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Multimedia Instructional Tools and Student Learning in Computer Applications Courses

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The University of Southern Mississippi

MULTIMEDIA INSTRUCTIONAL TOOLS AND STUDENT LEARNING IN COMPUTER APPLICATIONS COURSES

by

Debra Laier Chapman

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

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ABSTRACT

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Advances in technology and changes in educational strategies have resulted in the integration of technology into the classroom. Multimedia instructional tools (MMIT) have been identified as a way to provide student-centered active-learning instructional material to students. MMITs are common in introductory computer applications courses based on the theory that this type of educational tool should be effective in increasing student knowledge and result in positive changes to motivation and the learning strategies used in the course.

The purpose of this study was to examine the use of the MMIT in an introductory computer applications course to determine if there was a significant relationship between the level of use of the MMIT and student knowledge. Additionally, motivation and learning strategies were examined to determine if the use of the MMIT resulted in a change in students' motivation and learning strategies within the computer applications course. Study participants included 404 students enrolled in an online introductory computer applications course at one southeastern university.

Data were collected by using the student activity and gradebook reports available through the MMIT. This allowed the researcher to use descriptive statistics to demonstrate students' use of the MMIT and use the pre and post-course test scores to determine the change in student knowledge over the course of the research study.

Motivation and learning strategies were evaluated using the Motivated Strategies for Learning Questionnaire (MSLQ). Students completed this questionnaire at the beginning of the semester before use of the MMIT and again at the end of the semester. MANOVAs were used to analyze the data for each of the 15 motivation and learning strategies scales of the MSQL survey and the level of MMIT use for the different activity types to determine if a change in motivation or learning strategies occurred.

Findings from this study revealed no significant impact on student knowledge based on the level of use of the MMIT grader assignments or training activities. A significant difference was found based on the level of use of the MMIT quizzes. The motivation and learning strategies data indicated a significant impact on three motivational scales, task value, self-efficacy of learning and performance, and test anxiety in relation to the MMIT grader assignments. There was no significant change in any of the other three motivation strategies scales or any of the nine learning strategies scales or in relation to the training activities or quizzes.

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CHAPTER I

INTRODUCTION

Advances in technology have led to many changes in education. The integration of technology into the teaching and learning processes has the potential to improve instruction by creating a technology-based, student-centered learning environment that allows students to take charge of their own learning (Gaytan & Slate, 2002-2003). One significant change is the development of multimedia instructional activities. Multimedia is defined by Gaytan and Slate (2002-2003) and Zin, Latif, Bhari, Salaiman, Rahman, Mahdi, and Jamain (2012) as a combination of many different types of media communications including text, graphics, audio, video, music, and animation. Interactive media is incorporating multimedia with computing technologies (Eastman, Iyer, & Eastman, 2011). Interactive media places the user in charge of his/her own content delivery. Multimedia instructional tools (MMIT) are created when interactive media content is developed in conjunction with the instructional design processes to provide students with educational and learning opportunities. MMIT requires students to take an active role in the learning experience which can increase the communication between students and faculty. Gayton and Slate (2002-2003) state that if users are not required to participate through creating and contributing their own works, this is not considered a MMIT; the product is simply a video.

A need for restructuring the teaching and learning processes has been identified due, in part, to an increase in the diversity of the student population, as well as higher education costs coupled with lower state education funding (Gaytan & Slate, 2002-2003). The cost of a college education is continually increasing with no significant change identified for the near future. Colleges and universities cannot rely on their students to cover this rising cost through tuition increases alone (Twigg, 1999). Institutions of higher education are looking internally to identify ways they can reduce their costs while maintaining quality in the educational process (Twigg, 2011). Simultaneously, educational institutions have seen an increase in the use of technology. The cost of technology is decreasing, while other educational costs are on the rise. Technology use in the classroom, including MMIT, is focused on offsetting the rising cost of education without decreasing student learning (Bassoppo-Moyo, 2011).

Multimedia Instructional Tools in the Classroom

Appropriate integration of technology in the classroom through the use of MMIT coupled with a focus on student learning by changing to a student-centered pedagogy results in an increased quality of education without increase in the cost (Sanchez, 1994). MMIT allow faculty to maintain control over the design of the course, the content, and the assessment of students, while students take control of the delivery and pace of the content, empowering them to be responsible for their own learning (Chien & Chang, 2012). Information technology has developed to the point where MMIT can present some instructional course material so well that instructors no longer need to do so. Instructors then have the ability to allocate their time to providing individual instruction and assistance where it is needed instead of delivering content to the class as a whole (Twigg, 2011). This use of technology shifts the presentation of instructional material from the instructor to the available technology through the use of MMIT. This moves the focus of class activities from the instructor and the presentation of course material to the student through the use of student-centered activities. Students use interactive, learner-centered, problem-solving activities that incorporate the use of course materials to support their individual learning. One of the instructor's main functions within a MMIT is student assessment. Assessment is the various ways of gathering information concerning student learning and performance. The MMIT does not replace the role of the instructor in providing grades and determining who needs individualized attention, but it provides the instructor with the information necessary to make these decisions (Eyal, 2012).

Technology-based materials offer students on-going practice opportunities that provide immediate, high-quality, detailed feedback. High quality, timely, and frequent feedback can help improve students' work as well as their learning (Schilling, 2009). Learning opportunities and formative assessments are available through the use of problem-solving activities, simulations, and practice assignments. Available summative assessment activities include computer-based quizzes, capstone projects, and computer graded exams (Twigg, 2000). Research by Nichol (2009) has shown that assessment activities can be used to support student learning. This is especially true for first year students who often make up a large population of introductory college courses. It is important that students are provided with productive and relevant learning activities that encourage them to spend appropriate time on task. MMIT can provide students with these opportunities. The use of multimedia applications has been shown to improve student learning by providing meaningful student engagement with their activities. Multi-modal activities that provide content using multiple modes of representation including text, visual images, simulations, etc., such as those provided through MMIT, have been found to be more effective than traditional classroom activities in terms of learning outcomes and motivation due to their interactivity and perceived relevance (Schilling, 2009). This type of activity provides for equal to significantly improved student learning and retention when compared to traditional instructional techniques (Stegeman & Zydney, 2010).

Computer Applications Courses

MMIT is readily available for introductory computer application courses. Many computer applications textbook publishers provide MMIT to accompany their textbooks, such as myitlab, SAM, SNAP, and SIMnet. Myitlab is a Web application used for online assessment and training for Microsoft Office Applications and Computer Concepts courses created and published by Pearson Education. Students can access multimedia instructional materials, interactive training lessons, end-of-chapter capstone exercises, and summative assessment activities covering the basic Microsoft Office applications including Word, Excel, PowerPoint, and Access within myitlab. Students complete automatically graded computer-based learning activities that provide the student and instructor with immediate detailed feedback. Computerized grading allows for standardization in grading across multiple course sections and provides a significant reduction in instructor grading time. Students can repeat course assignments multiple times to increase their knowledge without impacting the amount of time required by the instructor in teaching this course. Students' level of use of the MMIT, including myitlab, range from none as students choose not to use the MMIT for course assignments; minimal use as students use the MMIT to complete some or all of their course assignments; however, assignments are completed only one time regardless of the score achieved; to maximum use, as students re-do course assignments until passing scores or higher are attained. MMIT tools have widespread use in colleges and universities across the United States. January 2010 data indicated the myitlab program is used in more than 800 institutions nationwide and has over 700,000 users, with that number expected to grow in future academic terms (Speckler, 2010). Myitlab and other similar products are provided as Web-based programs allowing course activities to be completed anywhere, anytime, on any Internet connected computer (Speckler, 2010).

The School of Computing (SOC) at a southern university is currently using Pearson Education's myitlab MMIT in its *Introduction to Computer Applications* (CIS 150) course. The CIS 150 course is a basic computer applications course provided to the university as a service course, which is for students who are from other departments or majors. As is the case with many other service courses, CIS 150 has a large and varied student population. Annual enrollment averages over 1500 students of various ages, majors, and demographics. Improvements to this course can help make a significant change in student learning. Research shows that large courses have many challenges including difficulty in getting students to participate and in allowing faculty members to accurately assess students (Eastman et al., 2011). This course can also demand a substantial amount of grading time by the instructors for the required lab assignments and class activities. Furthermore, this course is traditionally very resource intensive as it requires multiple sections taught by different instructors and requires significant computer laboratories and classroom facilities. The use of the MMIT will minimize the said problems. The faculty within the SOC made the decision to adopt the myitlab MMIT primarily based on its reported ability to provide improved student learning while reducing resource requirements and costs for the SOC as indicated by Pearson Education, the publisher of the myitlab application (Speckler, 2010).

***Myitlab*.** Myitlab is an interactive Website that provides students with a student-centered learning environment for the Microsoft Office applications. Students may choose their approach to learning the material through a variety of options available within the myitlab site. Students may access the textbook material through the use of a traditional textbook, the electronic-textbook provided in the myitlab program, and through audio PowerPoint slide shows contained in myitlab. Assistance in completing lab assignments is available in the textbook as a step-by-step hands-on exercise. The myitlab program provides support for the lab assignments through the use of audio and text instructions called *hints* to guide the student as well as multimedia automated demonstrations of the requirements known as *show me*.

The program also provides end-of-chapter capstone exercises to provide students with active learning opportunities. The capstone exercises provide more real-world problems that students must solve in the Office applications not the simulated environment used for the training and tests. These exercises are submitted to the myitlab application for feedback and grading. The automated grading provided through the myitlab MMIT provides students with feedback and allows students, with instructor permission, to modify and resubmit their assignments to increase their learning and improve their grades.

Students in the CIS 150 course are introduced to the myitlab program through an online class orientation session. Instructional PowerPoint slide shows are posted to the course Website as additional support in using myitlab. Pearson Education provides video tutorials, instructional documentation, and 24/7 live student support through their myitlab Website. Students needing additional help with the course material, organization, or the myitlab program can attend weekly open lab sessions staffed by graduate assistants dedicated to the CIS 150 course.

Previous research on both MMIT (Bassoppo-Moyo, 2011; Milovanovic, Takaci, & Milajic, 2011; Neo, Neo, & Leow, 2011; Zin et al., 2012) and the use of technology presented content leads the author to conclude that the use of myitlab in the CIS 150 course should increase student knowledge and motivation. However, this research does not specifically address computer applications courses or student motivation and learning strategies when using MMIT. Thus, this proposed research study intends to examine the following topics:

- The effectiveness of MMITs on increasing student knowledge in an introductory computer applications course.
- The change on students' motivation and learning strategies to increase their knowledge after using the MMIT.
- Students' beliefs on the benefits of using the MMIT.

Statement of the Problem

MMIT is being integrated into higher education classrooms as a way to increase student learning and motivation while maintaining or even reducing costs (Gaytan & Slate, 2002-2003). MMIT for computer applications courses are being created and marketed by higher education publishers, as well as corporate software developers. MMIT use is widespread across the United States and is continuing to increase despite a lack of research on its actual effectiveness (Speckler, 2010). This type of basic technology course is a standard at most universities. Many universities are adopting MMIT in these courses (Twigg, 2011); however, their effectiveness has not been studied after the implementation. Introductory computer applications courses are generally large enrollment courses that require a significant amount of university resources. Impacting student success in this type of course by improving student knowledge and thereby, increasing the course's pass rate through the use of MMIT could have a significant effect on the overall university by reducing the university resources required for this course (Twigg, 1999). Research by Kodippili and Senaratne (2008) showed that mymathlab, a MMIT similar to myitlab, had a positive impact on overall success rates in a college algebra course; however, only limited research is available on the widespread use of MMIT in higher education classrooms with none available in the specific area of computer applications courses or myitlab.

A literature review indicated the lack of research in the area of MMIT use in higher education (Bekele, 2010), specifically in computer applications courses. Little research has been conducted concerning students' expectations and experiences with e-learning and technology tools. The research that has been conducted was focused on specific components with the course such as interaction with the instructor, the learning management system, and the specific course characteristics (Paechter, Maier, & Macher, 2010). Further, there is a lack of research in the relationship between the use of a computer application's MMIT and student learning and motivation in an introductory computer applications course. Studies on the motivation and satisfaction of MMIT is limited to the use of older technologies, such as synchronous and asynchronous communication and course Web pages (Bekele, 2010). Although a movement toward student-centered active-learning based on the integration of technology and the use of MMIT in the classroom exists (Wang, 2010), there is a lack of research regarding the effectiveness of this change. No existing research has been identified in relation to the use of MMIT in computer applications courses.

Purpose of the Study

The purpose of this study was to examine the relationship between multimedia instructional tools and student knowledge in an introductory computer applications course. Specifically, this study sought to determine if the students' use of a MMIT in the introductory computer applications course increases student knowledge. Additionally, this study explored how students utilized the MMIT and determined whether their level of use of the tools resulted in a change in the motivation and learning strategies for students in an introductory computer applications course. The results of this study help to determine if MMIT use provided benefits for the student and ultimately the courses the MMIT were used in.

Research Questions

The specific research questions to be addressed in this study included:

Research Question 1: To what extent do students utilize the MMIT?

Research Question 2: Is there a significant relationship between students' level of use of the MMIT and their knowledge as measured by changes in their pre and post exam scores?

Research Question 3: Did students report a significant difference in their motivation and learning strategies in the course based on the MMIT as indicated through changes in pre and post course questionnaires?

Definition of Terms

The following terms are defined in order to provide an understanding of the language and terminology used in this study and to include definitions of how the terms are measured within this body of work.

Cognitive Learning Theory – Cognitive learning theory is based on changes in student behavior as it relates to their learning. Learning is achieved through creating new internal links through repetition and contiguity and occurs when new information is acquired and organized in context with the learner's existing knowledge (Good & Brophy, 1990).

Constructivist Learning Theory – Constructivist learning theory is founded on the belief that learners are responsible for creating their own knowledge. Learning takes place through the use of authentic *real-world* activities that require learners to extend their knowledge through the use of active problem solving (Fosnot & Perry, 2005).

Interactive Media – The combination of multimedia applications combined with computing and Internet technologies that allows users to individually control their access to and use and manipulation of the content.

Knowledge – The facts, principles, and understanding of a topic that is obtained through experience or study.

Learning Strategies – The cognitive and meta-cognitive techniques and management of resources utilized by students to success in a course. Learning strategies are dynamic and can vary from course to course.

Motivation – A student's ability to self-regulate their own learning process, both meta-cognitively and behaviorally, to achieve their goals in a course. Motivation is dynamically and contextually bound as it can change over time and for different courses.

Multimedia – The use of a variety of data and file types to present instructional material. This includes the use of text, audio, video, graphics, and animations.

MMIT (Multimedia Instructional Tools) – An instructional computer program or application that is created by applying instructional design techniques to present material for student learning through the use of interactive media. Myitlab is an example of a MMIT.

Service Course – Courses offered by a department or college of the university to students who are not majors of that department or college.

Student-Centered Learning – Learning where students use interactive, learner-centered, problem-solving activities that incorporate the use of course materials to support their own individual learning. The focus of class activities changes from the instructor and the presentation of course material to the student through the use of student-centered activities (Twigg, 2000).

Delimitations

This study was delimited to students enrolled in the online sections of the *Introduction to Computer Applications* course in the spring 2013 semester at one southeastern university using the myitlab MMIT. Multiple environments were not studied. For the research, only the data on the Excel module were examined due to students' traditionally lower levels of pre-existing knowledge on this content subject. This provided the biggest opportunity for learning to occur and for students to acquire new knowledge. These delimitations may impact ability of the results to be extended to other courses and at other institutions of higher education.

Assumptions

Several assumptions were made in regard to this study. The researcher assumed that students were homogenous in their background as college students and basic motivation to be successful in the course. As the CIS 150 course is an online course, the researcher assumed students enrolled in the course had regular and reliable access to a computer or utilized provided lab times to complete course assignments. Students were assumed to have basic working knowledge of a computer and the Internet. Additionally, the researcher assumed that students completing the pre-module and post-module questionnaires answered the questions honestly and based on an accurate representation of course activities.

Justification

This study helps to determine if the use of MMIT in an introductory computer applications course increased student knowledge and motivation as previous research on the incorporation of MMIT indicated for other subject matters. Although publishers claim positive benefits from the use of MMIT, there is currently no identified prior research that examines the use of MMIT in the area of computer applications courses. Computer applications courses differ from many other courses in that the MMIT uses technology to teach students technology skills. Previous research on the effects of the mymathlab MMIT was inconclusive due to the small sample size (Kodippili & Senaratne, 2008). This study specifically examined whether students in the introductory computer applications course increased their knowledge by using the myitlab MMIT to learn the instruction material, including the ability to access the materials and exercises multiple times. The study also examined whether students recognized and reported benefits, such as an increase in their knowledge, motivation, and interest in the course from using the MMIT.

The results of this study can help college instructors to determine whether MMIT can effectively be implemented in their computer applications course to support student learning. If shown to improve student knowledge, these tools can be used by other institutions in their introductory computer applications courses to help enhance their courses. The results could also be expanded to the different modes of teaching to include not only online offerings of computer applications courses, but the blended and face-to-face sections as well. This type of basic technology course is a standard and high enrollment course at most universities. Improvements to this course, based on the research findings of this study, could be applied to a large number of students attending a large number of institutions creating a significant overall impact. Colleges and departments teaching subject areas where similar MMITs are available may also find the results of this study helpful. The results may indicate whether these tools could improve student knowledge in their courses.

Publishers of the multimedia instructional tools, including Pearson Education and others may benefit from the information provided by this study on the effectiveness of the tool. The results may indicate areas of improvement for the publishers of MMIT and how to better design MMIT for their publication packages used by instructors, leading to an increase in adoption and sales of their textbook and MMIT.

Summary

Changes in education coupled with advancements in technology have led to the use of MMIT within the classroom. MMIT have been incorporated into today's educational environment to provide students with multimedia content combined with student-centered, hands-on, active learning activities with the goal of increasing student knowledge and motivation (Wang, 2010). These tools have the ability to present instructional content and move the focus of class activities away from the instructor and to the individual students. MMIT provide students with interactive problem-solving activities, practice opportunities, assessment, and frequent feedback in an effort to improve knowledge through student engagement.

MMITs are widely used in computer applications courses, with their popularity continuing to increase (Speckler, 2010). Many publishers, including Pearson Education, provide MMIT to accompany their computer applications textbooks. These tools contain instructional materials, training lessons, end-of-chapter exercises, and summative assessment activities. Each of these activities can be completed and evaluated multiple times without increasing the instructor workload. Myitlab is an example of a MMIT used in an introductory computer applications course.

No existing research examines whether the use of MMIT in computer applications courses achieves the goal of increased student learning. As the MMITs are often used in large enrollment services courses, including introduction computer applications courses, their effectiveness in increasing student knowledge and motivation can have a significant impact within the university (Twigg, 2011). This research study examines the relationship between the use of MMIT in computer applications courses and an increase in student knowledge and student motivation.

Chapter II includes a review of the relevant literature that had been identified in the preparation of this research study. The literature review focused on instructional technology and multimedia instructional tools, specifically as they relate to higher education, computer applications courses, student learning, and student motivation. Examining previous research is a critical component of any current research study. Chapter III describes the design of this research study. Details are provided on the study participants, data collection processes, and data analysis procedures used to address the three research questions. Chapter IV presents the results of the data analysis. Findings related to each research question will be presented. Any results indicating a statistically significant difference will be identified. Chapter V discusses implications of the study results. Research limitations are identified and recommendations for additional research opportunities are provided.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The purpose of this study was to examine the relationship between MMIT and student learning in an introductory computer applications course. This chapter presents a review of the relevant literature used in the preparation of this study. The topics of the literature review for the study focus on the integration of instructional technology, the incorporation of multimedia in the classroom, introductory computer applications courses, the use of MMIT in higher education, MMIT and student learning, and MMIT and student motivation. The various sections of the literature review cover the integration and use of MMIT within a college level introductory computer applications course. Specifically, how the integration of the MMIT affects student learning and student motivation in the course. Reviewing literature related to past and current research on the integration of multimedia and MMIT in the classroom is critical toward understanding MMIT's impact on education.

