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Students' Perceptions of Multimedia Classrooms at East Tennessee State University

A dissertation
presented to the faculty of the
Department of Educational Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree in
Doctor of Education

By
Shouhong Zhang
December 2002

Dr. Hal Knight, Chair
Dr. Terry Tollefson
Dr. Russell Mays
Dr. Lee Daniels

Keywords: Multimedia Classroom, Traditional Classroom, Instructional Technology,
Instructional Method, Learning Style

ABSTRACT

Students' Perceptions of Multimedia Classrooms at East Tennessee State University

By
Shouhong Zhang

The purpose of this study was to investigate students' perceptions of multimedia classrooms at East Tennessee State University regarding technologies in multimedia classrooms, students' learning achievements, instructors' instructional methods, and students' learning styles. Two surveys in multimedia classrooms and traditional classrooms were designed to measure and compare students' perceptions of multimedia classrooms. The VARK (Fleming, 2002b) learning style survey was used to calculate the students' learning styles.

The research was conducted during spring semester 2002. Participants in this study included 187 students in multimedia classrooms and 110 students in traditional classrooms at East Tennessee State University. The majority of students were from the School of Business and the College of Applied Science and Technology. The results of data analysis showed that there were no significant differences in students' perceptions of multimedia classrooms regarding technologies, learning achievements, and learning styles. However, there were significant differences in students' perceptions of multimedia classrooms regarding instructors' instructional methods. Students in multimedia classrooms had more positive perceptions of instructors' instructional methods than students in traditional classrooms. Furthermore, the majority of students in multimedia classrooms and traditional classrooms had positive attitudes towards multimedia classrooms.

Several recommendations for future research, VARK learning styles, and administrators and policy makers at East Tennessee State University resulted from this study. A future study with a larger and more diverse population using both quantitative and qualitative methodology is recommended to further explore the effectiveness of multimedia classrooms in higher education. Reinforcement of training, technical support, and classroom maintenance are recommended to administrators and policy makers at East Tennessee State University in order to use multimedia classrooms more effectively.

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CHAPTER 1

INTRODUCTION

Ever since the first computer appeared in 1946, the world has witnessed a great transformation in higher education (Cates, 1995). The impact of the information revolution on society, industry, business, the work-place, and education has been immense. Humans seek to understand not only the new technologies but also to recognize the influence, change, and impact that has been brought by them. Education, particularly, has been revolutionized with the advent of the information age (Simonson & Thompson, 1997). The higher education market continues to change dramatically with millions of dollars invested annually. According to Bialo and Sivin-Kachala (2001), spending for instructional technology in higher education has tripled in the last 10 years, with estimated total technology expenditures of \$2.7 billion in 1999-2000.

The evolution of technology in higher education is informed by developments in psychology, pedagogy, and technology (Hannafin, 1992; Jonassen, 1996). Technology has also been at the forefront of new instructional techniques in adult education (Hannafin, 1996). The use of technology is regarded as an instructional enhancement in the classroom. Many researchers, including Clark (1983) and Kearsley (1996), for example, have shown that there is a relationship between learning and instructional technology: Either instructional technology can be effective for learners or instructional technology makes no difference for learners (Cuban, 1986). The increased use of technology in academe has been designed to improve both learning procedures and outcomes for learners in classrooms and elsewhere. There are many issues in assessing the effectiveness of technology in classroom, however. Variations in learning styles, delivery of instruction, and the use of instructional technology have been found to be critical

(Dunn, Dunn, & Price, 1985; McDonald, 1996). Learners were found to have different learning styles in classrooms. For example, some learn by hearing and seeing or reflecting and acting, while others learn by reasoning, memorizing and visualizing or combining both (Kolb, 1984; McDonald). Therefore, instructors need to adjust their strategies to improve learning procedures and outcomes of students in the classroom (Jonassen, 1991). Jonassen stated that learning theories had shifted from behaviorism to constructivism, therefore, instruction in classrooms must accommodate students' individual needs and interests in learning. The systematic studies of classroom environment by Darkenwald (1989) reported seven dimensions in the classroom social environment: involvement, affiliation, teacher's support, task orientation, personal goal attainment, organization and clarity, and student influence. Incorporating these seven factors into the learning environment to address different learners' needs has been the principal consideration in the integration of instructional technology into classroom instructors for learners (Ester, 1995). Jonassen (1996) also suggested that the integration of instructional technology should consider individual characteristics of learners, instructors, and physical settings.

