relationship between teachers' beliefs, attitudes, and perceptions and their use of technology to promote student learning. Unlike most previous studies of technology integration, this study is conducted at a gender specific, technology-rich, religious-based private school. This study will not include any student's participation.

5. **Subject Inclusion:**
   The participants in this study include teachers, and administrators at St. Josephs Academy School, Baton Rouge.

6. **Number of subjects**: The anticipated number of teachers participating in this study is atleast fifty (50).

7. **Study Procedures**: This study adopts a mixed methods research approach which includes both quantitative and qualitative data collection and analysis. The study will be conducted in two phases. In the first phase, subjects will spend approximately 25 minutes completing questionnaires about technology integration. The second phase will mainly comprise of interviews and document reviews, which will last for no more than 15 minutes.
Two teachers will be randomly selected from each grade level to participate in the interviews. The interviews will be followed by document reviews of lesson plans and course syllabi. Interviews for administrators will also include the technology coordinator and Principal.

8. **Benefits**: The study may yield valuable information that will be shared with the school administration.

9. **Risks**: This study poses no risks to the participants and there is/are no sensitive information found or included in the questionnaires or interviews.

10. **Right to Refuse**: Subjects may choose not to participate or to withdraw from the study at any time without penalty or loss of any benefit to which they might otherwise be entitled.
11. **Privacy**: Results of the study may be published, but no names or identifying information will be included in the publication. Subject identity will remain confidential unless disclosure is required by law.
12. Signatures:

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about

Appendix F
Institutional Review Board Approval Form

Institutional Review Board Approval Form

Application for Exemption from Institutional Oversight

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research/ projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This Form helps the PI determine if a project may be exempted, and is used to request an exemption.

Institutional Review Board
Dr. Robert Mathews, Chair
203 B-1 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
irb@lsu.edu
lsu.edu/irb

- Applicant,Please fill out the application in its entirety and include the completed application as well as parts A-E, listed below, when submitting to the IRB. Once the application is completed, please submit two copies of the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee c an be found at http://www.lsu.edu/screeningmembers.shtml
- A Complete Application Includes All of the Following:
  - **(A)** Two copies of this completed form and two copies of part B thru E.
  - **(B)** A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)
  - **(C)** Copies of all instruments to be used.
    - *If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
  - **(D)** The consent form that you will use in the study (see part 3 for more information.)
  - **(E)** Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://phrp.nihtaining.com/users/login.php.)

1) Principal Investigator: PATRICK K. SAIDU **Ph:** 225-806-0125 **Student? Y/N** Y

Dept: ELRC **Ph:** 225-578-6523 **E-mail:** PSAIDU1@LSU.EDU

2) Co Investigator(s): please include department, rank, phone and e-mail for each
*If student, please identify and name supervising professor in this space

DR. EUGENE KENNEDY (Major Professor)

IRB# E4883 LSU Proposal #

⊗ Complete Application

⊗ Human Subjects Training

3) Project Title: A Study of Technology Integration in an All Girls School: The Role of Attitudes and Beliefs

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Exemption Expires: 12-10-2012

4) Proposal? (yes or no) no **If Yes, LSU Proposal Number**

Also, if YES, either ◯ This application completely matches the scope of work in the grant

OR ◯ More IRB Applications will be filed later

5) Subject pool (e.g. Psychology students) TEACHERS

*Circle any **"vulnerable populations" to be used**: (children <18; the mentally impaired, pregnant women, the ages, other). Projects with incarcerated persons cannot be exempted.

6) PI Signature Patrick Saidu **Date** 12-10-09 (no per signatures)

**** I certify my responses are accurate and complete.** If the project scope or design is later changes, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted X Not Exempted ___ Category/Paragraph 1

Reviewer: S. Kimmacgregor **Signature** [signature] **Date** 12/17/09

Part 1: Determination of "Research" and Potential For Risk

- This section determines whether the project meets the Department of Health and Human Services (HSS) definition of research involving human subjects, and if not, whether it nevertheless presents more than "minimal risk" to human subjects that makes IRB review prudent and necessary.

subjects' rights or other concerns, I can contact Robert C. Mathews, Institutional Review Board,(225) 578-8692, irb@lsu.edu, www.lsu.edu/irb. I agree to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Subject Signature:_____ Date:_____

Institutional Review Board
Dr. Robert Mathews, Chair
203 B-1 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.6792
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Study Exempted By:
Dr. Robert C. Mathews, Chairman
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Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Exemption Expires: 12-16-2012

Vita

Patrick Kelvin Saidu was born in June, 1971 in Njala, Sierra Leone. Patrick graduated from the Bo Government Secondary School for boys in 1988 and worked at the Sierra Rutile Mines for two years as Instrumentation Technician and then proceeded to Fourah Bay College, University of Sierra Leone, to pursue a degree in mechanical engineering. With the raging war in most rural parts and provinces in Sierra Leone in the 1990's, Patrick's education was interrupted multiple times. Not relenting on his personal goal and ambition to pursue education vigorously and to the highest possible extent, Patrick endured the bitterness of the civil war in Sierra Leone and stayed in college and graduated with a Bachelor of Science (B.Sc. Ed) degree in Education, majoring in physics, in 1998. Patrick taught physics at Njala University College for two years before he embarked on the second leg of his academic journey to the United States of America to pursue a master's degree in physics at the Louisiana State University in Baton Rouge, in fall of 2000. While pursuing a degree in physics, Patrick served as Teaching Assistant in physics from 2002-2003. Since 2003 to date, Patrick has served as Teaching Assistant, teaching educational statistics in the Department of Educational Leadership, Research and Counseling. Patrick has been a student all through his life and completed his requirements for the Doctor of Philosophy degree at the Louisiana State University in summer of 2010.