Theoretical Framework

Many different learning theories have been designed in an attempt to improve the teaching and learning process by helping people understand how learning works. Three critical factors of learning have been identified as components of all learning theories: (1) the knowledge to be learned, (2) the situation or context for the learning, and (3) the activities that will be used as part of the learning process (Ertmer & Newby, 1993). Learning theories offer focus and direction for the instructional design process used in the development of MMIT. These theories help indicate what components are important to include in the instructional activities for learning to occur (McLeod, 2003). This research project was based on a combination of constructivism and cognitive learning theory.

Constructivism

Constructivism is founded on the belief that learners are responsible for creating their own knowledge based upon their own experiences. Each learner creates meaning through their own interpretation of the instructional material. Learning takes place through the use of authentic *real-world* authentic tasks and problems based on relevant material that require learners to extend their knowledge through the use of problem solving (Ertmer & Newby, 1993). Meaning is created by the learner as new information is linked to the learner's existing knowledge base. Instructors provide important direction and guidance in the learning process; however, the student's mind determines what is learned by what it receives from the outside world (Koohang, Riley, & Smith, 2009). Constructivism is able to provide a more complete picture of the conditions for learning including the learner's mental processes and the incorporation of the learner's individual differences in the instructional design process (Tennyson, 2010).

Constructivists believe that knowledge is situationally determined. Learning is embedded in the various situations that learners find themselves in. There is an emphasis on contextually-based problem solving that allows learners to apply pre-existing knowledge to new problems and new situations. Instructors are not responsible for teaching students facts, but instead prepare students to apply the facts they already know to new or different situations. The learning tasks must be deemed relevant to the learner and occur in a realistic setting (Ertmer & Newby, 1993).

Goals for learning include the use of realistic and relevant content, the introduction of multiple perspectives, and positive reinforcement to encourage students to take ownership in their own learning process (Koohang et al., 2009). Providing multiple contexts for presenting the content allows learners to develop their own individual representation and interpretation of the information. Students are encouraged to identify and use sources of information that best align with their learning styles and strategies. This allows for active knowledge construction and encourages students to develop their own individual interests and interpretations. Instructors are mentors and guides in the learning process (Koohang et al., 2009).

Constructivism identifies learning as an adaptive activity relying on experiences, prior learning, and social interaction. Conceptual growth derives from determining meaning from individual experiences, sharing multiple perspectives with others, and by changing internal representation through a collaborative learning process (Mergel, 1998). The main focus of constructivism is higher order processing and problem solving, not data representation (Koohang et al., 2009)

MMITs, including myitlab, implement this learning theory through activities including simulated hands-on exercises and end-of-chapter summative capstone exercises. The hands-on exercises provide students with authentic *real-world* situations presented in a simulated environment. Students are asked to use their existing knowledge to complete tasks and to apply this knowledge to new situations for learning. If students complete the tasks, they proceed to the next situation. However, if they need help and instruction, multiple sources of information are available to them aimed at different learning styles. These include the textbook, audio PowerPoint presentations, multi-modal step-by-step guides, and audio-video *show-me* tutorials. The learning theory is further implemented through the end-of-chapter capstone exercises. The activities require students to create their own documents and spreadsheets that solve the problems presented and meet the objectives set for the chapter. Students must apply the knowledge they learned throughout the chapter's activities and lessons to new situations provided in these summative projects.

Cognitive Learning Theory

The cognitive learning theory was developed to explain perceived problems in the preexisting behaviorist learning theory. Behaviorists believe that learning is a response to a stimulus; therefore, the focus of learning should be directed at creating or strengthening the relationships between the stimuli and the desired response (Ertmer & Newby, 1993). However, cognitive learning theorists point out that not all reinforced behavior will be repeated and that some behavior is repeated despite a lack of reinforcement. Cognitive learning theory attempts to identify the thought processes behind learners' behaviors (Mergel, 1998). The focus on cognitivism is on complex learning processes including problem solving, reasoning, thinking, and information processing. The learner, it is believed, is an active participant who is taught how to learn (Ertmer & Newby, 1993). Cognitive learning theory is based on changes in learner behavior as it relates to learning. Cognitive theorists believe that learning is achieved through creating new internal links through repetition and contiguity. Learning occurs when new information is acquired and organized in context with the learner's existing knowledge (Deubel, 2003). Positive reinforcement through the use of appropriate feedback is important for learning success. Practice, supplemented with rewards, feedback, and reinforcement will improve learning and the retention of knowledge (Good & Brophy, 1990). Contiguity and repetition account for a large amount of the learning, while feedback and reinforcements are noted as important contributors (Mergel, 1998). Cognitive learning theory is aimed at higher levels of learning than other theories, including behaviorism (McLeod, 2003)

A significant key to the learning process is the quality of the information processes that occurs when a learner is actively engaged with the material. Learners must view the learning as important and relevant in order to achieve a meaningful and long-lasting learning process. There must be a belief that the information is useful and important before learners will create a relevant association with it (Ertmer & Newby, 1993). A three-stand information processing model identifies the learning process. Stage 1 is where the material enters the learners' sensory register where it can reside for up to four seconds. After four seconds, information that is identified as important is transferred to stage 2 in short-term memory. Short-term memory holds on average seven, plus or minus two, items for a period of up to twenty seconds. Short-term memory items can then be transferred to stage 3, long-term memory, for longer retention and use. Long-term memory has no identified limits. The deeper the knowledge process, including creating links between new and existing knowledge, the better the data retention. Cognitive memory concepts such as practice, mnemonics, organization, serial position, and inference effects can help to create and improve such data linkages (Mergel, 1998).

A main emphasis of cognitive learning theory is based on connecting new learning to students' prior knowledge. Learning is a cognitive activity that requires internal coding by the learner (Ertmer & Newby, 1993). Problems can occur when students are lacking in pre-requisite knowledge. This requires instruction be appropriate for all experiences and skill levels. This can be a time-consuming and expensive process for instructors (McLeod, 2003).

Myitlab and other MMITs incorporate the use of cognitive learning strategies. Myitlab was created as a multimedia tool incorporating the use of audio, visual, and tactile learning. Students are allowed to demonstrate their knowledge by performing tasks. If tasks are completed correctly, the student receives multimodal positive feedback and is prompted to complete additional tasks. If the student does not or cannot perform the task, they are provided with multi-modal instructions that help provide directions on how to complete the task. This approach allows students to demonstrate their existing knowledge and supplement this knowledge with new material. Students are provided immediate feedback, both positive and negative, as they progress through the assignments. Tasks may be repeated by the student multiple times as reinforcement. Additionally, at the instructor's discretion entire assignments may also be repeated (Speckler, 2010).

Multimedia and Student Learning

Research indicated that the use of multimedia materials improves learning and retention as compared to traditional approaches to instruction, including the use of lectures and Power-Point slide shows (Kawulich, 2010). Presenting materials in multi-modal formats, including both auditory and visually, has effectively increased student learning. The technology allows teachers to assist students in applying the material presented in textbooks. Multimedia learning platforms encourage student to engage in active learning and allow the student to easily identify the proper learning method and achieve the learning target (Wang, 2010). Multimedia instruction has also been shown to make classes more vivid and interesting which can increase student learning, motivation, and class efficiency (Dong & Li, 2011). Many different levels and types of learning exist. Each learning type requires a specific type of instruction to support effective learning. Nine instructional events have been identified by Gagne (Gagne, Briggs, & Wager, 1991) as requirements for learning within the intellectual learning type used as a basis for higher education and often serve as the steps for planning instruction (Gagne, Wager, & Rojas, 1981). These nine events include: gaining learner's attention, informing learner of the learning objectives, stimulating recall of existing knowledge, presenting new information, providing guidance and direction, requiring learner performance, providing feedback, assessing the learner's performance, and improving retention of the knowledge. These nine events serve as the foundation for designing instructional materials although each of these events do not need to be provided for every lesson and the events do not always happen in the given order. The role of the instructional events is to stimulate information processing. Some events may be obvious to the learner rendering them unnecessary. Additionally, one or more of the events may be provided by the learner themselves, especially in the case of self-directed learners (Gagne et al., 1981).

MMIT incorporate instructional design to support student learning through the incorporation of these nine instructional events into specific components of the MMIT. Pearson Education applies each of the nine instructional events into the various learning components of the myitlab MMIT. The training exercises provide one example of how this is accomplished. Students' attention is gained by providing initial instructions for the lesson and by highlighting the specific step the student is currently working on. Each step in the training exercises is linked directly to one or more of the published objectives for the textbook chapter. The objective number is displayed with the instructions. The recall of prior learning is stimulated by encouraging students to complete tasks they have previously learned. Instruction is only provided for tasks the learner is unable to complete on their own. Stimuli are presented in the instructions for each activity. Additionally, the stimuli and instructions are mapped directly to the textbook materials for each lesson. Guided learning is provided in the myitlab program through the *show me* and *hints* methods. These provide auditory and visual instructions on specifically how to complete each step of the lesson. Students' performance is elicited by the requirement of the students to complete each component of the lesson, even if they have been shown how to complete the activity through the *show me* or *hint* instructions. Immediate feedback is provided after each completed task. Correct completion of a task results in students being directed to the next task. Incorrect actions result in an *Incorrect Action* notification and the student being redirected back to the task to try again, with or without additional instruction. Performance is assessed through the use of assessment exercises that are specifically mapped to the training exercises. Retention and learning transfer is enhanced through the application of the exercises using additional scenarios and the use of end-of-chapter capstone exercises. The incorporation of the nine instructional events of learning supports the assertions by the MMIT publishers to be tested by this research study that the use of these tools supports and increases learning (Speckler, 2010).

Multimedia, Interactive Media and Virtual Learning Environments

Multimedia has been defined by as a combination of multiple types of media, including text, graphics, animation, music, sound effects, etc., in communication (Gaytan & Slate, 2003/2003; Zin et al., 2012). Interactive media is created when multimedia is combined with computing technologies to provide the four essential components of multimedia instruction: (1) a computer to coordinate the sound and video and allow interactivity on the part of the viewers, (2) hyperlinks to connect the information, (3) navigational tools that place the user in charge of accessing and browsing the information, and (4) methods for students to gather, process, and communicate the information and ideas (Gaytan & Slate, 2002-2003). Multimedia uses computers to present and combine the different media elements with links and tools that allows for the navigation, interaction, and communication by the users (Gaytan & Slate, 2002-2003). Multimedia allows for a large spectrum of options to be available for improved teaching and learning (Milovanovic et al., 2011). Multimedia has been found to successfully increase student learning, especially for those with low achievement levels. A student's level of understanding the instructional material is higher when multimedia applications are employed. Additionally, communication between the teacher and student is also increased, which can have an empowering effect on the student (Zin et al., 2012). Multimedia adds multiple views of the content allowing a clearer picture of the subject matter. This adds richness and meaning to the material by providing additional visual and verbal information to increase the depth of learning (Neo et al., 2011).

Multimedia Types

Four main types of multimedia have been identified: static text, image-based, video-based, and animated interactive multimedia (Chen & Sun, 2012). Multimedia has the ability to offer students video and animation that can clearly demonstrate complicated concepts in a way that works with student intuition and visual perception (Milovanovic et al., 2011). Video is often a significant component of multimedia technology. Video places the technology in control of the learner's activities that allows students to take a learner-centered independent approach permitting the instructor to spend more time on difficult material (Van der Westuizen, Nel, & Richter, 2012). Multimedia using video and animation does however, require additional computing resources for viewing and storage as video files and presentations typically produce large data files. Although text-based information is cheaper, easier to develop, and has minimal computing requirements, audio and video has the potential to improve students' knowledge, technological skills, and academic performance (Van der Westuizen et al., 2012). Students prefer using modern approaches to learning including multimedia, educational software, and the Internet (Milovanovic et al., 2011). Multimedia impacts student learning by allowing students to identify the relevant components from the material and internally organize them into meaningful visual and verbal representations that the students can then create internal connections between (Chien & Chang, 2012). Additionally, Chien and Chang (2012) identified three categories of multimedia lessons: static graphics, simple learner-paced animation, and full learner paced animation. Static graphics consists of pictures only. Simple learner-paced animation allows students to control the speed of the animation by stopping, rewinding, and replaying the instructional content. This reduces the cognitive load during the learning process and improves the learning outcomes over the use of static graphics alone. Full learner-paced animation allows students to directly manipulate the individual parts of the presented learning objects, or the entire object as a whole. Students gain full control of the representative process (Chien & Chang, 2012). Hands-on learning activities in myitlab provide this type of multimedia instruction. Students are provided authentic learning activities in a simulated Microsoft Office environment. Students are provided with tasks to complete. If they successfully complete the task, they move onto the next task. Students requiring instruction may choose a multimedia *show-me* video, an interactive step-by-step *hints* option, or traditional textbook instruction. Students have the ability to choose which activities they complete and how much instruction they obtain for each of these exercises.

Interactive Multimedia

Interactive multimedia, according to Stemler (1997), is a learning process and not a specific technology. Interactivity when used in multimedia learning is an activity between the learner and the learning environment. The action of the learner is dependent on the reaction of the multimedia learning environment and vice versa. It is a dynamic relationship between the student and the learning environment (Domagk, Schwartz, & Plass, 2010). There are two requirements for interactivity to occur: (1) there must be at least two participants, whereby the learning environment can be one of the participants, and (2) there must be reciprocity. This requires change on both sides; the actions of one participant cause a change in the other (Domagk et al., 2010). The purpose of interactivity is to place additional learning potential in the hands of the learners themselves. The user's or student's needs and the educational content must be the focus of technology-based educational software. Multimedia provides learning activities within a meaningful context allowing for the promotion of inquiry-based and discovery learning (Bourgonjon, Valcke, Soetaert, & Schellens, 2010). Interactive multimedia is used to promote both learning and motivation. It provides a powerful opportunity to improve student learning (Chen & Sun, 2012). Interactivity makes it easy for students to direct their own learning. The students can choose what parts of the content to focus on, explore that content more fully, test their own ideas, and receive appropriate feedback. The possibility to improve learning is there, but students are required to be actively engaged for the learning to occur (Domagk et al., 2010). The development of interactive technologies has changed the educational process and eased the resource burden often associated with the teaching and learning process. The use of interactive technology combined with effective teaching strategies allows for mastery learning to be used as a teaching tool by providing easy implementation and quick informative feedback on learning units. Feedback is used to reinforce, clarify, and narrow the learner's focus (Hoon, Chong, & Ngah, 2010).

Virtual Learning Environments

Virtual learning environments (VLEs) are computer-based environments with relatively open systems that allow for interactions between students and instructors while also providing access to a wide range of available resources (Piccoli, Ahmad, & Ives, 2001). VLEs consist of information systems, including but not limited to MMIT, used to electronically support learning in higher education environments. Their advantages can include efficiency, individuality, timeliness, task orientation, collaboration, communication, and convenience (Mueller & Strohmeier, 2011). Their low-cost simulated environments can serve many purposes including, but not limited to, education and training. MMIT used in computer applications courses, including myitlab, provide a simulated Microsoft Office environment that allows students to learn how to use the Office applications without the university or the students having to purchase the Microsoft Office application software. They can provide a cost-effective way to deliver content and training (Porter, Weisenford, & Smith, 2012). VLEs are a designated informational space, as well as a social space to allow student to interact with each other and with faculty. This can include messaging and chat features. This virtual space is explicitly represented and can include anything from text to 3-D simulations. The representation itself is not as important as what the students do with the representation and how it influences their work and activities (Dillenbourg, Schneider, & Synteta, 2001). Students must actively participate and constructively add to the space. They must be producers and information consumers. Students each respond to postings that can be read by the participants in the class, and possibly others in the virtual world. VLEs are not limited to distance education courses and can be used to support the traditional classroom environment. VLEs often overlap the physical classroom environment by integrating physical tools found in the classroom including books, non-electronic resources, and face-to-face discussions, with technical and software tools in the VLE (Dillenbourg et al., 2001).

VLEs and MMIT consist of three main characteristics: system functionality, content and learning materials, and support including the human-related support and communication that work within the system. There is very little existing research on these three characteristics of the VLE (Mueller & Strohmeier, 2011). VLEs integrate heterogeneous technologies with multiple pedagogical approaches that allow the combination of resources for information, collaboration, communication, learning, and classroom management. VLEs allow learners to access course materials independently, work through the material using their own individually selected path, utilize different methods of displaying the content material, and incorporate the many-to-many relationships between students and faculty members (Piccoli et al., 2001).

Traditional learning environments are defined by time, place, and space. VLEs add technology, interaction, and control to this definition. Traditionally, technology has not had a significant impact on the overall educational environment. For example, e-mail did not have a major effect on how teachers taught. However, VLEs, MMIT, and technology integration provide a high level of student control and the means and the opportunity to change the overall teaching and learning experience for both teachers and students (Piccoli et al., 2001).

Planning for the VLE is vital. Design is a critical component for success in any training or educational activities. The instructional design process should be included when developing a VLE. The designer needs to select the appropriate technology for the right content using the correct programs and applications (Porter et al., 2012). Success depends on the VLE being appropriately developed and implemented. Not all VLEs are successful; they must be developed using appropriate instructional design theories and techniques (Mueller & Strohmeier, 2011). The technology should not drive the creation of the VLE. An instructional designer should create scenarios and learning activities, including assessment and feedback that match the learning objectives (Porter et al., 2012).

Primary components of a VLE and a MMIT include students, instructors, technology, learning model, and content (Piccoli et al., 2001). Students are the primary participants in any learning environment and virtual learning environments require extensive interaction on the part of the students. Students have control over the instructional material. They make their own decisions regarding the path, flow, and interactions with the content. Instructors are the main actors in this type of learning environment. Students using a virtual learning environment often believe their class is *in session* whenever they log on, and they expect the instructor to be available to them. This requires a significant increase in time and energy for the instructor. The technology, including necessary hardware and software must be reliable, easy to access, and of high quality. Technological access is an important component of an effective virtual learning environment. The constructivist learning model influences the design and effectiveness of the learning environment allowing for student-centered active learning. Uncertainty is one of the best subject matters and content types for VLEs. Computer-aided instruction often applies to factual and procedural knowledge; however, communication and interaction can be used in this environment to develop higher-order thinking skills and to build conceptual knowledge. This can be accomplished through discussions, brainstorming, problem solving, collaboration, and reflection (Piccoli et al., 2001). Integration of Instructional Technology Educational technology is the use of technology to support the educational teaching and learning process (Bassoppo-Moyo, 2011). Over the past several decades instructional technology has been impacted by the developments of the personal computer. Computers were originally dismissed as educational tools and the Internet was originally thought to be too slow and complicated for use in education

(Bassoppo-Moyo, 2011). The Internet revolution has transformed instructional technology. Most of today's teachers have Internet access both at home and at work. Instruction is no longer limited to the formal classroom, and the instructor is no longer the only source of information Computers have simplified the day-to-day activities of education by allowing teachers to work smarter not harder (Bassoppo-Moyo, 2011). Gaytan and Slate (2002-2003) report that technology-based learning environments have developed as a response to several factors including:

- A decrease in all levels of educational funding.
- An increase in the overall cost of education including faculty, staff, and learning environments.
- An increase in global competition.
- The increasing diversity of the student population.
- A change in student's technical background and their educational expectations.
- A growing need for lifelong learning.
- The need for educational institutions, as part of the free enterprise system, to maintain a competitive edge while providing a trained workforce.

The emergence of technology-based learning environments has the potential to create a student-centered learning environment that, when based on technology, allows the student to develop a greater sense of responsibility and control over their individual learning process. The focus of teaching shifts from teacher-centered learning to student-centered learning in an attempt to help students become autonomous learners who can continue to learn outside of the classroom (Tsai, 2012).