Technology in the classroom is a quiet revolution. The multimedia classroom is a new form of classroom with increased integration of instructional technology and employment of cutting-edge technology to enhance learning. Its design is based on the concept of a "lab classroom" or "master classroom" (Wilson, 1993). It is generally characterized by its small size (20 to 30 seat capacity) and installation of advanced technology equipment such as powerful computers or workstations with internet connections (wired or wireless). Other teaching tools may include a video projection system, an audio system, an audio and video conversion system, a touch panel control and monitoring system, a digitalization studio system, a Smartboard or

other presentation system, special software and computing applications, or a video conferencing system. Universities and colleges have built multimedia classrooms to meet the needs of new learners in the information age based on the research in learning theories and instructional technology (Bialo & Sivin-Kachala, 1996, 2001). Bialo and Sivin-Kachala listed the following benefits of using technology in the classroom: emphasizing active learning, responding to different learning styles, enhancing collaborative learning, increasing individualized learning and self-paced study, and encouraging greater student independence. Other researchers (Cardenas, 1998; Lyons, Kysilka, & Pawlas, 1999) also reported the positive learning benefits for learners using multimedia classrooms, for example, more interactivity, exploratory learning, and higher class retention.

The Office of Information Technology (OIT) at East Tennessee State University (ETSU) manages the integration of ever-changing information technology with learning and instruction. Its mission is to “provide the leadership, guidance, and technical skills required to establish and support an information technology architecture and accompanying services that support ETSU’s vision, mission, and goals” (ETSU, OIT, 2001, Mission, para. 1). Since its inception in 1997, the Technology Access Fee (TAF), paid each semester by all students and allocated to make technology accessible to all students at ETSU, has provided students at ETSU with superior technology opportunities (ETSU, OIT, 2001, Technology Access Fee). One of the projects is the development of multimedia classrooms.

Multimedia classrooms at ETSU offer faculty members and students an up-to-date teaching and learning environment, which distinguishes them from other classrooms (Ranker, 2001).

Faculty members are provided a stable and reliable teaching environment that is fully supported and maintained by the Office of Information Technology. Students are provided an enhanced learning opportunity through the incorporation of various instructional media into the regular classroom lecture (ETSU, OIT, 2001, Purpose, para. 1).

Each multimedia classroom has presentation equipment including a document camera, an LCD projector, and a Smartboard; audio/visual equipment including a cassette recorder, a VHS player, and a DVD player; computer equipment including a PC and laptop connections for students and instructor; instructor's support equipment including a wall phone, a Crestron touch panel monitor, and portable mouse. Other technology-aided presentation equipment includes an audio and video conferencing unit, a slide/video converter, a portable video camera, a digital still camera, and a laser disc player (ETSU, OIT, 2002, Equipment, para. 1).

The first multimedia classroom on campus was completed in January 2000. Now ETSU has six multimedia classrooms with five on the main campus and one on the Kingsport, TN campus. The physical configuration of the classroom, advanced technology devices, and technical support provide excellent opportunities for learning and instruction (Ranker, 2001). OIT has adjusted and upgraded the equipment in the multimedia classrooms based on the development of new technologies and ongoing learning evaluation from both instructors and students (ETSU, OIT, 2002, Plan Narrative, para. 1). For example, wireless internet connection and virtual classroom technologies are being implemented in a new multimedia classroom's design and construction based on users evaluation of the six multimedia classrooms built from 2000 to 2002 (ETSU, OIT, 2001, Information Technology Strategic Plan: 2000--2003).

Statement of the Problem

Many students have taken classes in multimedia classrooms since these classrooms were first used in 2000. Multimedia classrooms cost considerably more than traditional classrooms due to the installation of technology, maintenance support, and training (Ranker, 2001). They are built with the intent that they will enhance student learning. However, no systematic research has been done on the effectiveness of the multimedia classroom in enhancing students' learning. OIT only has done evaluation of multimedia classrooms' physical configurations (ETSU, OIT, 2001, Training). Some faculty members have discussed this topic; however, there has been no systematic research related to students' perceptions of multimedia classrooms regarding learning achievements, instructors' methods, and satisfaction with technologies provided in multimedia classrooms and physical configurations of multimedia classrooms (Ranker).