Technology Adoption

Three levels of technology adoption exist (Rogers, 2000). The first level consists of the use of personal productivity aids. This includes the use of tools like spreadsheets and word processors to help students and instructors complete their required tasks quickly and easily. The second level is the use of enrichment add-ins. This includes adding new materials into the traditional model of teaching and learning. This level has no significant change to teaching but instead uses technology like e-mail, Web pages, and multimedia to enhance the regular model of learning. According to Rogers (2000), this level is the most common type of technology adoption. The third level is the paradigm shift. This level reconfigures the old style of teaching to incorporate new technology to enhance student learning. The paradigm shift requires the focus change away from the student-centered classroom where the focus is on student learning. The role of faculty must shift focus to student learning by allowing the application of technology to be responsible for delivering the content to the student. Virtual classes and content delivery must be very different than traditional face-to-face classes. Adequate training for the faculty and continued technical support is often the weak link. Although such training and support is critical to success, most faculty receive little effective training on the use of technology in their classroom (Burns, 2010; Rogers, 2000).

Constructivist theories drive this third level by allowing students to focus on the lessons and instructional strategies. Focus is placed on different learning styles. Appealing to the student’s individual learning styles and preferences will increase the learning efficiency and retention. Students who experience higher levels of interaction also have higher achievement levels (Rogers, 2000). Instructors with proper knowledge of how to use the technology can create equal or better classrooms that include interactive learning activities, timely asynchronous communication, collaboration and group work, well-planned teaching environments and activities, frequent high-quality feedback, immediate access to information and course materials, and allow students to progress at their own rate while supporting various learning styles (Rogers, 2000). Learning research has shifted focus to a more open and learner-centered process. This change requires students to have high-order reasoning skills and knowledge construction ability. The goal is to provide students with the opportunity of exploration, whether they are using computer-based learning or not (Leung, 2003).

Issues with Technology Integration

There are issues associated with the integration of technology. According to Bradley, Mbarika, Sankar, and Kaba, (2007) these include, but are not limited to:

- Inadequate Hardware.
- Platform compatibility issues.
- The obsolescence of technology.
- Software compatibility issues.
- Software Requirements – including operating systems, interface software, authoring software, and courseware needed to create and deliver multimedia content.
- Lack of support, training and assistance.

The educational process must be modified to allow the integration of technology (Keengwe & Kidd, 2010).

The implementation of technology into the learning environment provides students with relevant material, state-of-the-art educational content delivery systems, a cost-effective approach to instructional delivery, and the opportunity to increase the quality of the educational environment without a significant increase in the cost. Control must be shifted to the student empowering them to direct their own learning and letting them choose what and how they learn (Gaytan & Slate, 2002-2003).

The reality is that today's students have largely grown up in the digital age and have never known life without a computer. They rely on technology for most of their information, learning, and education. They are not scared of technology, nor are they in awe of it like many of their predecessors. To them technology simply is a natural part of their lives (Bradford, 2005). Students' familiarity with computers and technology has affected their educational preferences and learning styles. They demand instant access to information and have low tolerance for passive learning. Students expect technology to be incorporated into their education (Waycott, Bennett, Kennedy, Dalgarno, & Gray, 2010). However, research shows that students make a clear distinction between what they designate as *living* technologies and *learning* technologies. The way students use technology socially on a daily basis is very different from how they want to use technology in education. Students do not want social technology like instant messaging and social media to be used in their educational computing; it should remain in their private lives (Waycott et al., 2010).

Incorporation of Multimedia in the Classroom

Worley (2011) reports the purpose of education is not to provide students with instruction; the purpose is to have students learn. Today's students have different motivations, outlooks, attitudes, and approaches to their education (Worley, 2011). The thought exists that if school was good enough for us the way it was in the past, then it should be good enough for today's student (Knowlton, 2005). However, the world has changed dramatically since then with different equipment, different expectations, and different challenges (Knowlton, 2005). The use and adoption of technology is widespread in commercial industries which makes it important for education to keep up in order to provide a trained workforce. Technology changes how work is accomplished and how business is conducted (deLange, Suwardy, & Mavondo, 2003).

Benefits of Multimedia in the Classroom

Incorporating MMIT into the educational process can be beneficial to student learning. Educational technology has been shown to increase student learning, encourage active learning, and aid in building competencies (Eastman et al., 2011). Research by Kawulich (2010) on the use of multimedia in a management information systems course indicated the technology provided students an innovative way to learn the material and relate the lessons to real-life situations. The students in this study preferred the integration of technology in the course to the traditional lecture format, with none of the students indicating the addition of the technology was ineffective for their learning (Kawulich, 2010). Students report the addition of multimedia makes the class more interesting and vivid, increasing their interest in the topic and in learning (Dong & Li, 2011). Data from early use of MMIT shows that the use of multimedia fosters communication between faculty and students while focusing on active learning principles. MMIT and the incorporation of technology in education changed the learning process from where students just heard and forgot, to where they saw and performed actions that increased their learning and understanding of the material (Gaines, Johnson, & King, 1996).

The premise that technology can help students learn more effectively and efficiently has not been substantially supported by empirical evidence. Research has been inconsistent and contradictory as some studies show improvement and significant positive impact from the integration of technology and other studies showing no positive effect (Lei, 2010). These findings may be flawed because the studies treat all technology the same, with no distinction made between the type of technology or how it is used. Additionally, the studies only examine how much technology is used without regard to how it is used or the quality of the technology used (Lei, 2010) There is a need for further research on effective educational strategies (Stegeman & Zydney, 2010).

Student-Centered Learning

The incorporation of MMIT focuses on the use of sound pedagogical principles to move toward active student-centered learning. Students are required to shift from a passive to an active role in their learning process. Course components that focus on knowledge acquisition, repetitive teaching tasks, and learning basic skills can often be improved by shifting them away from the traditional teacher-centered instructional format to a student-centered information technology (IT) format and the use of MMIT. Students then take control of their own learning process. Students can access the instructional materials at their own pace and use their preferred learning styles. The material can be revisited multiple times to reinforce and to support student learning. MMIT provides an informative and enjoyable learning environment by combining the instructional theory with practice through the use of real-world problem solving opportunities. The tools allow large amounts of material and information to be easily accessible and available to the students at all times (Bradley et al., 2007). MMIT provides students with a consistent curriculum and interactive instruction that is available on-demand. Information and instructions presented to students are consistent regardless of how many times the students access them, which is not always the case in a traditional classroom environment. Instructors can use MMIT to present course instructional materials in multiple formats including videos, reading assignments, and simulations.

Net Generation

Students today are part of the digitally switched on generation. Students born between 1980 and 2000 are referred to as millennials or the net generation. They are larger than previous generations and are expected to make up over 75% of the population in 2012 (Worley, 2011). They have never been without access to a computer. They are multi-taskers and prefer experimenting as the favored way of learning. Anywhere, anytime learning and communication are the expectations. Today's students readily relearn and adapt to new technologies. They are global players in the social, educational, and job markets. Their cultural awareness allows easy collaboration with others, even those in different countries, time zone, cultures, etc. (Knowlton, 2005). Net generation students process information and communicate differently than previous generations. They are comfortable with technology. They prefer task-oriented and experimental learning. They access information using multiple communication channels, often at the same time. They also e-communicate with their friends and teachers (Limniou & Smith, 2010).

Classrooms must reflect this new reality. One-way communication, *chalk and talk* by the instructor, often causes students to be passive recipients of information. This increases boredom and inattention by the students (Zin et al., 2012). One of the greatest educational challenges is in the area of technology use. The students are more technologically advanced, but the faculty members are often not ready to meet the challenges presented by these students. The instructors grew up with different learning and teaching styles than their students. There are significant differences in the expectations and technology use between the faculty members who are doing the teaching and the students who are doing the learning (Worley, 2011). Colleges must change to meet the students where they are. Students need more visualization. They want more hands-on active learning assignments and edutainment. Edutainment are the new methods and practices that promote faster and more efficient learning through the use of entertainment methods that include gaming, interactivity, and multimedia (Rajendran, Veilumuthu, & Divya, 2010).

Changes in Education

Despite the typical resistance to change, the education system and curriculum is undergoing a fundamental transformation and all educators need to stay focused and aware of these changes. The rise of information and communication technologies has changed the educational process; it has helped to ease the resource burden often required for the teaching and learning process (Hoon et al., 2010). There is a flattening of the world based on digital content and communication tools. The same flatteners of the economic world are now changing the world of education. Content must be digital in order to be globally relevant. Today’s students often look to the Internet as their first source of information (Waycott et al., 2010). Information is now more widely and extensively available than ever before. Students must be able to sort through it all, understand it, and process it. Most of the information is unfiltered. There is no editorial or review process for much of what is posted to the Internet. Students have to learn how to simply deal with all of the available material. This includes gathering information, evaluating, verifying, and comprehending this material. Accessing and using the information is just the first step in the learning process. This is followed by collaboration and new knowledge creation. There are some worries about information overload, ineffective teaching methods, and the possible weakening role of the instructor. Multimedia can present too much material without distinguishing between that which is relevant. It can also provide information that is above the students' ability level, increasing their anxiety and decreasing motivation (Dong & Li, 2011).

Removing collaboration barriers. The adoption of technology has been able to remove or reduce many of the barriers to collaboration that have previously caused significant issues. Traditionally, finding a time and location for a group of people to meet and collaborate was quite difficult, expensive, and time consuming. Communication and collaboration could require travel and significant financial resources including expensive long-distance telephone calls, airline tickets, hotel rooms, travel expenses, time, and postage to mail letters and packages. Digital communication technology has been able to remove many of these issues. Instant messaging, text, synchronous and asynchronous chatting, and videoconferencing are now possible at minimal costs, removing many of the preexisting collaboration issues including travel expenses. This makes increased collaboration for both teachers and students with peers in their classroom and around the world possible and feasible, while also increasing the development of student's multimedia and computer literacy skills.

Using technology and the World Wide Web (WWW) as a platform, learning becomes an active process. The traditional passive education where information passes from the mouth of the teacher into the brain of the student is replaced by a collaborative active environment where the student is engaged in comprehending information and creating their own knowledge. The WWW allows technology use to increase while decreasing software and hardware expenses. Shareware, open source software including Linux and Open Office, and free Web tools are readily available to everyone. The WWW as the primary platform decreases the relevancy of the operating system. This digital environment with 24/7 online access to a wealth of information is now an expectation. The educational environment has been required to adapt to it creating a demand for efficient, hands-on, interactive, customizable learning curriculums (Fryer, 2005).

Resistance to change. One of the best practices in today's educational environment is maximizing the use of multimedia applications (Zin et al., 2012). Diversity in education, by using different types of media including graphics, animation, text, audio and video, can have a positive impact on students' learning and on their interest in the learning process. A diversity of teaching methods when presenting instructional material is an important component for student motivation (Zin et al., 2012). Interactive multimedia and MMIT can facilitate both teaching and learning. However, this is not an easy transition. According to Keengwe and Kidd (2010), teachers are hesitant to adopt new technologies for a variety of reasons including:

- An already heavy workload.
- A lack of training and familiarity with the technology.
- Limitations of the technology.
- A move away from face-to-face interaction and towards electronic communication.
- Difficulty in developing or obtaining high quality materials.
- Problems with the technology and existing school infrastructures. (Keengwe & Kidd, 2010)

Higher education teachers are trained in their primary content field, not in education or in the use of technology (Limniou & Smith, 2010). Students' assessment of their instructor's expertise in the use of technology and online learning, combined with the instructor's support and encouragement of the students, were good predictors of the students overall achievement and satisfaction with the course (Paechter et al., 2010).

Information management. Computers and computing technology have changed the way we manage information. Multimedia allowed computing to evolve from text-based data into graphics, sound, images, and video that provides a multi-sensory experience for the user (Gantt, 1998). Multimedia in education provides many advantages for both faculty members and students. Faculty members benefit from having more engaging classroom environments. They have access to current, up-to-date content curriculum for their subject area. They are also developing better ways to communicate content information to their students including animations and simulations. The new approaches to teaching allow for improved faculty and student interaction and increased interdisciplinary opportunities to work with other teachers and students around the world.

Technology allows the quality of education to improve while containing the costs (Chen et al., 2010). Similarly, multimedia provides many benefits for the students. The use of multimedia mirrors how the human mind works in thinking learning and remembering. MMIT allow students time for interpretation, analysis, and exploration. The combination of a variety of media components within a lesson allows the learners to use their preferred sensory modes and learning styles. Interactive exercises in the MMIT allow students to discover knowledge on their own through active involvement with the material. This process also allows misconceptions to be clarified and corrected early and quickly. Students have the benefit of being able to take a break to allow for review, remediation, and further analysis, encouraging a non-linear approach to learning. Additionally, MMIT allows those students with various literacy and math levels to fully participate in the lesson. Problem solving and collaborative team skills are promoted. The instructors can focus on the content components that require their input and interaction while allowing students to learn at their own pace (Gantt, 1998).

Events of Instruction

Many of the features of multimedia instructional tools correspond directly to Gagne’s nine events of instruction. For example, good screen design can help focus the learner’s attention, develop and maintain their interest, promote processing, promote engagement between the learner and the content, help learners find and organize instructional information, and help facilitate lesson navigation (Stemler, 1997). Neo et al. (2011) reported an increase in learning when Gagne’s nine instructional events are included as part of the design and development process of an interactive multimedia learning activity. Students in their study reported positive feedback on both their learning experience and the content delivery. The use of the nine events of instruction provided an effective guideline for developing the multimedia learning module and provided a well-organized structure and sequence (Neo et al., 2011). MMIT allows for the development of interfaces that include orientation cues that help students negotiate their way through large amounts of data using buttons, hot spots, previous / next options, and help systems. Learner control is central for interactive instruction. Increased learner control provided by MMIT promotes increased satisfaction and allows students to feel responsible for their own learning. Color in multimedia can be another effective tool; however, it should be used only for cueing and highlighting to gain attention as the more color used the less effective it becomes. Multimedia allows content to be presented in either graphical or text format. MMIT allow for the content to be provided in both formats to appeal to different learning styles. Animations can also be used in MMIT to illustrate points, teach concepts, and motivate student through the demonstrations (Stemler, 1997). Multimedia programs can effectively combine hypermedia techniques and instructions to present content to students. Multimedia often enhances the three main events of instruction: gaining attention, finding and organizing pertinent information, and integrating the new knowledge into the existing knowledge base (Stemler, 1997).

Good practices in undergraduate education. MMIT can also be used to promote each of the seven principles identified by Chickering and Gamson (1987) for good practice in undergraduate education:

1. Encouraging frequent contact between student and faculty. This can be one of the more important factors influencing motivation and student involvement.

2. Encouraging collaboration and cooperation between students. This serves to increase the social aspect of learning. Sharing ideas and responding to others can help to improve one's own understanding.
3. Encouraging active learning. Students must interact with what they are trying to learn. Talking, writing, applying, relating to their own experiences, and integrating active learning into their existing knowledge all increases learning.
4. Providing prompt feedback. Students need to know what they know and what they do not know so they can focus their learning. They need help in assessing their existing knowledge, and they need opportunities to perform, demonstrate their learning, and receive direction. Students need the chance to reflect on what they have learned and what they still need to learn.
5. Emphasizing time on task. Effective time management, allocating realistic amounts of time for learning, and well-defined expectations can help students focus their time and efforts.
6. Communication of high expectations. The higher the educational bar is set for students, the more the students will perform. Expecting students to perform can be a self-fulfilling prophecy.
7. Respecting diverse talents and different ways of learning. Students need to be able to work and learn in a way that is effective for them (Chickering & Gamson, 1987).

E-learning activities and MMITs are often based on constructivist strategies that rely on intrinsic student characteristics of curiosity, explorative behaviors, and learning for understanding not memorization (Martin et al., 2004). The ease of use of the technology by the students impacts the students' overall opinions and attitudes toward the technology. Students who frequently use computers feel more engaged in their learning process and have a more positive attitude on the impact that computer-aided instruction is having on their learning (Eastman et al., 2011).

Using MMIT. The use of interactive computing technology and MMIT in an attempt to increase interest in a science course showed improvement in student achievement and in perceptions towards science. This study indicated the use of technology based programs, and MMIT was a motivating factor for the students (Gaddy, 2007). Multimedia allows for a larger variety of options in the teaching and learning process and is an important component of modern teaching methodologies. MMIT provides the ability to include visualizations and animations that can clearly demonstrate complicated concepts by integrating students' intuition and visual perception (Milovanovic et al., 2011).

MMIT is gaining popularity with today's students. Spellman's (2000) study of the use of MMIT in geography courses indicated a lack of student support for the MMIT. This study found that the increasing use of MMIT was unpopular with students. Although there was an agreement that technology skills were useful for employability and they were relevant for teaching and learning, student resistance to the tools was high. Students preferred a more spontaneous relationship with the instructor than what was provided with previous MMIT (Spellman, 2000). Students today indicate the use of MMIT makes the material more interesting and easier to understand. Students report an ability to learn faster and easier when using technological tools (Milovanovic et al., 2011). MMIT provides diversity in learning tools, including graphics, animation, text, audio and video that can successfully impact student learning. Zin et al. (2012) reports that multimedia data is retained in the student's memory longer than information obtained through reading or listening alone. MMIT use can increase student interest and reduces boredom and inattention (Zin et al., 2012).

Computer-based learning programs and MMITs are developed and alleged to be interactive, learner-focused, based on constructivist learning models and encourage higher order thinking skills. However, there is no generally accepted framework or standard design guidelines to use as the basis for the creation of learning programs, including MMIT. This can be a difficult process as the requirements for each program may be different based on the specific content topic, the role of the instructional tool, and how the tool is to be integrated into the instructional process (Leung, 2003). Many software developers lack teaching experience, and the MMIT can lack a theoretical background. Some presentations and interfaces are too distracting for students. Livelier material can distract from a student's ability to learn (Wang, 2010). The technology itself will not lead to student success. Educators must utilize technology as a way to increase engagement and maximize the power of computing and instructional technology, which will lead to student success (Chen et al., 2010). There is a need for continuous improvement and constant innovation to continue to engage students (Eastman et al., 2011).

MMIT in Computer Applications Courses

According to Bradley et al, (2007), the use of MMIT in computing courses has shown some significant benefits for students including:

- Non-linear, on-demand, self-paced access to a great deal of information.

- More effective in gaining the user's attention.
- Engagement for the students.
- Better matched to support interactive learning activities than the traditional methods of conveying content and information.
- Directed specifically at improving what students learn and how they learn.
- Combining theory with practice.
- Providing students with a fun interactive learning experience.
- Encouraging collaborative learning and real world problem solving.

The use of MMIT can be resource intensive on the part of the instructor, especially during the initial implementation. Additionally, it can be difficult to measure students' actual learning. This often requires the use of pre- and post-assessments (Bradley et al., 2007). This specific study focused on the use of multimedia case studies and is not directly applicable to the introductory computer applications course.

Use of MMIT within computing classrooms teaches both technical and non-technical content. Multimedia instructional materials created by the Laboratory for Innovative Technology and Engineering Education helped improve cognitive learning at a higher level and helped convey technical concepts to students in both technical and non-technical fields (Bradley et al., 2007). Studies show the MMIT, when used in conjunction with traditional teaching methods, increasing the learning of content material. Studies are inconsistent in whether there are actually significant gains when using MMIT; however, research finds minimally equal gains when comparing MMIT with traditional learning environments, indicating the use of MMIT is at least as effective as traditional instruction (Stegeman & Zydney, 2010). The use of MMIT may be more effective for specific types of learning, including skill acquisition, where student-paced instruction allows students to stop, repeat, and review the material, can be invaluable. MMIT allows students to observe the process and procedures so they can visualize a complex process before completing it themselves (Stegeman & Zydney, 2010). Students also see an increase in their technological literacy and computing skills when utilizing MMIT (Chen et al., 2010). However, students often report being less satisfied with the course overall. Students' learning satisfaction with technology and MMIT may depend on their computer self-efficacy, the functionality of the tool, the course content, performance expectations, and learning climate. Students feel a big shift in the responsibility to the student, away from the instructor. The students reported a need to be both teacher and student. This can prove to be a very difficult adjustment (Wu et al., 2010).