Current curriculum designing and planning concentrates more and more on learners (Drew, 1998). This study investigated how students at ETSU perceived multimedia classrooms regarding learning achievements, instructors' methods, instructional technologies, and learning styles.

Research Questions

This study investigated ETSU students' perceptions of multimedia classrooms regarding learning achievements, instructors' methods, instructional technologies, and learning styles in multimedia classrooms and traditional classrooms. Five main areas were addressed in the study: students' learning achievements, instructors' methods, students' learning styles, instructional

technologies employed in instruction using the multimedia classrooms, and general perceptions of multimedia classrooms by different groups of age, gender, and discipline of study.

The following six questions were addressed:

1. Are students who take classes in multimedia classrooms satisfied with the technology provided, as compared with those who take classes in traditional classrooms?
2. Do students who take classes in multimedia classrooms perceive their learning achievements differently than do those who take classes in traditional classrooms?
3. Do students who take classes in multimedia classrooms perceive the instructors' instructional methods differently than do those who take classes in traditional classrooms?
4. Are there differences in the students' general perceptions of multimedia classrooms based on gender, discipline of study, and age?
5. Is there a difference in students' prior computer knowledge and use between students who take classes in multimedia classrooms and those in traditional classrooms?
6. Is there a difference in students' general perceptions of multimedia classrooms between students with different learning styles taking classes in multimedia classrooms and those with different learning styles taking classes in traditional classrooms?

Significance of the Study

There is little literature available on the effectiveness of multimedia classrooms.

Therefore, this study could be a significant contribution to knowledge in this area. The results

could be very significant to ETSU as well because this study provided information on students' perceptions of the effectiveness of multimedia classrooms.

Research on the effectiveness of instructional technology is a mixed body of work (Cooper & Miller, 1991; Jonassen, 1996). The integration of technology into education is often discussed topic about which many have strong opinions. However, research in this field has not maintained pace with the development of the new technologies.

Multimedia classrooms are a relatively new innovation in the design of educational facilities. This research could contribute more understanding on the perceived effectiveness of multimedia classroom. At ETSU, this research could help administrators better understand students' perceptions of multimedia classrooms in terms of their learning achievements, instructors' methods, and use of instructional technologies. It provided ETSU with baseline data for future development of multimedia classrooms and faculty professional development. The benefit of this research should also impact other institutions as the results could provide useful data to administrators and educators in other higher learning institutions concerning the development of multimedia classrooms.

Definitions

Instructional Technology is “the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning” (Seels & Richey, 1994, p. 11). It covers not only any employment of technologies in instruction but also any effective learning methods (Seels & Richey).

A Multimedia Classroom is a sophisticated computer-based classroom that uses multimedia applications for the delivery of instruction.

A Traditional Classroom is a general classroom without computer-based technologies.

Learning Styles are the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment (Keefe, 1989). According to the VARK learning style inventory (Fleming, 1987), which is the instrument used in this study, there are four learning styles: visual, aural, read/write, and kinesthetic.

Learning Achievements are learners' perceptions regarding their academic performance, goal achievement, and knowledge acquisition.

General Perceptions of multimedia classrooms in this study include students' perception of Technology Access Fee to build multimedia classrooms at East Tennessee State University, students' preferences of instructors' use of technology in class, and students' future choice of taking class in a multimedia classroom.

Limitations

This study was limited because the population of this study was only from multimedia classrooms and their mappings from traditional classrooms with the same teaching contents (the same syllabus in this study) and some with the same instructors and the same teaching contents at East Tennessee State University on the main campus during spring semester 2002. Furthermore, subgroups of the study subjects were limited by the number as well. This study was limited by the fact that 92% of respondents were from Business and Applied Science and Technology. Therefore, the findings of this study were not generalizable to all students at East Tennessee State University.