One research study by Cooper (2001) was identified that specifically studied computer application courses. This study compared a traditional computer applications course that covered basic computer concepts and the Microsoft Office applications with an online version of the same course. A survey of the 94 traditional students and 37 online students showed that all of the students believed the class met their expectations. Students in the traditional class were more likely to *strongly* agree to positive statements on the pace of instruction, understanding of the course layout, teacher organization, and course grading. Online students were more likely to *strongly* agree to ask questions and usefulness of the course. A comparison of the quality of the instruction showed that 38% of online students reported they learned the same amount in the online class as they did in a traditional class, 31% reported they learned more in a traditional class, and 12.5% reported they learned more in the online class (Cooper, 2001).

Mymathlab

Mymathlab is a product created and distributed by Pearson Education that is somewhat comparable to myitlab. Mymathlab uses the same instructional platform as myitlab and uses a similar format for the instructional activities. Students are provided free-response exercises that correlate to the textbook, homework assignments, quizzes and exams in a manner as myitlab. Students are given problems to solve within the mymathlab tool. If the student can correctly solve the problem, they move to the next task. If the student needs additional help, they are provided with interactive guided solutions, animations, and video lectures. Activities are available in unlimited practice mode for repetition and reinforcement or in homework mode for graded assignments. Mymathlab does not include summative end-of-chapter capstone exercises that are available in myitlab.

Kodippile and Senaratne (2008) conducted research on mymathlab in an introductory college algebra course. They studied 72 students taking a required college algebra class. In the study, one section of the course completed traditional paper-based assignments while the other section completed assignments using the MMIT. The MMIT allowed students to receive immediate feedback on homework answers including providing suggestions and guidance on how to correctly solve the problem. Similar problems can be requested and completed by the student until they are able to solve them correctly without support. The results of the study did not provide a significant statistical difference in student achievement between the two sections. However, one noteworthy limitation of the study was the small sample size that the authors believed may have led to the non-significant finding. The study did indicate a significant difference in student success rates as measured by the percentage of students earning a grade of ‘C’ or higher for the course. Seventy percent of the students using mymathlab achieved success based on this standard as compared to 49% of students completing traditional paper-based homework. Additional benefits identified by the study included the ability of the faculty to spend more time interacting one-on-one with students due to the decreased grading time, as well as the ability for students to learn at their own pace and use their own preferred learning style, whether auditory, visual, or kinesthetic.

Kodippili and Senaratne (2008) recommend further research on the use of MMIT using larger sample sizes. Computer applications courses use the MMIT differently than other disciplines as they focus on teaching additional technical computing skills through the incorporation of technology of the MMIT. Therefore, the researcher of this study is hoping to provide valuable findings to the field.

MMIT in Higher Education

Changes in technology have caused changes in the overall educational structure. Institutes of higher education are changing from the traditional teacher-centered learning paradigm of the sage-on-the-stage to a technology-based and student-centered learning paradigm. The integration of technology within the field of education has the potential to enhance instruction and better prepare students for the job market (Gaytan & Slate, 2002-2003). Multimedia use in higher education will continue to increase (Chen & Sun, 2012). University administrations see MMIT and VLEs as a way to increase revenue by providing a strong return on their financial investments. Students like the flexibility the technology allows (King, 2010).

Distance Education

Internet technologies and multimedia are impacting the teaching and learning industry and education in general. Most higher education institutions use online learning management systems and provide wireless Internet access in their classrooms (Chen et al., 2010). Distance education implementing Internet technologies, VLEs, including WebCT and Blackboard, and/or MMIT is now commonplace in almost all higher education environments (Chen et al., 2010). The Internet and computing technology is completely integrated into the lives of today's college student. Students expect instructors to incorporate Internet technologies and multimedia instruction into their classes (Chen et al., 2010). Many educational units are increasing the use of technology as using MMIT has been seen as a possible answer for the increasing demands on the educational system. However, much of this pressure is coming from influences outside of education. The use of learning management systems is less of a choice and more of a directive at many institutions of higher education (Schoonenboom, 2012). There are many challenges that must be addressed in order for faculty members to embrace this change including pride, time, and technological ability (King, 2010). Faculty members have a full schedule already consisting of their teaching, professional development, research, and service requirements. Finding time to learn new technologies and teaching methods is often a challenge. The lack of technology training is not an insignificant issue. Faculty members report spending more than thirty extra hours in course preparation work for their semesters due to changes in technology. Previously, faculty members were only expected to be experts in their chosen field. Now they are required to keep up with changes in technology while also focusing on the learning styles of their students (King, 2010).

The increase in the use of VLEs with online courses is a major concern for some educators. There is not a clear agreement or understanding between what is expected from online courses and what is actually delivered. The delivery approach can be different from one school to the next. National standards have shifted the focus to the quality of the overall educational experience. Online learning and VLEs have traditionally been viewed as less reliable in performance measures; however, educators are now using a more critical approach in the areas of testing and assessment (Bassoppo-Moyo, 2011).

*Students use of multimedia***.** Students often report a preference for the use of multimedia instruction. Students indicate it is much easier to see and understand the content and it is more interesting, resulting in faster and easier learning (Milovanovic et al., 2011). Students are interested in using modern approaches to learning including multimedia, educational software, and the Internet (Milovanovic et al., 2011). Advantages of multimedia include efficiency, timeliness, task orientation, individuality, collaboration, communication, and convenience. The success of the tool, however, depends on the proper development and implementation of the tool (Mueller & Strohmeier, 2011). Usefulness and ease of use are important components for student acceptance of technology. Students need to see the advantages of the technology as an instructional tool; they do not want to use technology simply to use technology (Bourgonjon et al., 2010). Hoskins and vanHoof (2005) examined which students utilize

Web-based learning and how it influenced their academic achievement by studying undergraduate psychology students using the WebCT virtual learning environment. The results indicated that online learning provides students with the opportunity to practice a broad range of generic skills, interact in a real-world, engaging environments, obtain quick, informative feedback, and enhance their computer literacy. The author's assumption was that the opportunity for Web-based learning environments will automatically lead to Web-based learning. However, the research showed that not all students utilized the opportunities available to them, and therefore, did not see the possible educational benefits. Individual student differences determine the extent to which students make use of the virtual learning environment. The differences include gender, age, technology background, and whether the student is a passive or active technology user. There is a concern that technological tools will only serve to engage students who are already highly motivated and academically able (Hoskins & vanHooff, 2005). Additionally, it is important for universities to develop comprehensive training programs that emphasize learning and provide technological support for faculty members to integrate technology into their classrooms based on the ever increasing pressure for higher education classes to implement new technologies (Rogers, 2000).

Research on the use of VLEs and MMIT has been called for since 1993 when Laurillard indicated that while the growth of technology instruction is prodigious, it is not being matched with a complete understanding of it (Laurillard, 2002). Technology has been shown to be effective in promoting student engagement; however, research on the connections between technology use and learning has been mixed (Chen et al., 2010) There is not a clear agreement or understanding of what is expected from the use of

MMIT and educational technology and what is actually delivered. National standards have changed the focus from the tool itself to the quality of the overall educational experience (Bassoppo-Moyo, 2011). Little research has been conducted studying the major design characteristics of MMIT and VLE's, mainly system functionality, content and learning materials, and the support and communication tools that support the tools (Mueller & Strohmeier, 2011).

MMIT and Student Learning

Many researchers have found that technology-based instruction can be more effective than traditional instruction. Gantt (1998) reports that people retain 20% of what they hear, 40% of what they see, and 75% of what they see, hear, and do. Additionally, 60% of Americans are visual learners, 37% are auditory learners, and 3% are kinesthetic learners (Gantt, 1998). The use of multimedia allows for people to learn more naturally and more spontaneously using the modes they prefer. MMIT allows users to pause, branch off into various directions, as well as to stop for further explorations (Stegeman & Zydney, 2010). It increases flexibility and can improve the effectiveness of individual and collaborative learning while promoting self-directed learning (Wu et al., 2010)

A review of the literature has shown limited current research on motivation and higher education use of multimedia and Internet based learning environments (Bekele, 2010). Multimedia has been shown to successfully impact student learning and increase bilateral communication between the teacher and student (Zin et al., 2012). Interactive multimedia provides a powerful opportunity to improve student understanding and learning. Multimedia instructional materials provides an improved learning performance as it can positively impact learners with different learning styles including visual and verbal learners (Chen & Sun, 2012). The application of technology changes how students learn, what they learn, and with whom they learn (Wang, 2010). Integrating MMIT into teaching directs the focus of instruction to helping students become autonomous learners (Tsai, 2012).

Studies show that MMIT may be more beneficial when it is used in conjunction with traditional teaching methods to help increase the learning of content material. The studies are inconsistent in whether the use of MMIT provides significant gains; however, most literature found, at least, equal gains in the MMIT group and the traditional learning (Stegeman & Zydney, 2010). Hoon et al. (2010) found no significant learning difference for high achieving students based on the use of multimedia instructional strategies. However, there were significant differences for low achieving students (Hoon et al., 2010). Carefully and well-designed MMIT can deliver content to students in ways that can increase their learning and improve the learning of previously covered material. The MMIT should be interactive, student-centered, and engaging. The tool should create a structured, student-centered, student-paced, interactive environment that allows for the development of critical thinking and decision making skills in a save educational environment. This allows students to have an increased ability to retain the material while allowing instructors to cover the content at a deeper level (Stegeman & Zydney, 2010).

Active Learning

Learning has changed from a passive to an active process with educational environments advocating change to active student-centered instruction, referred to as the guide-on-the-side technique, away from the passive instructor lead instruction, the sage-on-the-stage (Leung, 2003). Computer-based instruction requires learners to be self-regulating in terms of their environment, their behavior, and themselves. Students' responsibility for their environment includes the location and access requirements of the MMIT, finding time in their personal schedule to complete the instructional activities, time management, and dealing with technical issues that may arise. Their behavior requires that participants be willing to try the new instructional tool. They must learn how to use the tool, ask questions, and actively participate in the learning process. As for themselves, students must approach the new educational tool with an open mind and have the positive attitude necessary for success in any new situation and experience. Self-regulation and self-direction are related to student maturity. As students mature, their self-regulation and self-direction improves (Hodges, 2005).

Effectiveness of MMIT

Some research has indicated improvement with the use of technology and computer-based instruction including the use of MMIT. Results of a study with seventh grade students showed the use of technology improved their achievement and perceptions towards science (Gaddy, 2007). The use of instructional technology and MMIT has changed the educational process. The use of MMIT combined with effective teaching strategies has huge potential for positive changes in the teaching and learning process (Hoon et al., 2010). Carefully, well-designed MMIT can deliver content to students in a manner that can increase and improve their learning. MMIT provides a structured, student-centered, self-paced, interactive learning environment that allows for the development of decision making and critical thinking skills. Students have an increased ability to retain the material covered in the lesson (Stegeman & Zydney, 2010).

Rajendran et al. (2010) evaluated the utilization of MMIT and virtual labs and found that students preferred the MMIT and computer assisted tools over the use of traditional teaching methods and textbooks. Results of the study showed that 90% of the students recommended the use of the MMIT and computer-based learning over the textbook. The technology increased the students' learning potential by allowing them to complete active learning exercises on their own instead of simply watching and/or listening. This allowed the students to improve their knowledge and learning and allowed the instructor to explain the concepts more fully (Rajendran et al., 2010). Multimedia can add multiple views of the content, adding richness and meaning to the material, to increase students' understanding of the subject matter. Interactivity promotes more engaging and effective learning environments (Neo et al., 2011).

There are disagreements over the effectiveness and efficiency of MMIT. Over the past several decades, significant investments have been made in educational technology around the world, supported by the idea that technology can help students to learn more effectively and efficiently and can also increase student achievement. This theory has not been conclusively supported by research (Lei, 2010). Some studies show that the use of MMIT increases motivation, active learning, experimental learning, and student-centered learning that can lead to better learning. Active learning engages the students, and student centered learning provides the students with more control which can increase their motivation to learn. However, other studies indicate little positive impact from technology use (Lei, 2010). There is a mismatch between the vision of education technology leaders and reality. There is a strong need for increased research on the development and use of MMIT to ensure improvements in the teaching and learning process (Harris, Mishra, & Koehler, 2009).

MMIT and Student Motivation

Martin et al. (2004) defined motivation as the involvement of students in their own learning process that makes them more likely to take personal responsibility for their own learning. Bradford (2005) conducted a survey of teachers in California and found that student motivation was the greatest limitation on a teacher's effectiveness. Motivation is critical for productive learning (Bekele, 2010). Motivation must be addressed as students learn more when they are able to create their own learning opportunities.

Teaching Strategies

Faculty members are constantly looking for new and better ways to keep students engaged in class, to capture their attention, encourage better class participation, and to improve their motivation, attitude, and satisfaction in class (Eastman et al., 2011). Traditional instruction methods, including lectures with PowerPoint presentations, provide students with little motivation. This instructional approach has very little interaction. Students are often bored and inattentive causing frustration, poor performance, and possibly withdrawal from the course. This approach also does not address students' different learning styles or levels of background knowledge (Limniou & Smith, 2010). Computer-based programs and online learning can be motivating for students (Gaddy, 2007). Multimedia can make the content more interesting and enjoyable for the students, increasing their motivation for learning (Dong & Li, 2011). Students are more successful in mastering required academic standards when they are immersed in hands-on technology-integrated projects that provide them with additional learning experiences. These activities engage the students in their own learning while making learning more relevant and useful (Bradford, 2005). The results of the Bekele (2010) study indicated the use of educational technology, and MMIT supports a motivated learning environment. Student engagement and technological use, combined with flexibility and convenience, provide significant sources of motivation (Bekele, 2010). Student interaction with the delivery medium appears to increase their motivation. MMIT and VLEs contain these interactive learning tools. The use of technology to support content delivery has the potential to increase a student's motivation, satisfaction with the content, and their learning. The use of technology has been shown to be effective in promoting student engagement (Chen et al., 2010). This supports the idea that changing teaching styles and incorporating technology can increase student learning (Bassoppo-Moyo, 2011).

Types of Motivation

Two types of motivation were identified by Martin et al. (2004): intrinsic and extrinsic. Intrinsic motivation is an internal and self driven function. Intrinsic motivation is based on a student's sense of control. Students complete learning activities for the inherent satisfaction of doing so. Features associated with intrinsic motivation are curiosity, exploratory behaviors, and a deeper level of learning aimed at understanding. Extrinsic motivation is external. Extrinsic motivation is rewards-based. The student performs due to an expectation of a reward, which can include a grade, payment, or other benefit for completing the task (Xiang, Bruene, & Chen, 2005). Intrinsic motivation is helpful for students to be successful in online learning as these students are more persistent, more likely to set goals, and to achieve these goals. External rewards can lead to a lower sense of control and a decrease in intrinsic motivation (Martin et al., 2004).

MMIT and Motivation

Bekele (2010) examined the use of MMIT and Internet supported learning environments in terms of student motivation. He found that VLEs and online courses tend to have more highly motivated students than traditional classes. Several studies (deLange et al., 2003; Dong & Li, 2011; Gaddy, 2007; Gayton & Slate, 2002/2003; Hoon et al., 2010; Milovanovic et al., 2011; Stegeman & Zydney, 2010, Zin et al., 2012) examined indicated online courses were at least as effective as traditional classes and indicated that motivation and achievement are positively correlated. According to Bekele (2010), the major sources of motivation included:

- Student engagement – including task accomplishment, knowledge acquisition, and online interaction.
- Course Quality – consisting of content, organization, and relevance.
- Technology use – made up of usability, synchronous and asynchronous tools, and the use of multimedia.
- Program format – including flexibility and convenience.

The use of technology alone neither motivated nor satisfied students. Content, educational methods, and available support systems were also important. According to Bekele (2010), previous studies on Internet supported learning environments examined student motivation but not the methodology.

Learning Strategies

Student motivation is related to the use of learning strategies. Motivation has an impact on the type of learning strategies used by a student. Motivation can predict self-regulation strategies of the student. Students who are more motivated, or who become more motivated during a class, will be more strategic in their choice of learning strategies. The students who pick a course based on intrinsic motivation including relevancy for the future tend to employ deeper processing learning strategies than those who take the course based on rewards or other extrinsic motivations. Additionally, being confident in their learning ability and their capability to be successful leads students to the use of more complicated and deeper learning strategies. However, learning strategies do not necessarily impact student motivation. The student's use of various cognitive and meta-cognitive strategies at the beginning of a course is not a good predictor of student motivation later in the course (Berger & Karabenick, 2011).

Researchers are working to link instructional strategies, motivational processes, and learning outcomes (Martin et al., 2004). Students who value specific achievements are more likely to invest more in their learning by applying various learning strategies and spending more time studying (Paechter et al., 2010). Students' individual preferences for using multimedia as determined by their preference for use of visual or verbal learning styles may affect the student's motivation. Learning styles are consistent, stable, and do not change over time, while motivation may be constantly changing (Chen & Sun, 2012). Intrinsically motivated students have a tendency to outperform students with low intrinsic motivation, but little is known about what may lead to the differences in outcomes, especially when it is applied to simulations and electronic or technology-based learning environments (Gaddy, 2007). E-learning is one form of independent learning that has long lacked adequate process research. The results of how students actually perform with the instructional materials provided through online courses are inconsistent and contradictory (Lei, 2010). Additionally, it is unknown whether developers can actually increase motivation through the instructional materials and the use of multimedia instructional tools. The addition of these tools may not be enough to cause an increase in student motivation. Educational software developers often have misconceptions about the effects of their programs on the motivation of students (Martin et al., 2004). The results of the Martin et al. (2004) study on motivation and e-learning indicated that students with intrinsic motivation did not do more with the MMIT, but simply did qualitatively different tasks than the externally motivated students. They did not complete more instructional activities, but were more explorative in what activities they did. An analysis of the students' test scores did not show a correlation with intrinsic motivation, indicating that these students did not learn any more than the externally motivated students (Martin et al., 2004). Student motivation and their selection and use of learning strategies are related. This relationship needs further examination (Berger & Karabenick, 2011).

Summary

The use of MMIT and VLEs provide many benefits for students and instructors. Multimedia appeals to students of all ages. It encourages self-expression, allows for better communication between students and faculty, provides a sense of ownership to the student, and creates an active-learning environment that provides authentic learning experiences (Gaytan & Slate, 2002-2003). Technology provides opportunities needed by today's student population. Students like the flexibility and convenience provided by the MMIT. They find they are better able to manage their work and school life, can set their own self-directed pace, and determine how much time they need to spend on their schoolwork. Technology provides effective learning environments that can offer a viable alternative to the traditional classroom environment (Chen et al., 2010). However, students do have concerns over the quality of the instruction. They are hesitant to take on the role of instructor along with their role as student. Many students do not want to see MMIT and online learning to be a replacement for traditional instruction (Wu et al., 2010).

Technological use in education, including the use of MMIT, is one area where the existing research is much less helpful than expected (Lei, 2010). Little research has been conducted on the effectiveness of Web-based courses and MMIT, which is very surprising based on the large market for online learning and the overall impact that for-profit educational institutions can have on traditional colleges and universities through implementing technology (Piccoli et al., 2001). There are several concerns for educators. Educators and the adopters of the technology assume that the innovations are as effective as claimed in the literature and advertisements. There are worries about information overload, low quality content and courseware, and the possible weakening role of the instructor (Dong & Li, 2011).

The use of MMIT holds great promise; however, much still needs to be examined. Are today's technologically literate students different learners than previous students? Do these students process information differently? Do they perform well in virtual worlds as well as in the real world? Students' familiarity with computing and technology has affected their preferences and skills as related to their education (Waycott et al., 2010). Significant research is still needed for educators to understand how teaching and learning changes with the incorporation of technology. Technology, including MMIT, has the potential and promise to improve education; however, this potential has not been proven as reality by existing research (Lei, 2010).