There were other limitations associated with this research, for instance, this study was further limited to the degree that it relied on human assessments, self-reported data, and perceptions.

The descriptive and comparative study findings revealed students' perceptions of multimedia classrooms from some aspects. It was ultimately hoped that more systematic and comprehensive studies will be conducted to determine the effectiveness of multimedia classrooms for learners in higher education.

Overview of the Study

This study is divided into five chapters. Chapter one is an introduction to the study including the statement of the problem, research questions, significance of the study, definitions used in the study, and the limitations of the study. Chapter two presents a review of the literature on the history of classroom design in higher education, instructional technology, learning styles, integrating technology into classroom, and classroom environment theories. Chapter three introduces the research design, population and sample, research questions and related hypotheses, instrumentation, validity and reliability, pilot study, data collection, and data analysis. Chapter four includes data description, data analysis, interpretation of the data, and brief summary. Chapter five contains findings, conclusions, and recommendations derived from this study.

CHAPTER 2

REVIEW OF THE LITERATURE

This research investigated students' perceptions of ETSU multimedia classrooms regarding technologies, instructors' methods, learning styles, and learning achievements. The literature review presented below addresses the history of classroom design in higher education, instructional technology, learning styles, integrating technology into classroom, and classroom environment theories.

History of Classroom Design in Higher Education

Administrators in higher education most often consider educational and social factors when they design and develop the facilities. Educational facilities must meet the learning needs of students (Brubaker, 1998; Lackney, 1998). Social trends play an influential role in designing classrooms in higher education.

Three hundred years ago, higher education was characterized by survival education (Lackey, 1998). Illiteracy was high among people. The establishment of Harvard College in 1636 and the College of William and Mary in 1688 illustrated the nature of higher education: education for the elite.

With the advent of the industrial revolution, the industrial society spawned railroads, factories, and cities. By 1850, the northeastern U.S. industries produced firearms, farm implements, textiles, and sewing machines. Factories, on the other hand, led to producing new learning as well. This gave rise to the public higher education system with highly formalized, hierarchical structures designed to sort students who were eligible for promotion to higher levels

in the system (Filler, 1965). Standardized psychological testing was introduced during this period. A new purpose of education, focusing on individual development, was formulated (Coleman & Hoffer, 1987). Carnegie Units were developed as a way to give more people access to colleges and universities. John Dewey launched his progressive movement based on the assumption that all students could learn if they were immersed in active learning environments (Ryan, 1995). By the end of the 19th century, classrooms began to be designed and constructed with other functional considerations in higher education (Graves, 1993), for example, hallways were widened to accommodate increased student flows. Meanwhile auditoriums, laboratories, art studios, and gymnasiums were added along with these classrooms in colleges and universities.

Educational reform movements happened in the 1960s focusing on curriculum and instruction. Open education with individualized instruction was introduced. Education became more and more politicized (Arnold & Rand, 1979). In the 1980s and early 1990s, educational reformers began to experiment with mirroring the corporate business world. Classroom planning and design responded to this trend in higher education. Classrooms got bigger in size. Planners and designers of classrooms began to think about how learning could best be supported and nurtured for adult learners (Cutler, 1989).

During this period, classroom design and development in higher education was greatly influenced by public schools as well. The baby boom after World War II brought a crisis in educational facilities. The American Institute of Architects formed a Committee on School Buildings in 1953 (Marks, 2000). Its guiding principles from the beginning were, “to concentrate on things we could do something about, and to strike a balance between what the educational establishment wanted and what it didn't know it wanted but needed”(Armsey, 1976,

p. 6). As Graves (1993) remarked, classrooms, “should be more sensitively designed to the new needs of education in a period of rapid, revolutionary change in instruction and social conditions and intelligent economy should be encouraged wherever, whenever, and however it could be” (p.viii). These educators, architects and suppliers,

(1) studied and promoted the use of folding and movable walls to gain the advantages of flexible space, (2) investigated and funded examples of ‘system’ building components to build schools faster, cheaper, and better, (3) explored the use of new media, especially television, and studied how they might influence school design, and (4) encouraged school systems to try new organizational methods such as team teaching, new curricula, and new relationships within their communities. (Brubaker, 1998, p.20)

Classrooms were planned and designed with large, open, and flexible spaces adapting to educational needs in colleges and universities. The classrooms were designed as a way to facilitate the change in the relationships among teachers and students. All classroom components were designed to meet performance specifications. Classrooms in colleges and universities featured flexible folding and movable walls, systems components, and the potential for larger open spaces (Sanoff, 1999).