Chapter III will detail the design of the research study. It includes specifics on the study participants, the research instruments, and the data collection techniques used to complete the study. The data analysis used to test the research questions will also be detailed in Chapter III.

CHAPTER III

METHODOLOGY

Introduction

This chapter contains an overview of the research design, research setting, participants, data collection methods, and data analysis information for this study. The purpose of the study was to determine whether a relationship existed between the use of a MMIT and student learning, specifically in an introductory computer applications course. The study explored how students utilized the MMIT to determine if the student's use of the tool had a statistically significant impact on the student's motivation and learning strategies for this course. This chapter details the participants of the study, as well as the research instruments and data collection techniques that were used in the study. This chapter concludes with a discussion of the data analysis that has been used to test the research questions.

Research Design

Quantitative research methods, including descriptive statistics, correlational, and survey data, were used to address the research questions identified for this study. According to Creswell and Plano Clark (2007), quantitative research provides reliable data that is quantifiable and useful when generalizing results. Creswell (2012) also states that quantitative research allows researchers to study a sample of a population and obtain trends, attitudes, and opinions for the population as a whole. Therefore, quantitative research methods were appropriate for collecting and analyzing the data of this study. Research Question 1, determine the extent to which students utilize the MMIT, was answered using descriptive statistics.

Correlational research examines whether a relationship exists between two or more variables. Huck (2011) indicates that the main factor contributing to correlation is the relationship between the variables, including whether a relationship exists and the extent of this relationship. As this research sought to compare success for students based on their level of use of the MMIT, correlational research was used to provide necessary information in regard to Research Question 2: Is there a significant relationship between a student's level of MMIT use and their knowledge as measured by exam scores? The dependent variable in this study was the amount of knowledge obtained as indicated by the difference in pre- and post-instruction exam scores for the Excel section of the course. The independent variable was the level of MMIT use. The study focused on the Excel section of the course because this was the content area that students typically have the least amount of pre-existing knowledge. Experience in teaching this course has shown that many students enter the course with fairly good knowledge on using Windows, Word, and the Internet. However, the students often do not have a solid background in Excel. This section provided the greatest learning opportunity for students through the use of the MMIT.

Survey design is a type of quantitative research that examines general trends within the population being studied. This type of research does not test a specific activity or intervention, but instead examines attitudes, opinions, and behaviors and is accomplished through the administration of a questionnaire or survey (Creswell, 2012). Survey research was conducted through the use of pre- and post-study questionnaires to address Research Question 3: Did student reports indicate a difference in their knowledge, motivation, and learning strategies in the course based on their level of MMIT use as indicated through pre and post course questionnaires?

Research Setting

The research setting was the *Introduction to Computer Applications* course at one southeastern university during the spring 2013 semester. The university had an enrollment of 14,883 students in 10 colleges and schools. The student population at the university was 60.06% female, 39.96% male, 77% full-time, 23% part-time, with 40.2% between the ages of 18-21 and another 25.7% between the ages of 22-25. Most students, 72.2%, come from within the state of Alabama (Office of Public Relations, 2012). The *Introduction to Computer Applications* course is a service course offered to all university students to satisfy the computer proficiency graduation requirement. The course serves as a pre-requisite course for the *Advanced Computer Applications* course required for business majors. There are no pre-requisites for enrollment into the *Introduction to Computer Applications* course. This course is offered in both a blended and an online format. The blended format includes a required weekly 75 minute lab session whereas the online section has no required class meeting times. Students self-select into the version of the course they prefer. The online sections of the course were selected for this study to ensure standardization of course content, presentation of all of the instruction, and instructor support for all participating students. Attempting to ensure that course format and learning environment was the same for all participants was critical for the study. MMIT is an important component of the course as it is used to present the course materials and provide instruction and remediation as needed.

Course Activities

Students were assigned weekly activities within the MMIT to support their learning. These activities included chapter quizzes, training activities, and end-of-chapter capstone grader assignments. Chapter quizzes were used to encourage students to review and study the chapter material in addition to working through the weekly activities. These chapter quizzes contained 10 multiple-choice questions to be completed within a ten minute time frame. Students were allowed to retake the quiz as many times as they liked during the available time period.

The training activities were provided as skills-based multimedia instructional materials within the MMIT. Students complete these exercises by working through the individual steps of the lesson within a simulated Microsoft Office environment. Students receive no instruction on the tasks not having to review lesson material on content the student already knows. If a student did not know how to complete a task, they could work through the fully functional ribbon and menu bars to try to figure the task out, or they could access the available instructional material. Students needing help on these exercises could also consult their textbook that contained identical instructional material in the form of step-by-step hands-on-exercises. The MMIT provided additional assistance in the form of *hints* that gave the student audio and text instructions and the *show me* multimedia demonstrations of the specific tasks. Students who incorrectly attempted a task three times were automatically directed to the *show me* demonstrations. Students were allowed to complete the skills-based training exercises as many times as they liked during the assigned time period.

Grader assignments consisted of end-of-chapter capstone exercises that provided students with authentic active-learning activities. Students were given larger problems to be solved live in the Microsoft Office application. Students were given the tasks that needed to be completed on a starter program file but were given no additional instruction on how to complete the tasks. They did have access to all available instructional materials for assistance when working on these exercises. The completed data files were then submitted to the MMIT for automated grading. Students were provided with detailed feedback reports on their submission. Students were allowed to resubmit the capstone exercises as many times as they liked during the assigned time period. Each of the individual grader assignments provided students the opportunity for active learning by working through real-world problems in a constructivist learning environment.

Assessments are provided in the form of exams given through the MMIT. Exams consist of both multiple-choice and performance-based questions. The multiple choice questions are designed to assess the concepts covered in the applicable chapters while the performance-based questions allow students to demonstrate their knowledge of the application. The performance-based questions are provided using the identical interface and simulated Microsoft Office environment the students used to complete the skills-based trainings. For the purpose of this study, a pre-test was given at the beginning of both the Word and Excel modules to document students’ pre-existing knowledge followed by a post-test at the conclusion of the module for assessment and to serve as a measure of student learning.

Course Management

The course is maintained and directed by a course coordinator to ensure all students receive standardized instruction across the multiple sections. The researcher served as the course coordinator for the *Introduction to Computer Applications* course during the time of this research study. The course coordinator creates all of the course materials and the course shells within the learning management system and MMIT. The coordinator selects the activities for the course, including the quizzes, audio Power-Point presentations, hands-on exercises, capstone exercises, and exams. The coordinator selects or creates the questions for the exams. The coordinator can also select options of the MMIT for each assignment such as the number of times each activity can be completed, the number of times each component of the activity can be completed, and if assignments can be submitted late. For this course, students were allowed to complete each assignment, except the exams, an unlimited number of times for instruction and remediation. Individual components of each of the myitlab activities were required to be correctly completed within three attempts or the MMIT directed the student to available instructional materials. The weekly assignments were due on Friday of the assigned week to provide students with structure for the online course and keep the students progressing through the course materials; however, students were allowed to submit late and resubmit any assignments until the day of the associated content exam. The course instructors were responsible for the day-to-day activities associated with the class including supervising the lab sessions, answering questions, communicating and e-mailing with students, delivering exams, calculating, and assigning course grades. They did not deliver any course content.

Participants

Participants for this study were the students who self-selected enrollment into the online sections of the *Introduction to Computer Applications* course at one southeastern university during the spring 2013 semester. Participation in the study was completely voluntary and could be terminated by the student at any time with no impact on their academic standing in this course. During the spring 2013 semester, nine blended and four online sections of the course were offered. A total of 404 students, 170 male and 234 females, were enrolled in the four online sections making them eligible to participate in this research study. Participants included 17 new first-semester freshmen, 334 traditional students continuing beyond the first semester of their freshman year, 26 students returning to the university after not being enrolled the previous semester, one non-degree student, and 26 students in their first semester at this university after transferring from another college or university. The students' reported majors included Allied Health (77), Arts and Sciences (144), Business (56), Computing (3), Education (29), Engineering (9), Interdisciplinary Studies (9), and Nursing (76), with one undeclared major. Ethnic backgrounds included 13 Asian, 111 African American, 244 Caucasian, 7 Native American, and 9 Hispanic students, with 20 backgrounds unreported. A total of 381 students participated by completing at least one of the activities that made up the components of the study.

Students enrolled in the online sections of the course were required to have access to a Windows-based computer with the Office 2010 software and a high-speed Internet connection. Fully equipped computer labs were available for online students who did not have the required technologies for this course. The computer labs were located in the

School of Computing building. The labs were reserved for the *Introduction to Computer Applications* students for a minimum of eight hours per week. Trained lab assistants were available to help students during, at minimum, eight hours of scheduled lab time per week.

Students in the *Introduction to Computer Applications* course were provided several methods of accessing the course content material. Students purchased traditional textbooks and were also provided unlimited access to electronic copies of the textbook through the MMIT. Additionally, the instructional material for each chapter was available to students as an audio PowerPoint slide show. All assignments, course activities, quizzes, and exams were conducted through the MMIT.

Research Instruments

The data collection instruments included myitlab MMIT, pre-test and post-test Excel exams administered through myitlab, and the Motivated Strategies and Learning Questionnaire (MSLQ). Myitlab was used to collect the data required for Research Question 1 regarding the category of use of the MMIT. Pre-test and Post-test Excel exams provided the data on the increase of student learning to address Research Question 2. The MSLQ was used for Research Question 3 to determine student reports of their knowledge, motivation, and learning strategies in this course based on their use of the MMIT.

Myitlab

Myitlab is a component of the course and is available to students with their required textbook package. Stand-alone myitlab access is available for students to purchase who do not buy new textbooks. The myitlab MMIT has the report features to collect data on students' use of the tools such as students' weekly quizzes, hands-on lab activities, and end-of-chapter capstone projects. Students completed and submitted these assignments to myitlab for automated grading and immediate feedback. Students could modify and resubmit their assignments to increase their learning and improve their grade until the day of the exam for that chapter. The myitlab activity reports provided information on the number of times each individual student completed these assignments, including their grade for each of these attempts. This information allowed the researcher to determine each student's level of use of the MMIT for these activities.

Excel Tests

Students used myitlab lab throughout the semester to study the Windows operating system, basic Internet use, Word, and Excel; however, only the Excel material was analyzed for this study as students typically have the least amount of preexisting knowledge of Excel. At this point in the semester, students would be familiar with the tool and its features so changes identified in the study are more likely to be a direct result of the use of the MMIT rather than any problems associated with using the tool. At the beginning of the Excel module of the course, students were given a 38 question pre-test. This test, consisting of 18 performance-based questions and 20 multiple-choice questions, was used to provide a baseline for students' existing knowledge on the Excel spreadsheet program. Performance-based questions required students to complete requested tasks within the simulated Microsoft Office environment. The pre-test was used to check for pre-existing differences in student knowledge allowing the researcher to track changes over time. This ability to track changes in student knowledge was especially important due to the lack of randomization of the students within course sections. The use of pre-and post-test grades was necessary to accommodate for students who had more pre-existing knowledge of Excel than other students. This pre-test, given through the myitlab MMIT, used the assessment scenario one as the theme for the performance questions. The MMIT provides multiple scenarios to be applied to activities to allow testing of identical objectives with similar but not identical questions by changing the theme of the question.

At the completion of the Excel module, which coincided with the end of the semester, students completed the Excel post-test. The post-test consisted of the same identical 38 multiple-choice and performance-based questions from the pre-test, using assessment scenario two as the theme for the performance-based questions. This feature provided students with a post-test covering the same content material, skills, and learning objectives as the pre-test but used a different situational environment as the foundation for the questions. The post-test was given as part of the comprehensive final exam. The post-test questions were extrapolated from the final exam and a post-test grade determined for only these 38 questions. The pre- and post-test were created in myitlab by the course coordinator.

Motivated Strategies for Learning Questionnaire

The MSLQ is an 81-item student self-reporting instrument that was designed under a Department of Education grant through the National Center for Research on Improving Postsecondary Teaching and Learning at the University of Michigan. The instrument was available for use without charge in academic applications and educational research. The MSLQ was provided to the students through the use of Qualtrics online survey software. The questionnaire needed approximately 20-30 minutes to complete and was available to the students during the first two weeks and the last two weeks of the semester. MSLQ is for Research Question 3, whether students report a difference in their knowledge, motivation, and learning strategies in the course based on the MMIT.

The MSLQ is used primarily to measure the motivational orientations of college students and their use of different learning strategies for a college course (Pintrich, Smith, Garcia, & Mckeachie, 1993). The MSLQ was developed based on view of student motivation and self-regulated learning as a social-cognitive feature. This makes the assumption that neither motivation nor learning strategies are static traits for the student. Motivation can change from course to course, or even within courses, based on student interest, efficacy, student performance, etc. Students can learn new or different learning strategies that may cause their learning strategies to be dynamic as well, depending on the specific course (Duncan & McKeachie, 2005). The MSLQ was designed to measure the motivation and self-regulated learning of undergraduate students as it related to a single college course. The MSLQ can be used to evaluate the motivational and cognitive effects of instructional interventions, including the use of different course strategies and the use of various educational technologies (Pintrich et al., 1993). The MSLQ has been administered in computing courses to study programming performance, the introduction of computer information systems, and the use of self-directed learning within distance education courses (Eddins & Strouse, 2009). The MSLQ was given as a pre- and post-course questionnaire to determine if the students reported a change in their motivation and learning strategies for this course after using the MMIT.

The MSLQ examines two cognitive scales: motivational strategies and learning strategies. The questionnaire consists of 81 Likert scale items with 15 subscales.

Students are directed to answer each question with a *1* if it is not at all true for them and a *7* if the question is very true for them. Eight individual items that are identified as *reverse coded* indicating a negative scoring process must be used. Student answers on each of these items must be reversed on the 1 to 7 scale – with a score of one being reversed to a seven, a score of two being reversed to a six, a score of three being reversed to a five, and so on – prior to the calculation of the mean for that scale. Instructions for using the MSLQ survey indicated that reversing the scores should be accomplished by subtracting the recorded answer from the value of eight. The researcher reverse scored these items through the use of a formula within the Excel spreadsheet. Scores for each individual scale of the MSLQ are determined by calculating the mean of the students' answers for the individual items that make up the specific scale. The main motivational components examined are expectancy, value, and affect. Expectancy examines students' beliefs that they are able to accomplish the tasks assigned. The value component focuses on the intrinsic and extrinsic goals of students in engaging in an assignment. Intrinsic motivation is based on achieving learning or mastery of the material while extrinsic motivation focuses on achieving a reward, grade, or approval from others. Affect components are focused on test anxiety issues. The MSLQ contains thirty-one items and six scales related to motivation. The motivation scales include: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety.

The learning strategy component consists of 50 items and nine subscales. The components of learning strategy focus on the use of different cognitive and meta-cognitive strategies as well as the student's management of resources. Cognitive strategies scales include rehearsal, elaboration, organization, and critical thinking. Meta-cognitive strategies scales consist of planning, monitoring, and regulating. Resources management scales focuses on student management of their time and study environment, effort management, peer learning, and help seeking (Pintrich, Garcia, & McKeachie, 1991).

MSLQ reliability and validity. The MSLQ, completed and published in 1990, had undergone a number of different statistical analyses to determine the reliability and validity of the questionnaire. The creators of the MSLQ acquired sample data from 380 students at a public Midwest university. This data was used as the basis of reliability and validity testing, including confirmatory factor analysis of both the motivational items and the learning strategies that demonstrated factor validity of the MSLQ (Pintrich et al., 1993). Internal consistency estimated of reliability using Cronbach's alpha indicated good internal reliability and zero-order correlations between the motivational and cognitive scales that also supported the questionnaire as a valid measure. Predictive validity was determined through a correlation of students' course grades with the MSLQ sub-scales. The significant correlations indicate predictive validity of the MSLQ (Pintrich et al., 1993). Additionally, the MSLQ has been used extensively since its release in 1991, including many current research studies. The MSLQ has been translated into over 20 languages and has undergone validity and reliability testing in Spanish and Chinese as well as English (Duncan & McKeachie, 2005).

The MSLQ does have limitations, as do all self-reporting instruments. The instrument's authors caution that the stability aspect of reliability is difficult for tools that are designed to examine context-dependent constructs (Duncan & McKeachie, 2005). A challenge for validity also exists in terms of the social desirability bias that is identified in all self-reporting instruments. However, the MSLQ authors found that response bias did not cause a significant variance and caused no change in the final results of the study (Duncan & McKeachie, 2005).

Procedures

Data collection procedures began after permission was granted by the Institutional Review Board of the research institution. Initial contact with the students began on the first day of classes during the spring 2013 semester. The 415 student enrolled in the *Introduction to Computer Applications* course received a *Request to Participate* in the research study (see Appendix B) via e-mail and a course announcement posting in the course online Website. All students were a minimum of eighteen years old and asked to voluntarily participate. The request for participation explained that the students were free to choose not to participate or to terminate their participation at any time without any impact on their course grade. The e-mail and course announcement contained a hyperlink access to the pre-course administration of the MSLQ through Qualtrics online survey software. The pre-course MSLQ closed at the end of the second week of the semester. The researcher collected the pre-test data from the MSLQ survey after the end of week two.

Student Participation

Several steps were employed to encourage student participation in the study. Multiple follow-up e-mails and announcements were sent out in addition to the initial request to participate: one mid-week of the first week of the course, one at the beginning of the second week of the course, and a final reminder send mid-week of the second week prior to the close of the pre-course survey. Students who completed all of the study components were entered in a random drawing to win one of two $50 Visa gift cards given away by the researcher at the completion of the research study.

To protect the identities of the participants, the anonymity of the responses, and the confidentiality of the data, participating students completed the MSLQ surveys using a unique self-created identification code consisting of the last four digits of their student ID number, the two digits of their day of birth, and the last two digits of their primary phone number. This identification code was also added in the student ID field within each student's myitlab account. The identification code was used to connect the pre- and post-MSLQ data, the pre- and post-instruction Exam scores, and the level of MMIT use for each individual student.

The researcher, as the course coordinator for the *Introduction to Computer Applications* course, has direct administrator access to the course data within myitlab to collect research data; however, the course coordinator has no input or influence on the assignment of grades for this course. The course instructors did not have any knowledge of which students did or did not participate in the research study or any results of the MSLQ surveys. After the initial MSLQ survey and the Excel pre-test was completed, no additional data collection or data analysis was conducted until the conclusion of the course and after final course grades had been assigned. To protect the integrity of the study and student feedback, course instructors had no knowledge of which students participated or did not participate.

Data Collection

Data was collected in an electronic format. MSLQ results were downloaded from Qualtrics as an Excel spreadsheet. Data on the pre-test and post-test and student activity reports were exported from the myitlab into an Excel spreadsheet based on the student identification codes used for this research study. This format allowed the researcher to identify changes in students' knowledge during the course. The test score data was imported into the SPSS software program to correlate the increase in knowledge with the students' use of the MMIT. The electronic data files were password protected and stored on a USB data drive that was kept in a locked filing cabinet in the researcher's office. All data will be securely stored for two years and then subsequently destroyed.

To calculate the minimum number of participants needed to represent the student population, sample size calculations were completed. The calculations indicated that a maximum sample size of 60 students needed to participate for a 95% confidence level. The calculation of sample size was completed using an a priori G-Power analysis for a MANOVA test containing six measurements.

Myitlab. Myitlab data collection began during week eleven when students started the Excel section of the course. Prior to week eleven, students completed course activities on Windows, basic Internet use, and Microsoft Word. This study focuses specifically on the Excel component of the course; therefore, data from before week eleven was not relevant for this research. In week eleven, students completed the Excel pre-test in myitlab. Students were reminded to complete the Excel pre-test through e-mail, a course announcement, and a listing of the pre-test as part of their weekly assignments for week eleven. At the end of week eleven, the researcher downloaded the pre-test scores through the myitlab reporting features, identified by the student identification code originally used in the MSLQ response, and added to their myitlab account. Students were allowed to edit their myitlab account information at any time to add this identification code to their personal data. This Excel pre-test data was maintained in an Excel spreadsheet for analysis after the end of the semester.

Students completed their normal required course activities in the Excel module during weeks twelve through fifteen of the course. Each week, students were assigned a quiz, a hands-on lab activity, and a capstone grader project in the myitlab MMIT for the Excel chapter covered in the course materials that week. No data was collected during these weeks as students had the ability to modify and resubmit all of their Excel assignments until their final exam during week sixteen.

Post-course survey. The opening of the end of the course MSLQ survey instrument, available through the Qualtrics survey software, took place at the beginning of week fifteen. Each student used their unique student generated identification code when completing the MSLQ. Students were prompted to recreate this same identification number by being asked for the last four digits of their student ID number, the two digits of their day of birth, and the last two digits of their primary phone number. Students were again encouraged to complete the questionnaire through multiple e-mail reminders, course announcements, and the ability to win one of two $50 Visa gift cards that were given away at the conclusion of the study. This post-course questionnaire was available in the online format for the students to complete during weeks fifteen and sixteen.

Post-test. Students completed the course final exam during their scheduled exam period in week sixteen. The comprehensive final exam consists of questions from each chapter of the textbook but also contains the same thirty-eight test questions found in the Excel pre-test, using myitlab scenario two. The pre-test was created using myitlab scenario one. The researcher extrapolated the student responses on these thirty-eight questions to determine the post-test Excel scores. This data was maintained in an Excel spreadsheet for analysis.

Reporting. At the conclusion of week sixteen, the researcher collected all of the remaining data for analysis in this study. The myitlab reporting tools, including the student activity reports and the gradebook, provided the necessary data. The student activity reports provided information for the researcher on the level of myitlab use for each student and each activity, identified by their identification code. The gradebook provided the necessary information on the scores for the Excel pre and post-test. This information was downloaded into Excel for analysis by the researcher.

The post-course MSLQ data was collected by the researcher from the Qualtrics software after week sixteen using the identical procedures used to collect the data from the pre-course survey. The researcher was the only person allowed to retrieved data from either Qualtrics or myitlab for this study. At no time was there any communication between the researcher and the course instructor regarding who did or did not participate in the study. The researcher maintained the only correlating documentation matching student identification codes for each student to their individual data and survey results. At the conclusion of the research study, this information will be stored for two years and then destroyed.

When all data was collected, the researcher determined which students, based on their identification code, completed all sixteen components of the research study. A random drawing of those participants was held determine the two winners of the Visa gift cards. Winners were notified by e-mail, and the gift card was picked up by the students from the researcher's office.

Data Analysis

After the collection of all relevant data, the researcher used descriptive and inferential statistics to analyze the data. All data was initially imported into multiple worksheets within an Excel workbook and then copied into the SPSS software package for further examination. Descriptive statistics was used to address Research Question 1 regarding the number of students in each category of MMIT use. Due to a lack of variability of student MMIT use, which would be necessary to show a correlation between the level of use and an increase in student knowledge, Research Question 2 could not be answered as a relationship. Therefore, the researcher modified Research Question 2 to allow the evaluation of MMIT use as a categorical value. The modified version of Research Question 2 asks if there is a significant difference between the level of MMIT use and student knowledge as measured by the change in the Excel pre and post exam scores. As mixed ANOVAs were used to analyze the effects of more than one independent variable, this type of statistical analysis was used to examine both independent variables of category of use and time, as determined by pre- and post-exams. The researcher analyzed the changes across time in the MSLQ scales based on the pre-course and post-course results in response to Research Question 3 determining if there was a significant difference in student motivation and learning strategies in this course. This was calculated using a MANOVA. MANOVA testing provides for multivariate testing examining multiple related dependent variables at one time while avoiding the

Type I error inflation rate that can be caused by conducting individual univariate tests on each of the dependent variables. Dependent variables evaluated for Research Question 3 included the category of MMIT use for each of the activity types as well as the 15 individual motivational and learning strategies scales.

MSLQ

Student responses on both the pre-course and post-course MSLQ surveys completed in Qualtrics were exported into an Excel spreadsheet. Survey results containing no responses were deleted. Duplicate results, where a student completed multiple copies of the survey, were deleted. The results of a student's first survey submission, based on the recorded time of submission, were recorded. Responses for students enrolled in the blended sections of the course were also removed.

The individual test items and student responses were copied into individual worksheets within the workbook based on the 15 individual scales. The mean for each student within each scale was calculated using the built-in Excel average formula. These means were copied onto a composite worksheet that contained each student identification code and their mean scores for each of the 15 scales of the MSLQ survey. The composite worksheets for both the pre-course survey responses and the post-course responses were combined into one worksheet based on the student identification code.

Myitlab

Reporting features within the myitlab program include an activity report that displays the results of multiple attempts of multiple activities for all of the students in the course section. This report provided data for each attempt of all 12 activities for all students participating in the study. The researcher used this activity report to determine the number of attempts for each student for each activity and the grades for each attempt reported by the student identification code. This information was copied into the existing Excel spreadsheet for each student. The mean for the number of attempts and the highest grade for each separate activity were calculated using the built-in Excel average formula. The myitlab gradebook provided the grades for each student for the pre- and post-test. These grades were downloaded from myitlab directly into an Excel worksheet in the workbook containing the survey data.

SPSS

The resulting Excel spreadsheet contained 55 columns and 381 rows of data. Columns included the student identification code, pre- and post-semester scores for each of the 15 MSLQ scales, the number of attempts and the highest score for each of the 12 myitlab activities, and the pre- and post-exam scores. The 12 myitlab activities were grouped into the four grader assignments, the four training activities, and the four quizzes, one for each chapter studied. There were 381 student responses for at least one portion of the study making up the rows of data. These data was imported into SPSS for analysis. Descriptive statistics for each variable was calculated using SPSS. This provided the researcher with the mean, standard deviation, variance, minimum value, and maximum value for each variable. The descriptive statistics were used to answer Research Question 1 determining the extent students utilized the MMIT and create the categories of MMIT use.

Modified Research Question 2 examined if there was a significant difference in student knowledge as measured by the change in the Excel pre- and post-exam scores based on the level of MMIT use. Three separate mixed ANOVAs were conducted in

SPSS to answer this question, one test for each type of MMIT activity in either the grader assignments, training activities, or quizzes. The category of use variable for each activity type, either CAT_GraderAtt, CAT_TrainAtt, or CAT_QuizAtt, was used as the independent variable for the mixed ANOVA. The dependent variable for each mixed ANOVA was the CH_ExcelTest which contains the change in student test scores between the Excel pre-test and the Excel post-test.

A MANOVA was conducted to address Research Question 3 to determine if there was a significant difference in student motivation and learning strategies in the course based on the MMIT as indicated through changes in the pre- and post-course MSLQ questionnaires. The dependent variables for the MANOVAs were the changed scores for each of the scales of the MSLQ. The six scales of motivation were analyzed using one MANOVA analysis while the nine scales of learning strategies were analyzed using a second MANOVA test. The independent variables were the categories of MMIT use for each of the MMIT activity types, CAT_GraderAtt, CAT_TrainAtt, and CAT_QuizAtt.

Summary

This study was conducted using quantitative research methods to determine if a relationship exists between the use of a MMIT and student learning in an introductory computer applications course. The study also examined whether the students reported a change in their motivation and learning strategies for this course based on their use of the MMIT. Participants were 381 college students enrolled in the online sections of the introductory computer applications course in the spring 2013 semester. The study used the myitlab MMIT, students' excel pre-test and post-test exams, and the MSLQ responses as the primary data collection instruments. Data was analyzed using descriptive and inferential statistics.

Chapter IV will detail the results of the statistical analysis. The individual statistical tests used to address each research question will be identified and discussed. Results will be presented for each research question. Statistically significant differences, as identified by the analysis, will be identified.

CHAPTER IV

RESULTS

Introduction

Chapter IV presents the results of the statistical analysis of this study. The results are presented by detailing the specific components of each test, including the independent and dependent variables, and the results of the statistical tests that include the mixed ANOVA and MANOVA tests. The study indicated a significant difference for student knowledge based on time as determined by the pre- and post-Excel test scores. The category of use, determined to be either NONE, AVERAGE, or HIGH, did not have a significant effect on student knowledge. The analysis of the motivation and learning strategy scales of the MSLQ showed a significant effect for the three motivational scales of task value, self-efficacy for learning and performance, and test anxiety based on the student's category of use for the grader assignments. No other motivational or learning strategies scale, nor other category of use analysis indicated a significant effect. Results of each statistical analysis, including the identified significance level and effect size, are included. Tables are provided to present specific results of the statistical tests.

Participants

Students enrolled in the online sections of the CIS 150 - *Introduction to Computer Applications* course at a southeastern university during the spring semester served as the population for this study. All 404 students who were enrolled in the online sections of CIS 150 were invited to participate with 381 students taking part in this study. A total of 309 (76.4%) students completed the pre-course MSLQ survey with 153 (37.8%) students completing the post-course MSQL survey, 150 (37.1%) students completed the Excel pre-test, 267 (66.0%) students completed the Excel post-test, and 381 (94.3%) students completed at least one of the required Excel grader assignments, training activities, or quizzes in the MMIT. This study evaluated data collected from the Excel section of the course. Students often have pre-existing knowledge in the topic areas covered in this course. Excel is the section of the course where they typically have the least amount of pre-existing knowledge and have the biggest opportunity for a significant difference in their knowledge.

Results of Research Study

The results of the research study are presented in this section. The results are divided and presented by the individual research question. Each research question is presented individually. The data analysis used to address the question, and the results as determined by the data analysis are detailed for each question.

Research Question 1: To What Extent did Students Utilize the MMIT?

To answer Research Question 1, activity data were collapsed to determine the total number of attempts for each of the three activity types (grader assignments, training activities, and quizzes). All of the attempts for each of the four Excel chapter grader assignments were summed together, all of the attempts for each of the four Excel chapter training activities were summed together, and all of the attempts for each of the four Excel chapter quizzes were summed together. This created the SPSS variables of SumGraderAtt that contained the total number of attempts for all grader assignments, SumTrainingAtt that contained the total number of attempts for all training activities, and SumQuizAtt that contained the total number of all attempts for the quizzes. The results of the study were based on the sum of activity attempts for each student within each activity usage category (grader assignments, training activities, and quizzes). The researcher did not use the average attempts per category due to a lack of variability in the data. The lack of variability with each assignment of each usage category would have resulted in a generalized lack of variability in the final averages. This would make determining the categories of use difficult. Additionally, an average calculation would result in decimal point values adding additional complication into categorizing the results based on number of attempts.

Table 1

Descriptive Statistics for Attempts per Activity

	Min	Max	Mean	SD
SumGraderAtt	0	52	3.84	5.14
SumTrainingAtt	0	19	2.97	2.36
SumQuizAtt	0	66	6.91	7.80

Descriptive analysis of this data provided a mean, minimum, maximum, and standard deviation for each sum variable (see Table 1). The descriptive analysis allowed the researcher to determine a category of use by categorizing the attempts per activity into three distinct categories: NONE, AVERAGE, and HIGH. Students with no attempts on any of the MMIT activities in the specific activity type are assigned to the NONE category. The AVERAGE category contained the students who attempted the MMIT activities between one and +1 standard deviation times for that activity type. The standard deviation for each activity type was different, so the range of attempts assigned to the AVERAGE category was different for each activity type. The HIGH category contained the students who attempted the activities more than +1 standard deviation number of times.

Descriptive data analysis regarding the four grader assignments demonstrated a mean of 3.84 attempts, a minimum number of attempts of 0, a maximum number of attempts of 52, and a standard deviation of 5.14. Attempts for the four grader assignments within the MMIT included 132 students who fell into the NONE category by attempting none of the grader assignments assigned for the four Excel chapters. Two hundred nineteen students fell into the AVERAGE category based on the average plus one standard deviation of 5.14, making the range of average use between one and nine attempts for combination of the four Excel grader assignments. Thirty students were assigned to the HIGH category based on attempting the four grader assignments more than nine times (see Table 2).

Table 2

Frequency Table of Grader Attempts

	Frequency	Percent	Valid Percent	Cumulative Percent
.00	132	34.6	34.6	34.6
1.00	14	3.7	3.7	38.3
2.00	19	5.0	5.0	43.3
3.00	28	7.3	7.3	50.7
4.00	72	18.9	18.9	69.6
5.00	33	8.7	8.7	78.2
6.00	20	5.2	5.2	83.5
7.00	15	3.9	3.9	87.4

Table 2 (continued).

	Frequency	Percent	Valid Percent	Cumulative Percent
8.00	9	2.4	2.4	89.8
9.00	9	2.4	2.4	92.1
10.00	5	1.3	1.3	93.4
11.00	2	.5	.5	94.0
12.00	3	.8	.8	94.8
13.00	4	1.0	1.0	95.8
14.00	4	1.0	1.0	96.6
15.00	2	.5	.5	97.4
16.00	1	.3	.3	97.6
17.00	2	.5	.5	98.2
18.00	2	.5	.5	98.7
23.00	1	.3	.3	99.0
25.00	1	.3	.3	99.2
28.00	1	.3	.3	99.5
37.00	1	.3	.3	99.7
52.00	1	.3	.3	100
Total	381	100.0	100.0	

Descriptive data analysis regarding the four training activities demonstrated a mean of 2.97 attempts, a minimum number of attempts of 0, a maximum number of attempts of 19, and a standard deviation of 2.36. The NONE category for the training assignments included 107 students who attempted none of the training assignments. The

AVERAGE category consisted of 249 students who attempted the four MMIT training assignments combined between one and five times, based on the mean of 2.97 plus one standard deviation of 2.36 for the sum of attempts of the training activities. The HIGH use category, those students who attempted the training activities more than five times, contained twenty-five students (see Table 3).

Table 3

Frequency Table of Training Attempts

	Frequency	Percent	Valid Percent	Cumulative Percent
.00	107	28.1	28.1	28.1
1.00	14	3.7	3.7	31.8
2.00	14	3.7	3.7	35.4
3.00	18	4.7	4.7	40.2
4.00	181	47.5	47.5	87.7
5.00	22	5.8	5.8	93.4
6.00	8	2.1	2.1	95.5
7.00	6	1.6	1.6	97.1
8.00	6	1.6	1.6	98.7
9.00	1	.3	.3	99.0
11.00	2	.5	.5	99.5
12.00	1	.3	.3	99.7
19.00	1	.3	.3	100.0
Total	381	100.0	100.0	

Descriptive data analysis regarding the four quizzes demonstrated a mean of 6.91 attempts, a minimum number of attempts of 0, a maximum number of attempts of 66, and a standard deviation of 7.80. Ninety-seven students made up the NONE category for the four quizzes. Two hundred forty-nine students attempted the four quizzes combined between one and 15 times, as demonstrated by the mean of 6.91 plus one standard deviation of 7.80, placing them in the AVERAGE category. The HIGH category, students completing the quizzes more than 15 times, contained 35 students (see Table 4).

Table 4

Frequency Table of Quiz Attempts

	Frequency	Percent	Valid Percent	Cumulative Percent
.00	97	25.5	25.5	25.5
1.00	4	1.0	1.0	26.5
2.00	3	.8	.8	27.3
3.00	8	2.1	2.1	29.4
4.00	44	11.5	11.5	40.9
5.00	38	10.0	10.0	50.9
6.00	30	7.9	7.9	58.8
7.00	31	8.1	8.1	66.9
8.00	24	6.3	6.3	73.2
9.00	20	5.2	5.2	78.5
10.00	11	2.9	2.9	81.4
11.00	10	2.6	2.6	84.0

Table 4 (continued).

	Frequency	Percent	Valid Percent	Cumulative Percent
12.00	8	2.1	2.1	86.1
13.00	4	1.0	1.0	87.1
14.00	9	2.4	2.4	89.5
15.00	5	1.3	1.3	90.8
16.00	4	1.0	1.0	91.9
17.00	7	1.8	1.8	93.7
18.00	1	.3	.3	94.0
19.00	1	.3	.3	92.4
20.00	3	.8	.8	95.0
21.00	2	.5	.5	95.5
22.00	2	.5	.5	96.1
23.00	1	.3	.3	96.3
26.00	1	.3	.3	96.6
28.00	2	.5	.5	97.1
30.00	2	.5	.5	97.6
33.00	2	.5	.5	98.2
34.00	1	.3	.3	98.4
36.00	1	.3	.3	98.7
39.00	3	.8	.8	99.5
43.00	1	.3	.3	99.7

Table 4 (continued).

	Frequency	Percent	Valid Percent	Cumulative Percent
66.00	1	.3	.3	100.0
Total	381	100.0	100.0	

The NONE category included 132 students for the grader assignments, 107 students for the training activities, and 97 students for the quizzes. The average category included 219 students for grader assignments, 249 students for the training activities, and 249 for the quizzes. The high category consisted of 30 students for the grader assignments, 25 students for the training activities, and 35 students for the quizzes. Figure 1 details the number of students per activity in each category of use for the MMIT.

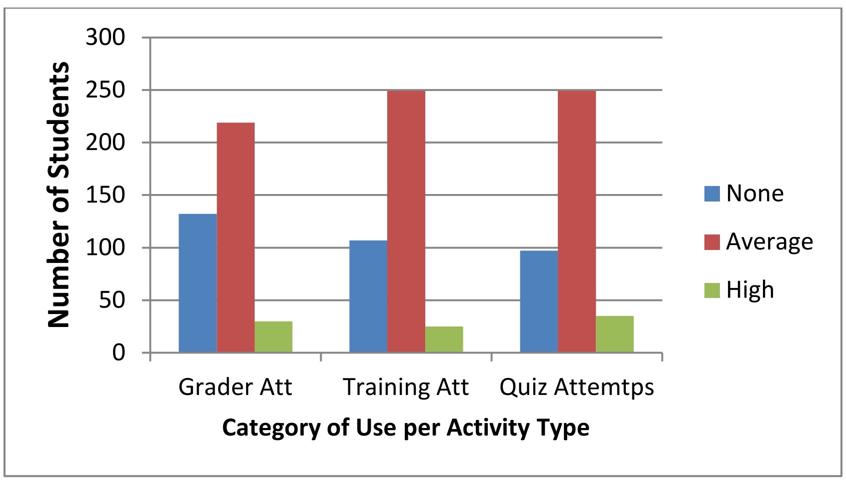

Figure 1. Category of Use per Activity Type.

Research Question 2: Is there a Significant Difference between the Student's Level of Use of the MMIT and their Knowledge as Measured by Changes in their Pre- and Post-Exam Scores?

Quantitative data from the MMIT gradebook were collected and analyzed, in conjunction with the results of Research Question 1, to address Research Question 2. The MMIT gradebook entries for the Excel pre- and post-test were downloaded into Excel and imported into SPSS for analysis. A change variable, Ch_ExcelTests, was computed to determine the difference in scores between students' pre- and post-tests. A total of 141 complete cases where students completed both the pre-test and the post-test were analyzed. Three separate 3 x 2 mixed design ANOVAs were calculated on these completed cases to examine the relationship between the category of use (NONE, AVERAGE, HIGH) and time (pre-test and post-test) on knowledge. A mixed ANOVA was performed for each of the three types of activities (grader activities, training activities, and quizzes). A one-way ANOVA was used to further analyze the change score for the pre- and post-exams as related to the category of use for each of the three activity types.