From the middle to late 1990s, with the fast development of research in learning and cognitive science, students in higher education were provided with project-based, authentic, and real-world learning environment in classrooms (Ritterspacher & Hill, 1990; Shields, 1993). Classrooms were decentralized into networks of smaller structures with federal financial support. Learners were kept in small groups in these classrooms to support the individualized instruction and cooperative learning in colleges and universities.

Technology advances happening in the end of 20th century and in recent years have led to the prevalence of computers and other electronic technologies in the everyday lives of people: at play, at work, in the home, and in higher education as well (Forester, 1989; Fox, 1989; Postman,

1992). The rapid growth in research on instructional technologies began to create the need to rebuild classrooms (Jonassen, 1996). Planning for self-contained classrooms has included additional space to house technological equipment with the advent of laptop computers, networks, video conferencing, distance learning, palm pilots, the Internet, and wireless technologies. Technology is everywhere in higher education and it is constantly changing. The integration of technology into classrooms in higher education is a tremendous challenge for educators and administrators (Marzano, 1992). The development and design of multimedia classrooms are based on “lab classroom” or “master classroom” with more integration of instructional technology and employment of learning enhancement technologies (Wilson, 1993). Such a classroom generally has 20 to 30 seats with the installation of cutting-edge technology equipment and computing applications, for example, powerful PCs with internet connection or wireless connection, video projection system, audio system, audio and video conversion system, touch panel control and monitoring system, Smart Board or any other presentation system, video conferencing system, and special digitalization studio softwares.

Instructional Technology

Instructional technology is the application of scientific knowledge and learning to the particular tasks of teaching and learning (Heinich, Molenda, Russell, & Smaldino, 1996). Technologies have been in use in higher education for hundreds of years (Palloff & Pratt, 1999). Printed words, textbooks, and chalkboards were early unique instructional technologies. Currently the application of instructional technologies in higher education has progressed to the use of complex multimedia products and advanced networking technologies.

The use of instructional technology has increased very fast in higher education over the past few years (Draude & Brace, 1999). Kerrey and Isakson (2001) reported that students enrolled in technological-delivered courses in postsecondary education were projected to triple to almost 15% in 2002, from just 5% in 1998; the number of technological-delivered courses doubled between 1994-95 and 1997-98 in postsecondary institutions. Computer technology provides students and teachers with unprecedented opportunities to transform the teaching and learning process. However, whether it has had a positive impact on the learning or not remains inconclusive (Sulla, 1999).

Attempts have been made to measure the effectiveness of instructional technology in terms of student achievement (Lockee, Burton, & Cross 1999). The most common approach was the media comparison study (Russell, 1997). Researchers compared the learning outcomes of different groups receiving the same content via different kinds of media. Essentially, the research outcome was what Russell called “the non-significant difference” phenomenon (p. 6). In 1983, Clark stated that media was only a delivery mechanism in instruction and did not impact learning. His research spurred great debate in the field of instructional technology. Clark (1983, 1994) maintained that it was the instructional method that had influence on learning, not the delivery media. This notion led to a heated debate within the field of instructional technology (Jonassen, Campbell, & Davidson, 1994). This debate continues today.

While Clark’s debate is still going on in the field of instructional technology, other researchers, for example, Kozma (1994) and Keegan (1996), have revealed that the attributes of media and the uses of instructional technology in class can and do affect learning outcomes. According to Kosakowski (1998), instructional technology can be highly effective in class instruction when it is appropriately used. Bialo and Sivin-Kachala (1996, 2001) suggested

there were positive results when college students used instructional technology in learning. These studies have shown that students responded that they felt more successful, were more motivated to learn, and had increased self confidence and self esteem when using computer-aided instruction. Sormunen and Ray's research (1996) on university business writing students who used group system software revealed that students gained more confidence in their study and scored significantly higher with the help of group management software than did students who took the class without using the software. Koedinger and Sueker (1996) found that college students using the Practical Algebra Tutor (PAT), an intelligent computer tutor, scored significantly higher in a performance assessment of algebraic problem solving, qualitative reasoning, and the ability to communicate effectively about mathematics than did students who did not use PAT. Technology has shown positive effects on the instructional process in higher education as well. Clark (1994) stated that the innovative use of instructional technology could reduce the amount of time needed for a labor-intensive tutoring system without reducing its effectiveness.

Although opinions of the impact of instructional media on learning outcomes differ (Clark, 1983; Mayer, 1997), some studies show that some media are better than others in conveying certain information in classroom instruction and presentation (Najjar, 1996). It is through electronic equipment in classrooms that different kinds of aural and visual media are realized in instruction and presentation. Auditory medium realized through sounds and speakers is generally better for short-term memory than visual information, for example, text in presentation or written on board (Murdock, 1968; Penney, 1975; Watkins & Watkins, 1980). For longer-term memory, text appears to be better than sound for communicating verbal information (Severin, 1967; Sewell & Moore, 1980). Based on dual coding theory (Paivio,

1991), it is believed that information is processed and stored in memory by two separate but interconnected channels: visual and verbal. This theory claims that visual representations such as pictures are faster and easier to recall. Verbal memory on the other hand is structured into discrete and sequential units (Dabbagh, 2001). If the learner's visual channel is already occupied, it may be better to use audio verbal information than textual information (Baggett & Ehrenfeucht, 1983; Mayer & Anderson, 1992). Pictures and videos realized through computers and projection system in class instruction are better than text or auditory instructions for spatial information (Rieber, 1990). Najjar (1998) commented that for verbal information, “text is better than auditory narration. For recalling and recognizing items, pictures are better than text. Pictures are also better than text or narration for communicating spatial information” (p.311). Several earlier studies showed that adding closely related, supportive medium to textual or auditory verbal information can improve learning performance (Paivio & Csapo, 1973).

Recent studies (Ellis & Cohen, 2001; Sims, 2000; Tergan, 1997) on multimedia mostly used in web and Internet technology suggest that animations and videos can also improve verbal information learning. “Multimedia is the use of text, graphics, animation, pictures, video, and sound to present information” (Najjar, 1996, p.131). Multimedia is the instructor’s enriched range of instructional tools, techniques, and methods in instruction. Students can watch demonstrations, try out instructed procedures, experience simulations, get feedback and help, and look up additional information and others with all means of multimedia. Students enjoy multimedia contents, prefer multimedia learning materials, and believe that multimedia helps them to learn (Fletcher, 1990). These beliefs are further explored by the assertion that (Hofstetter, 1997) people generally remember 10% of what they read, 20% of what they hear, 30% of what they see, and 50% of what they hear and see. This is the reason why animations

and videos are widely used in class instruction and presentation to enhance learning and teaching (Jonassen, 1999).

Some research has produced interesting findings related to the use of instructional technology and compared by gender, age, curriculum areas, and computer competency in adult learners. Gender concerns regarding the differences in instructional technology can be traced back to the identification of difference in women's math achievement in 1970s and 1980s (Shashaani, 1995). Mangione (1995) held that peer pressure, male metaphors, and gender bias in instructional technology would create a possible devastating effect on the educational opportunities for women in adult education. The differences between adult males and adult females in instructional technology concentrated on the cognitive and psychosocial differences between students of both genders or a consequence of a socialization process and experience base (Bain, Berelowitz, Hess, & Jones, 1999; Hattie & Fitzgerald, 1987). Linn and Hyde (1989) regarded differences in spatial visualization, mathematical computation and problem solving as small in cognitive and psychosocial domains. Bain et al. identified accessibility to technology as a pivotal factor in gender differences for adult learners in information technology. They held that information technology should be a routine component of all students' education. With the ever-growing changes in working environments, adult learners attend higher education classes to improve their skills (Bender, 1998). Learning theorists support the use of instructional technology to enhance learning and motivate adult learners (Bigge & Shermis, 1999). Anand and Zaimi (2000) demonstrated that traditional students in colleges and universities preferred lecture teaching rather than technology delivered teaching while adult learners react positively to technology delivered teaching. Other research (Lucini, 1998) also addressed the issue of student types and best working technologies in class. Researchers exploring the relationships

between curriculum areas and technology (Bissell & Simpson, 1993; Ferretti & Okolo, 1997; Newbold, 1993; Webster, 1990; Weir, 1992) also reported that adult students in language arts and social studies tend to have less computer literacy knowledge and less computer oriented task solving than students in mathematics and science in colleges and universities. This is intuitively understandable that technology and computer has been developed along with science, logic, and mathematics.