The ANOVA performed on grader activities indicated a significant main effect based on time ($F(1, 138) = 32.566$, $p < .001$, $\eta^2 = .191$) as determined by the difference in pre- and post-test scores but not for the category of use for grader attempts ($F(2,138) = .311$, $p = .73$, $\eta^2 = .733$). The effect for the interaction of time * category of use for the grader activities was not found to be significant ($F(2, 138) = 2.075$, $p = .13$, $\eta^2 = .029$). This indicated while there was a significant difference of student knowledge as demonstrated by the pre- and post-test scores there was not a significant impact on their knowledge based on the students' category of use for grader activities.

The ANOVA performed on training activities indicated there was a significant main effect was present based on time ($F(1, 138) = 9.824$, $p = .002$, $\eta^2 = .066$) as determined by the pre- and post-exam scores. However, the main effect for the category of use of training attempts was determined not to be significant ($F(2, 138) = 1.858$, $p = .16$, $\eta^2 = .026$). The effect for the interaction of time * category of use for training activities was also determined not to be significant ($F(2, 138) = 2.249$, $p = .11$, $\eta^2 = .032$). This indicated there was a significant difference in student knowledge as demonstrated by the student's pre- and post-test scores. There was not a significant impact on their knowledge based on their category of use for training activities.

The ANOVA performed on quiz attempts indicated a significant main effect was present based on time ($F(1, 139) = 109.050$, $p < .001$, $\eta^2 = .440$) as determined by the difference in pre- and post-test scores. However, the main effect for the category of quiz attempts was not determined to be significant ($F(1, 139) = .802$, $p = .37$, $\eta^2 = .006$). The effect for the interaction of time * category of use for quizzes was demonstrated to be significant ($F(1, 139) = 4.720$, $p = .03$, $\eta^2 = .033$). This indicated that in addition to a significant difference in student knowledge as demonstrated by the students' pre- and post-test scores. There was also a significant impact on student knowledge on the category of use for quizzes.

The ANOVA analysis on the change score for the pre- and post-Excel exams for each of the three categories of use for the MMIT indicated no significant effect for any of the category of use levels. No significant difference was identified for change score in regard to the category of use of the grader assignments ($F(2, 138) = 2.075$, $p = .129$). The effect for the change score in relation to the category of use of the training activities ($F(2, 138) = 1.858$, $p = .160$) and the category of use of the quizzes ($F(1,139) = .802$, $p = .372$) was also not significant.

The results of the mixed ANOVAs indicated a significant difference in student knowledge based on time as demonstrated by changes in students' pre- and post-test scores. While the category of use for grader and training activities did not have a significant impact on student knowledge, the category of use for quizzes did significantly impact student knowledge. The one-way ANOVA did not indicate a significant impact on the change score for category of use for the grader assignments, training activities, or quizzes.

Research Question 3: Is there a Significant Difference in Student Motivation and Learning Strategies in the Course Based on the MMIT as Indicated Through Changes in Pre- and Post-Course Questionnaires?

Qualitative survey data were collected through the pre- and post-course MSLQ surveys to address Research Question 3. Student responses for both the pre-course and post-course questionnaire were downloaded into Excel. There were 134 complete cases where a student completed both the pre-course and the post-course questionnaire included in the data analysis. The responses were organized based on the appropriate scale and mean values for each scale and were computed for both the pre- and post-course questionnaire for each student. These data were imported into SPSS where a change value for each individual scale was computed to determine the difference in the motivation and learning strategies scales across the time period of the study.

Motivation. A one-way MANOVA was calculated examining the effect of the category of use (NONE, AVERAGE, HIGH) on the MSLQ motivation scales. A significant effect was found for the category of use for grader attempts ($F(12, 250) = 1.924$, $p = .032$, $\eta^2 = .905$), as shown in Table 5. Follow-up univariate ANOVA on grader attempts indicated a significant effect in the motivation scales of task value (F(2) = 3.584, p = .031, η^2 = .652), self-efficacy of learning and performance (F(2) = 7.986, p = .001, η^2 = .952), and test anxiety (F(2), = 3.503, p = .033, η^2 = .645) based on the category of grader attempts (see Table 6). The category of use for the grader activities had a significant effect on the motivation scales of task value, self-efficacy of learning and performance, and test anxiety.

Table 5

MANOVA Multivariate Tests for Motivation Scales

	Value	*Hyp. Df*	*Error df*	F	Sig.
Category of Use – Grader Attempts	.84	12	250	1.92	.03
Category of Use – Training Attempts	.90	12	250	1.10	.36
Category of Use – Quiz Attempts	.87	12	250	1.46	.13

Table 6

MANOVA Results of Between-Subject Effect on Motivation Scales based on Grader Attempts

	SS	*Df*	MS	F	Sig.
Intrinsic Goal Orientation	2.66	2	1.33	.87	.42
Extrinsic Goal Orientation	3.13	2	1.56	1.29	.28
Task Value	8.79	2	4.36	3.58	.03
Control of Learning Beliefs	6.98	2	3.49	2.36	.10

Table 6 (continued).

	SS	*Df*	MS	F	Sig.
Self-Efficacy for Learning and Performance	22.83	2	11.92	7.99	.001
Test Anxiety	17.32	2	8.66	3.50	.03

Results of the MANOVA indicated there was no significant change in any of the other motivation scales of intrinsic goal orientation ($F(2) = .872$, $p = .421$, $\eta^2 = .197$), extrinsic goal orientation ($F(2) = 1.288$, $p = .279$, $\eta^2 = .275$), or control of learning beliefs ($F(2) = 2.631$, $p = .098$, $\eta^2 = .470$) as seen in Table 6. The category of use for the grader activities had no significant effect on the motivation scales of intrinsic goal orientation, external goal orientation, or control of learning.

The one-way MANOVA found no significant effect for the motivation scales in terms of the category of use for training activities ($F(12, 250) = 1.10$, $p = .36$, $\eta^2 = .631$), as shown in Table 5. The category of use for the training activities had no significant effect on the six motivation scales. As the results were not significant, no follow-up univariate testing was required.

No significant effect was indicated for any of the motivation scales in regard to category of use for quiz attempts ($F(12, 250) = .872$, $p > .134$, $\eta^2 =.790$), as shown in Table 5. None of the six motivation scales were significantly influenced by the category of use for the quizzes or any of the combinations of different categories of use. These results required no follow-up univariate testing.

Learning Strategies. A one-way MANOVA was calculated examining the effect of the category of use (NONE, AVERAGE, HIGH) on the MSLQ learning strategies scales. No significant effects were found for the category of grader attempts ($F(18, 242) = .860$, $p = .628$, $\eta^2 = .620$), as shown in Table 7. These results indicated none of the nine learning strategies scales were significantly impacted by any of the categories of use for the grader activities. Follow-up univariate ANOVAs were not indicated as there were no significant effects of the MANOVA.

Table 7

MANOVA Multivariate Tests for Learning Strategies Scales

	Value	*Hyp. df*	*Error df*	F	Sig.
Category of Use – Grader Attempts	.88	18	242	.86	.63
Category of Use – Training Attempts	.91	18	242	.66	.84
Category of Use – Quiz Attempts	.89	18	242	.82	.66

The one-way MANOVA indicated no significant effect for the learning strategies scales in relation to the category of use of training attempts ($F (18, 242) =.666$, $p > .843$, $\eta^2 = .482$), as seen in Table 7. These results indicated no significant impact on any of the nine learning strategies scales by the category of use for the training activities. These results required no follow-up univariate ANOVA.

No significant effect was shown in the one-way MANOVA for the learning strategies scales when analyzed for the category of use of quiz attempts , or for category of quiz attempts ($F(18, 242) = .821$, $p = .675$, $\eta^2 = .594$), as seen in Table 7. None of the nine learning strategies scales had a significant impact related to the category of use of the quizzes. No follow up univariate ANOVA was required.

Summary

This chapter summarized the statistical analysis of the data collected for this research study. Results indicated student use of the MMIT could be divided into three usage categories: (1) NONE, for students who do not attempt any of the MMIT activities; (2) AVERAGE, for students who attempt the activities from one to +1 standard deviation number of times (based on the type of activity); and (3) HIGH, for students who attempt the activities more than +1 standard deviation number of times. The examination of the categories of use of the MMIT activities and student knowledge through mixed ANOVA analysis indicated a significant difference in student knowledge based on time as demonstrated by Excel pre- and post-test scores. The main effects of the category of use of grader assignments, the category of use of training activities, and the category of use of quizzes was not significant. Additionally, the interaction of time * the category of use of grader assignments and the interaction of time * the category of use of training activities was not significant. There was, however, a significant effect demonstrated based on the interaction of time * the category of use of quizzes. A significant difference was found in student knowledge over the course of the study, although the interaction of time * category of use of quizzes was the only MMIT component that resulted in a statistically significant impact on student knowledge. The analysis of motivation in conjunction with the category of use of the MMIT indicated a significant effect on task value, self-efficacy for learning and performance, and test anxiety based on the category of use of the grader assignments. There was no significant effect on any of the other motivation scales, and there was no significant effect on any of the motivation scales based on the category of use of either the training activities or quizzes. The analysis of learning strategies in combination with the category of use of the MMIT indicated no significant effect on any of the nine learning strategies based on category of use of grader assignments, training activities, or quizzes.

Chapter V will discuss the researcher's conclusions based upon the findings of this study. Implications of the study's results on MMIT applications in education and learning will also be addressed to help institutions decide whether such systems are beneficial. The chapter finally examines limitations of the study and provides recommendations for future research.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

Introduction

This chapter provides an overview of the research study including a discussion of the quantitative research methods used to collect the data. Results of the research findings are discussed, and conclusions are provided based on the study's three research questions. Implications and limitations of the study are included, as well as research opportunities that exist for expanding this research into other disciplines and institutions.

Summary of the Study

Education is changing from a teacher-centric classroom environment to a student-centered active learning environment that allows students to take responsibility for their own learning. MMIT is an important part of this transition as it requires students to take an active role in their own educational process (Gayton & Slate, 2002-2003). Technology is being integrated into this classroom to support increased learning through empowering each student (Chien & Chang, 2012). MMIT can present the instructional material to students through the use of student-centered, interactive, problem-solving activities (Twigg, 2011). Studies have shown the use of multimedia applications and MMIT have improved student learning (Bassoppo-Moyo, 2011; Milovanovic et al., 2011; Neo et al., 2012; Schilling, 2009; Stegeman & Zydney, 2010; Zin et al., 2012).

Several different MMITs have been designed and created specifically for use in computer applications courses. These tools allow for standardization of the presentation of instructional material, student instruction through the use of active-learning student-centered activities, computerized and standardized grading, and frequent detailed feedback. MMIT is widely used in computer applications courses around the country (Speckler, 2010); however, there is very little research on its actual effectiveness after implementation in the classroom.

This study was designed to examine the use of MMIT in an introductory computer applications course and demonstrate whether students' use of the MMIT increased the students' knowledge. This study also looked at how the students utilized the tool to determine if the category of the tool's use impacted student motivation and learning strategies within the introductory computer applications course. Previous studies on MMIT in regard to motivation and satisfaction are limited to older technologies, including Web pages and synchronous and asynchronous communication tools (Bekele, 2010).

As previously stated, the research questions discussed in the following sections of this chapter include:

1. To what extend did students utilize the MMIT?
2. Is there a significant difference between the student's level of use of the MMIT and their knowledge as measured by changes in their pre- and post-exam scores?
3. Is there a significant difference in student motivation and learning strategies in the course based on the MMIT as indicated through changes in pre- and post-course questionnaires?

Quantitative research methods, including descriptive statistics and survey data, were used to address the research questions identified for this study. Creswell and Plano Clark (2007) indicate quantitative research provides reliable data that is quantifiable and useful when generalizing results. Creswell (2012) also concludes that the use of quantitative research allows researchers to study a sample of a population and obtain trends, attitudes, and opinions for the population as a whole. Quantitative research methods were determined to be appropriate for collecting and analyzing the data for this study.

Research Findings

A discussion of the research findings is presented in this section of Chapter V. While all research questions were addressed, it is important to mention that Research Question 1 was answered through the use of descriptive statistics, and the results of Research Question 1 were an integral component used to address Research Questions 2 and 3.

Research Question 1: To What Extent did Students Utilize the MMIT?

Research Question 1 sought to demonstrate the extent to which students utilized the MMIT in the *Introduction to Computer Applications* course. The researcher and course coordinator assumed that implementing the MMIT within the course made the students more active in completing the MMIT activities. Further, the researcher assumed that the more knowledge students would acquire would lead to a change in the motivation and learning strategies the students' used within this course.

Findings of this study indicated the vast majority of students did not use the MMIT at all or used the MMIT only rarely to complete the course activities within the MMIT. Findings showed 35% (132) of students did not complete any of the four grader assignments, 57% (219) of students completed the four grader assignments between one and nine times, and only 8% (30) of the students completed the four grader assignments more than nine times, with a maximum number of attempts on the four grader activities for any one student equaling 52. Similar results were seen for the training activities with 28% (107) of the students completing none of the four training activities, 209 (65%) students completing the four training activities a total of between one and five times, and only 7% (25) of students completing the four training activities more than five times. The maximum number of attempts for the four training activities by a student was 19. More students completed the quizzes than any of the other activities. Quizzes were only 10 questions and limited to 10 minutes. Only 25% (97) of students did not complete any of the four quizzes, while 65% (249) of students completed the four quizzes between one and 15 times, and 10% (35) of students completed the four quizzes more than 15 times. The maximum number of quizzes completed by a student was 66. This data supports results of a Martin et. al.'s (2004) study that showed the use of MMIT, even with highly intrinsically motivated students, did not result in students completing more instructional activities.

The category of use was based on the total sum of activity attempts for each student within each activity separate usage category (grader assignments, training activities, and quizzes). The average attempts per activity category were not used due to a lack of variability in the data. This lack of variability within each assignment would have resulted in a generalized lack of variability in the final averages that would make determining the categories of use difficult. The researcher also chose to create the average use and high use categories based on plus one standard deviation in the number of attempts. This decision was made by the researcher to fit a standard bell curve where the average attempts would fit within the normal curve.

These results showed that between 25%-35% of the students did not complete any of the MMIT activities in each of the three activity categories. An additional 57% – 65% of the students completed the activities an average number of times. Only 7% - 10% of students completed MMIT activities enough times to be considered a high user of the tool. These figures were based on the researcher's decision to use +1 standard deviation as the determining value for level of use. While this decision was reasonable and statistically sound, it may not have produced an entirely accurate result. In this study a high level of use is only high relative to the other students in the course. The results of the analysis might have shown more significant effects on knowledge, motivation, and learning strategies had the categories of use been calculated differently.

The decision to allow unlimited attempts for each activity was made based on the premise that most students would complete the MMIT activities until they received, or at minimum, a passing score of 70. This idea was not supported by the research. Although the majority of students completed the activities none or an average number of times, there were students who completed the activities many times, up to a total of 21 times for one grader activity and 22 for one of the quizzes. Additionally, many students completed activities again even after earning a grade of 100 on the activity. As indicated in the syllabus, the highest score on any activity was recorded in the gradebook, so there was no risk or penalty for attempting assignments again to review, study, or improve learning. There were many instances where a student's last score was not their highest score.

The quizzes resulted in a higher variability in student attempts than any other activity type. The quizzes had a higher mean attempts (6.90), a higher range (66), and a higher standard deviation (7.80). The quizzes were low-stakes, 10 question, multiple-choice quizzes limited to a maximum of 10 minutes. The quizzes took significantly less time to complete than any other activity type and therefore, could be completed multiple times in a short time frame. The multiple-choice quizzes could be considered easier assignments as they required a lower level of knowledge than the application based grader assignments and training activities. Additionally, the multiple-choice answers could be memorized and applied to future quiz attempts and even to the multiple-choice questions on the exams.

The results of this study support research by Domagk et al., (2010) indicating interactive media and the use of MMIT provides the possibility for improved learning. Chen and Sun (2012) also state that interactive multimedia provides students with powerful learning opportunities. However, success requires students to be actively engaged and to take charge of their own learning activities for the tools to be effective.

Research Question 2: Is there a Significant Relationship between the Student's Level of Use of the MMIT and their Knowledge as Measured by Changes in their Pre- and Post-Exam Scores?

Research Question 2, in its modified format, sought to demonstrate if there was a significant relationship between the student's level of MMIT use, as determined by the results of Research Question 1, and the change in their knowledge of the Excel material as measured by changes in the student's pre and post exam scores. The quantitative data were analyzed using three separate mixed design ANOVAs, one for each of the three types of MMIT activities, examining the category of use (NONE, AVERAGE, and HIGH) and time (pre-test and post-test scores).

All three mixed ANOVAs indicated a significant interaction based on time. This indicates a significant difference in students' knowledge as determined by the difference between pre-test and post-test scores. These data imply that students are learning the material presented by the MMIT. However, the data does not indicate that students are learning through the MMIT grader assignments or training activities. The results of the ANOVA for the grader assignments showed no significant impact based on any of the three usage categories. Additionally, the results of the ANOVA for the training activities showed no significant impact on student knowledge in relation to any of the three usage categories. These data do not indicate a relationship between the students' category of MMIT use of grader assignments or training activities and the change in knowledge as indicated by the students' pre-test and post-test scores.

The ANOVA on the MMIT quiz activities did not show a significant difference based on the main effect of the quizzes. But, when the quizzes were examined with the interaction of both time (pre-test and post-test) and usage category there was a significant difference. This indicates an effect on students' knowledge based on their post-test score and their category of MMIT use in regard to the quizzes. The researcher assumes this is due to students completing more of these activities.

These results appear to show students knowledge is increased more from the quizzes than from the other two MMIT activities. However, as previously stated, the multiple-choice answers could be recorded and/or memorized and applied to the multiple-choice questions on the post-test exam. The quizzes may or may not result in an actual change in knowledge although there was a difference in pre- and post-test scores.

Rogers (2000) research demonstrates that students with higher levels of interaction also have higher levels of achievement. This research appears to support this finding in that even students with low levels of interaction demonstrated large changes in knowledge over time. Findings indicate that students have acquired some knowledge through methods other than the MMIT, such as the textbook material or PowerPoint slide shows. These results support results of Lei (2010) indicating technology use in education, including MMIT, is one case where research is less helpful than expected as the results of effectiveness are contradictory and inconsistent. Additionally, it was likely that highly motivated students had increased use of the MMIT and earned higher grades in the course based on their level of motivation.

Research Question 3: Is there a Significant Difference in Student Motivation and Learning Strategies in the Course Based on the MMIT as Indicated through Changes in Pre- and Post-Course Questionnaires?

Research Question 3 examined if there was a significant difference in the students' motivation and learning strategies in the *Introductory Computer Applications* course based on the use of the MMIT as indicated through changes in students' pre- and post-course MSLQ questionnaires. One-way MANOVAs were run to examine the category of MMIT use and the motivation and learning strategies scales of the MSLQ questionnaire.

The MANOVA reported no significant difference in any of the six motivation scales in conjunction with the category of MMIT use for either training activities or quizzes or any of the combinations of activity use. However, there was a significant difference indicated for the motivation scales in regard to the grader assignments.

Follow-up univariate ANOVAs showed a significant difference in the motivation scales of task value, self-efficacy of learning and performance, and test anxiety. This indicates that the category of use of the grader activities can impact students' motivation for these three individual scales. The other three motivation scales did not show a significant change. This supports Bekele's (2010) determination that the use of technology alone did not motivate students. These results also support the Martin et al. (2004) study that shows that the use of MMIT in the classroom is not enough to increase student motivation and that software developers have erroneous beliefs about the effect of their tools on student motivation.

MANOVAs on the learning strategies scales indicated no significant effect for the category of MMIT use for the grader assignments, training activities, or quizzes. No follow-up univariate testing was necessary.