Learning Styles

Research shows that student motivation and performance improve when instruction is adapted to student learning preferences and styles (Felder & Henriques, 1995). Learning styles and how they are related to effective learning are of emerging significance in education (Brown, 1991). Many learning style theories have been proposed over the past 30 years that were designed for diversified learners to improve their learning performance. These models include the Theory of Multiple Intelligences (Gardner, 1993), the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), the Visual-Auditory-Kinesthetic Model (Dunn & Dunn, 1993), and the Visual, Aural, Read/write, and Kinesthetic (VARK) Learning Styles Inventory (Fleming, 1987).

The theory of multiple intelligences suggests that each individual has a number of forms of intelligence in varying degrees (Gardner, 1993). Gardner proposed seven forms of intelligence: linguistic, musical, logical-mathematical, spatial, body-kinesthetic, intrapersonal, and interpersonal. He later added naturalistic intelligence. The implication of the theory is that learning and instruction should not focus on only one particular intelligence. Furthermore, he stated that assessment of abilities should measure all forms of intelligence instead of just linguistic and logical-mathematical. Gardner's multiple intelligence theory challenged

traditional beliefs in the fields of education and cognitive science. Multiple intelligence theory has served as a supporting point for a reconsideration of the traditional education of the last century. However, Hirsch (1988) argued that multiple intelligence theory did not encourage educators to teach core knowledge. Gottfredson (1997) pointed out that multiple intelligences are not well defined and the theory is culturally embedded.

Kolb (1976) found individual differences in perceiving and processing information. He identified four different learning style types: Converger, Diverger, Assimilator, and Accommodator. He designed the Learning Style Inventory (LSI) to measure an individual's strengths and weaknesses as a learner (Kolb). The Myers-Briggs Type Indicator has become one of the most widely used instruments in the assessment of individual differences (Myers & McCaulley, 1985). It has been used for a wide range of objectives, including conflict management, personnel management, interpersonal communication, and organizational development. Bolz (1977) did not think that personality typology could conform to categorization. Mendelsohn, Weiss, and Feimer (1982) stated that, "There does not seem to be any typology in personality research that is demonstrably more than a simplifying way of talking about complex, continuous data" (p. 1157). It was found that Myers-Briggs Type Indicator failed to accurately reflect the underlying psychological attributes (O'Brien-Palmer, 1997). Furthermore, Curry (1990) suggested that this theory had three pervasive problems: inconsistency in definition, lacking of examination of subject matter, and weakness in validity and reliability of measurements. The reason why it is popular in education, business, and industry is that it provides a convenient way to explain the complexities of individual personality and some of the mysteries of interpersonal relationships (Chase & Chase, 1993).

The multisensory approach can reinforce learners' use of their less developed senses (Grinder, 1989). Learners use the senses of seeing, hearing, movement, and touch to process in one or several channels. Visual, auditory, and kinesthetic learning styles describe learner's preferences. The model of learning styles created by Dunn and Dunn (1993) comprised five major stimuli influencing the learning: environmental, emotional, sociological, physical, and psychological. Buell and Buell (1987) found in adult education that matching auditory, visual, and tactile preferences resulted in significant positive achievements. Studies on younger learners revealed the same result (Jonassen & Grabowski, 1993).