The use of the MMIT appeared to have minimal impact on students' motivation or the learning strategies used in the *Introductory Computer Applications* course as reported by students in the pre-course and post-course MSQL. In examining the descriptive statistics for the 15 individual scales of the MSQL, the mean score for 14 of the 15 scales actually decreased, although not a statistically significant decrease. Test anxiety was the only motivational scale that had an increase in the mean, although again not a statistically significant change. The use of the MMIT appears to have no significant impact on the learning strategies employed by students in the *Introductory Computer Applications* course. These results support the results of the Martin et al. (2004) study that indicated that intrinsically motivated students did tasks differently and were more exploratory in their use of the MMIT than extrinsically motivated students; however, the intrinsically motivated students did not do more tasks. This finding supports also research by Berget and Karabenick (2011) that indicates that motivation is related to the use of learning strategies but that learning strategies do not necessarily impact student motivation. Researchers are continuing to work on finding a link between instructional strategies, motivational processes, and learning outcomes (Martin et. al., 2004).

Conclusions and Discussion

The study indicates students are not making full use of the opportunities provided by the MMIT. One-fourth to one-third of the students did not complete any of the MMIT activities. An additional 57% to 65% of the students did complete activities using the MMIT; however, not to the fullest extent possible. Only eight to 10 percent of students used the tool to complete activities a large number of times. This resulted in a negative impact on student grades. The class had a success rate of only 55.4% with 27% of the students earning a grade of ‘D’ or ‘F’ and 17.6% of students withdrawing from the course. These results support Spellman’s (2000) study indicating not only a general lack of student support for the use of MMIT but a high student resistance to the use of the tools, especially since completion of these assignments were required. These findings suggest a problem with the use of the MMIT.

The different MMITs used in computer applications courses are based on the use of a simulated Microsoft Office environment in order to allow for automated grading and integrated multimedia instructional material. However, the simulated environment is not a complete and exact duplication of the real software product. The tool supports many, but not all, of the shortcut keys, access keys, and menu controls allowed by the real application software. This can lead to frustration for students who are used to completing a task in a method that is not accepted by the simulation. Additionally, as with all software products, there are minor *bugs* and flaws in the technology that can cause problems for the students.

Students have indicated a frustration with using one technological tool, the MMIT, to learn how to use a different technology tool, in this case Excel. Many of the students in this class do not have a technical background. The study participants included made up of 17 first-semester freshmen, 334 traditional students beyond the first semester of their freshman year, 26 returning students, 1 non-degree student, and 26 transfer students. Admission requirements for the university do not include computer proficiency. Students came from a variety of ethnic backgrounds, as shown in Table 8. The students reported majors included Allied Health (77), Arts and Sciences (144), Business (56), Computing (3), Education (29), Engineering (9), Interdisciplinary Studies (9), and Nursing (76), with one undeclared. Students in the College of Nursing, Allied Health, and Arts and Sciences make up 73% of the class population with 297 students. These colleges have no other required computing or technology courses. Students frequently report frustration with taking an introductory computer course in an online environment. The belief is that if the students can complete the tasks necessary to take an online course including, among other things, logging into the computer, accessing the Internet, logging into the course management system and MMIT, accessing the course materials, downloading the data files, completing the assignments in the appropriate tools, and uploading the assignments back to the tool then the students probably do not need to take an introductory computer course. Bradley et al., (2007) identifies several issues that interfere with effective integration of technology in the classroom, including software compatibility issues, software requirements, and a lack of support and training. The results of this study suggest these integration issues have a significant impact on student use of the MMIT.

Table 8

Students' Ethnic Background

	Number of Students
Asian	13
African-American	111
Caucasian	244
Native American	7
Hispanic	9
Unreported	20

This research study suggests there is a significant difference in knowledge of the Excel content material over the course of the instructional period, but the only significant relationship between this change in knowledge and the MMIT are the chapter quizzes, which are shorter and easier to complete. There is not a significant relationship with the use of the grader assignments or the training activities within the MMIT. The quizzes, however, are not full multimedia activities within the MMIT. The quizzes are simple text-based multiple-choice questions displayed through the tool for automated grading. There is no use of animation, video, audio, or other technology within the quizzes. The grader assignments and training activities are the components of the MMIT, making full use of constructivist learning theory and integration of technology. The lack of a significant relationship between the grader assignments and training activities with the change in knowledge does support previous conflicting research results where some studies on the integration of technology show a positive impact while other studies show no positive relationship based on the use of technology (Lei, 2010).

In regard to Research Question 3, the use of the MMIT was not shown to result in a significant change in most students' motivation or learning strategies scales. Changes to student motivation were seen in the areas of task value, self-efficacy of learning and performance, and test anxiety based on the category of use of the grader assignments. Task value corresponds to the student's determination of how useful or important a particular task is. Self-efficacy is the student's self-appraisal of their ability to accomplish a task. This includes their judgment about their ability to complete the task as well as their confidence in the skills necessary to perform the specific task. Test anxiety is based on student's negative concerns in regard to academic performance. The category of use of the grader activities, as real-world active-learning assignments, does appear to be related to the improvement within these three motivational scales. The researcher assumes that students with higher category of use of the grader assignments recognize the relevancy and importance of the Excel material. This also helps to decrease the students' anxiety in regard to success in this topic area.

There were no other significant changes in regard to motivation or learning strategies identified. The researcher believes this lack of change is, at least in part, a result of the previously mentioned student frustration and dislike of the MMIT itself. These results also indicate a resistance to change on the part of students in regard to their educational environment. While studies show that students generally report that MMIT makes instructional material more interesting and easier to understand (Milovanovic et al., 2011), other research shows that some MMITs are too distracting and can impede a student's ability to learn (Wang, 2010). Additionally, students have reported a frustration with this course in general. Many students have asked if it is realistic to offer an introductory computer applications course in a fully online format using learning management systems and MMIT. Their opinion, as related to the researcher, is that if they were computer literate enough to access the online course materials and successfully complete the tasks provided through the MMIT then they probably did not need to take an introductory computer course. The course, as it is currently designed, does require a level of computer competency in order to be successful. Further research should be conducted comparing the fully online sections of the *Introductory Computer Applications* courses to both blended and traditional instructional formats.

The research showed no significant positive relationship between the use of the multimedia instructional materials and the change in knowledge. Additionally, no significant relationship was indicated with most of the motivational and learning strategies scales. It is important to note, however, the research identified no negative relationship either. There was a significant change identified in student knowledge over the course of the study. Students did gain knowledge in the use of Excel during the instructional period. As all of the instructional material was presented through the use of the MMIT, including e-books, audio PowerPoints, and the researched instructional activities, the MMIT must be a component of this change. Additionally, none of the research indicates that the use of the MMIT had any negative impact on student knowledge, motivation, or learning strategies. This study appears to support existing research that calls for further research on effective educational strategies and the use of MMIT (Stegeman & Zydney, 2010).

Limitations

Limitations of this research study included the self-selection of students into the research study, the inability to limit students' access to the MMIT, the limitation of the research to the Excel section of the course, the restriction of the research study to one single school in the southeast United States, and possible researcher bias. There was no true randomization of students in this research study. Students self-selected to enroll in not only the *Introduction to Computer Applications* course but into the online sections as well. Enrollment statistics showed that students prefer to take this course in a blended format. Each of the blended sections of the course filled up and closed before there was steady enrollment in the online sections. No distinction was made between any of the online sections of the course as all four online sections were combined into one course within both the SAKAI learning management system and the MMIT. Additionally, all sections of the course, both blended and online, were taught by the same instructor so all students had the same instructor access and support.

This study focused largely on the students' category of use of the MMIT. This could not be tested using true randomization. Students could not be randomly assigned into a category of use nor could the students' access to the MMIT be ethically limited or controlled. Such a limitation could lead to a negative impact on students' knowledge or learning. Each student controlled his/her own access to the tool and determined their own category of use. This inherently led to the probability that more highly motivated students are more likely to have higher levels of use of the MMIT and thus, more likely to have higher levels of learning. The study counted the number of student attempts for each assignment to determine the students' category of use. This number will be low for students with pre-existing knowledge who scored well on their early attempts at the activity. While the students are permitted to complete assignments multiple times to improve grades and/or increase student learning, this may not be necessary for students who score well on their first attempt(s) and/or have pre-existing knowledge of the content. Pre-existing knowledge is accounted for in examining the change in student knowledge over the time of the research study by the pre-test, but the pre-existing knowledge is not evaluated in determining a students' category of use of the MMIT.

The portion of this study examining the change in knowledge was limited to the Excel component of the course. This section was selected as it is the section where students traditionally have the least amount of pre-existing knowledge and therefore have the greatest opportunity for a significant increase in their knowledge. However, this section of the course takes place during weeks 11-16 of the semester. Traditionally, this is after the drop date for the semester when students are allowed to drop the class without an academic penalty. Students who have difficulty in the Excel component do not have the option to drop the course as they do in previous sections of the course. During the semester, 71 students withdrew from the course. The researcher believes this number may have been higher and the data for the study impacted if students had the opportunity to withdraw during this time period.

This study was limited to one university in the southeastern United States. It was important for the study to maintain consistency over the course structure, course materials, course activities, and even the course instructor. This required the study to be constrained to one location. This also limited the study to one example of a MMIT, in this case myitlab. The enrollment numbers in this freshman level service course were high enough, at 404 enrolled students, to provide a large enough sample for this research study, with 381 students participating.

The researcher served as the course coordinator for the Introduction to Computer Applications course during the time period of this research study. This leads to the possibility of researcher bias as a limitation of the study. The course coordinator was responsible for setting up the individual course components and the course requirements; however, the course coordinator was not involved in the day-to-day activities of the course. To counter the possibility of researcher bias, with the exception of the pre-course MSLQ survey, no data was collected and no data analysis conducted until the conclusion of the course.

Recommendations for Policy or Practice

Advances in technology and changes in educational strategies have resulted in an increased use of MMIT in the classroom. These tools can present instructional content in a standardized, yet multi-modal format and move the focus of instruction from the teacher to the student. The increased use of MMIT is especially true in college-level introductory computer applications courses. Most, if not all, publishers of computer applications textbooks provide MMIT to accompany their textbooks, often at little to no additional cost over the price of the book. As the use of these tools continues to increase, research is needed to determine the most effective use of these tools to improve the educational process and increase student knowledge, motivation, and use of learning strategies. Research, such as this study and others, can help instructors make decisions in regard to which of the available tools and resources within the MMIT to utilize to have the most positive impact for the students. While there were limited positive relationships identified in regard to the use of the MMIT, these results have been confined by the limitations of the study.

Based on the results of this study, introductory computer applications courses should be developed focusing more on the use of MMIT. This study did indicate some positive results related to the use of the MMIT, and just as importantly, no negative results were identified. Studies have found contradictory results in regard to whether MMIT improves student knowledge, motivation, and changes learning strategies; however, none of the research has found a negative impact from the use of these tools. Previous research shows inconsistent results in regard to the amount of learning gains when MMIT is compared to traditional educational environments yet, existing research is consistent in finding the use of MMIT at least as effective as traditional instruction (Stegeman & Zydney, 2010). Instructors must work to determine the best use of the tools within their specific course and for their students. MMIT should be easy to use for both the instructors and the students. The tool should provide realistic simulations and make good use of multimedia to effectively demonstrate the material. Different instructional approaches should be included to provide flexibility of instruction and to appeal to students with different learning styles. Additionally, the tool should complement the existing instructional materials, including the textbook. The MMIT should be used to enhance the students’ learning experience within a given course.

Recommendations for Future Research

This research study provides many opportunities for additional research. This research specifically studied students in the online sections of the computer applications course. The use of MMIT in different modalities, including traditional classroom instruction and blended courses, could increase the generalizability of the results. Additionally, although it was not ethical to restrict student access to the MMIT, further research could be conducted comparing students in computer applications courses that have implemented MMIT to similar courses that employ optional use of the tool or do not use the tool at all. This could help determine the actual effect the use of the tool has on student knowledge, motivation, and learning strategies.

In order to fully capture the role of the MMIT in the introduction to computer applications courses, the addition of qualitative research to the current quantitative study is necessary. Qualitative studies may help researchers understand the specific student attitudes and behaviors that impact their use of the MMIT, as well as their motivation and learning strategies in this course. Interviews and focus groups may help researchers develop best practices and policies for the implementation of MMIT.

The study needs to be duplicated in different populations such as high schools, community colleges, or corporate training facilities that offer instruction in introductory computer applications. The examination of how different demographic features of students, including gender, age, major, and academic classification, impact MMIT use could provide valuable information. In addition, research examining the use of MMIT in different modalities of instruction is necessary.

Quantitative studies can be included with the quantitative research. This study does not examine the reasons why students enrolled in the course. Students' motivation for taking the course would provide valuable knowledge. Additionally, students' attitudes and feelings regarding the course activities and the MMIT is vital. The combination of quantitative and qualitative research would provide a more accurate and complete understanding how MMIT can be used effectively in the classroom.

APPENDIX A

MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

Part A. Motivation

The following questions ask about your motivation for and attitudes about this class. Remember there are no right or wrong answers, just answer as accurately as possible. Use the scale below to answer the questions.

If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1- 7 that best describes you.

1	2	3	4	5	6	7
Not at all true of me						*Very true of me*

1. In a class like this, I prefer course material that really challenges me so I can learn new things.
2. If I study in appropriate ways, then I will be able to learn the material in this course.
3. When I take a test I think about how poorly I am doing compared with other students.
4. I think I will be able to use what I learn in this course in other courses.
5. I believe I will receive an excellent grade in this class.
6. I'm certain I can understand the most difficult material presented in the readings for this course.
7. Getting a good grade in this class is the most satisfying thing for me right now.
8. When I take a test I think about items on other parts of the test I can't answer.
9. It is my own fault if I don't learn the material in this course.

10. It is important for me to learn the course material in this class
11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.
12. I'm confident I can learn the basic concepts taught in this course.
13. If I can, I want to get better grades in this class than most of the other students.
14. When I take tests I think of the consequences of failing.
15. I'm confident I can understand the most complex material presented by the instructor in this course.
16. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.
17. I am very interested in the content area of this course.
18. If I try hard enough, then I will understand the course material.
19. I have an uneasy, upset feeling when I take an exam.
20. I'm confident I can do an excellent job on the assignments and tests in this course.
21. I expect to do well in this class.
22. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
23. I think the course material in this class is useful for me to learn.
24. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.
25. If I don't understand the course material, it is because I didn't try hard enough.
26. I like the subject matter of this course.
27. Understanding the subject matter of this course is very important to me.

28. I feel my heart beating fast when I take an exam.

29. I'm certain I can master the skills being taught in this class.

30. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.

31. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.

Part B. Learning Strategies

The following questions ask about your learning strategies and study skills for this class. Again, there are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the remaining questions.

If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1- 7 that best describes you.

1	2	3	4	5	6	7
Not at all true of me						*Very true of me*

32. When I study the readings for this course, I outline the material to help me organize my thoughts.

33. During class time I often miss important points because I'm thinking of other things. (reverse coded)

34. When studying for this course, I often try to explain the material to a classmate or friend.

35. I usually study in a place where I can concentrate on my course work.
36. When reading for this course, I make up questions to help focus my reading.
37. I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do. (reverse coded)
38. I often find myself questioning things I hear or read in this course to decide if I find them convincing.
39. When I study for this class, I practice saying the material to myself over and over.
40. Even if I have trouble learning the material in this class, I try to do the work on my own, without help from anyone. (reverse coded)
41. When I become confused about something I'm reading for this class, I go back and try to figure it out.
42. When I study for this course, I go through the readings and my class notes and try to find the most important ideas.
43. I make good use of my study time for this course.
44. If course readings are difficult to understand, I change the way I read the material.
45. I try to work with other students from this class to complete the course assignments.
46. When studying for this course, I read my class notes and the course readings over and over again.
47. When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.
48. I work hard to do well in this class even if I don't like what we are doing.
49. I make simple charts, diagrams, or tables to help me organize course material.

50. When studying for this course, I often set aside time to discuss course material with a group of students from the class.
51. I treat the course material as a starting point and try to develop my own ideas about it.
52. I find it hard to stick to a study schedule. (reverse coded)
53. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.
54. Before I study new course material thoroughly, I often skim it to see how it is organized.
55. I ask myself questions to make sure I understand the material I have been studying in this class.
56. I try to change the way I study in order to fit the course requirements and the instructor's teaching style.
57. I often find that I have been reading for this class but don't know what it was all about.(reverse coded)
58. I ask the instructor to clarify concepts I don't understand well.
59. I memorize key words to remind me of important concepts in this class.
60. When course work is difficult, I either give up or only study the easy parts. (reverse coded)
61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for this course.
62. I try to relate ideas in this subject to those in other courses whenever possible.
63. When I study for this course, I go over my class notes and make an outline of important concepts.

64. When reading for this class, I try to relate the material to what I already know.
65. I have a regular place set aside for studying.
66. I try to play around with ideas of my own related to what I am learning in this course.
67. When I study for this course, I write brief summaries of the main ideas from the readings and my class notes.
68. When I can't understand the material in this course, I ask another student in this class for help.
69. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.
70. I make sure that I keep up with the weekly readings and assignments for this course.
71. Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.
72. I make lists of important items for this course and memorize the lists.
73. I attend this class regularly.
74. Even when course materials are dull and uninteresting, I manage to keep working until I finish.
75. I try to identify students in this class whom I can ask for help if necessary.
76. When studying for this course I try to determine which concepts I don't understand well.
77. I often find that I don't spend very much time on this course because of other activities. (reverse coded)
78. When I study for this class, I set goals for myself in order to direct my activities in each study period.

79. If I get confused taking notes in class, I make sure I sort it out afterwards.
80. I rarely find time to review my notes or readings before an exam. (reverse coded)
81. I try to apply ideas from course readings in other class activities such as lecture and discussion.

APPENDIX B

REQUEST TO PARTICIPATE

Dear Student:

I am a doctoral student in Instructional Technology at the University of Southern Mississippi. As part of the requirements for my dissertation, I am conducting a research project to better understand the relationship between the use of multimedia instructional tools (MMIT), such as myitlab, and student learning. Additionally, I am examining if the level of use of the MMIT causes a change in students' knowledge and motivation in an introductory computer applications course.

To gather research for this project, I am asking for your participation in this study. I am asking that you complete a 25-30 minute survey at the beginning and end of the semester. To access the initial survey click on the following link:

http://www.______________________

I will also collect data from your myitlab account regarding your use of the myitlab MMIT during the Excel component of the course. To encourage your involvement in this study, a $50 Visa gift card will be given away by random draw to two students who participate and complete both of the surveys.

The risks associated with this study are minimal. The researcher will observe and document the instructional activities attempted and completed by the study participants through data and statistics available within the myitlab program. All data will be analyzed by the researcher and will be used for research purposes only. Data will be kept secure and confidential until data analysis is completed, at which time they will be destroyed. Your participation in this study is completely voluntary and can be terminated at any time. The choice to participate will have no affect on your academic standing or your grade in this course. Please contact me at debra.chapman@eagles.usm.edu if you have any questions.

This project has been reviewed by the Institutional Review Boards at The University of Southern Mississippi and the University of South Alabama, which will ensure that research involving human subjects will be conducted in accordance with associated federal laws and regulations. Participants may contact the Institutional Review Board at any time in regard to their rights in terms of this research project: Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601)266-6820.

Thank you for your help and participation in this research project.
Sincerely,

Debra L. Chapman
Doctoral Candidate, The University of Southern Mississippi

APPENDIX C

IRB APPROVAL LETTER

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.6820 | Fax: 601.266.4377 | www.usm.edu/irb

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **12110606**
PROJECT TITLE: **Multimedia Instructional Tools and Student Learning in Computer Applications Courses**
PROJECT TYPE: **Dissertation**
RESEARCHER/S: **Debra Chapman**
COLLEGE/DIVISION: **College of Education & Psychology**
DEPARTMENT: **Curriculum, Instruction, & Special Education**
FUNDING AGENCY: **N/A**
IRB COMMITTEE ACTION: **Expedited Review Approval**
PERIOD OF PROJECT APPROVAL: **11/27/2012 to 11/26/2013**

Lawrence A. Hosman, Ph.D.
Institutional Review Board Chair

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