The VARK learning style inventory was initially developed by Fleming in 1987. VARK is an acronym made from the initial letters of four sensory modal preferences: Visual, Aural, Read/Write, and Kinesthetic. It assumed that modal preferences were used by people when they were taking in or giving out information. It was the first to systematically present a series of questions with help-sheets for students, teachers, and employees to use in their own ways. It is advisory rather than diagnostic and predictive. Fleming (1995) stated that the questionnaire could alert students and teachers to the different approaches to learning. It also supports students who have been having difficulties with their studies and teachers who would like to develop additional learning strategies for their classrooms. The inventory is widely used in educational institutions around the world and has received high acclaim from students and professors for its powerful application in learning (Fleming & Mills, 1992).

VARK learning style inventory has the following elements (Fleming, 2002a, The VARK Categories, para. 2):

Visual (V): This learning style preference is characterized by information drawing in charts, graphs, flow charts, and symbolic representations to present words. Most learners fall into this learning style category.

Aural (A): This learning style mode has a preference for aural information. Learners with this mode learn best from lectures, tutorials, tapes, and talking with peer learners.

Read/write (R): This learning style preference is for displayed information. Many researchers and instructors have a strong preference for written texts. This is the second biggest group of learning style after V(visual) learning style.

Kinesthetic (K): This category has fewer distributions than others among learners. This mode is the perceptual preference where learning happens when it is related to the experience and practice or simulated reality. Although this experience may co-occur with other modalities, the key point is that the learner cannot be isolated from reality, “either through experience, example, practice or simulation” (Fleming & Mills, 1992, pp. 140-141).

VARK is not only an inventory to determine learners’ preferences but to help learners and instructors select the best fitting learning strategies in the learning process and evaluation as well. VARK preferences can be used to help learners develop additional and effective study skills to take in information, study information for maximum learning, and study for performing well on an examination.

Different learning styles are suggested using different strategies in learning (Fleming, 2002, VARK Help Sheet, para. 4):

Visual study strategies (V): Learners take advantage of instructors’ gestures and picturesque language to take in information. Pictures, videos, posters, slides, flow charts, underlining, different colors, highlighters, textbooks with pictures and diagrams, graphs, symbols, and white spacing are all helpful in the learning process. For testing

and evaluation, learners are encouraged to draw things, use diagrams, and recall pictures to help reinforce knowledge chunk.

Aural study strategies (A): Learners learn best by attending lectures, attending tutorials, discussing topics with other learners, discussing topics with instructors, explaining new ideas to other people, using a tape recorder, remembering the interesting examples, stories, jokes..., describing the overheads, pictures and other visuals to somebody who was not there, and leaving spaces in notes for later recall and filling. They need to expand notes by talking with others and collecting notes from the textbook because they prefer to listen. These learners might put summarized notes onto tapes and listen to them, ask others to hear their understanding of a topic, read summarized notes aloud, and explain notes to another person with aural learning style. They have good outcomes if they can talk with the examiner, listen to their own voices and write them down, spend time in quiet places recalling the ideas, practice writing answers to old exam questions, and speak the answers.

Read and Write study strategies(R/W): This preference is characterized by using lists, headings, dictionaries, glossaries, definitions, handouts, textbooks, readings, lecture notes, words having lots of information, essays, and manuals. They learn best by writing out the words again and again, reading notes silently again and again, rewriting the ideas and principles into other words, organizing any diagrams, graphs ... into statements, e.g. "The trend is...", turning reactions, actions, diagrams, charts and flows into words, and imagining lists arranged in multiple choice questions and distinguishing from each other. They do well in exam and evaluation when they write exam answers, practice with multiple choice questions, write paragraphs, beginnings and endings, write lists (a,b,c,d,1,2,3,4), and arrange words into hierarchies and points.

Kinesthetic study strategies (K): This preference learners learn well when they take advantages of all senses - sight, touch, taste, smell, hearing..., laboratories, field trips, field tours, examples of principles, instructors who give real-life examples, applications, hands-on approaches, trial and error, collections of rock types, plants, shells, grasses..., exhibits, samples, photographs..., recipes - solutions to problems, and previous exam papers. They are suggested to remember the real things that happened, put plenty of examples into summary, use case studies and applications to help with principles and abstract concepts, talk about notes with another kinesthetic person, use pictures and photographs that illustrate an idea, go back to the laboratory or lab manual, recall the experiments, field trip..., write practice answers, paragraphs..., and role play the exam.

Learning is not only about subject matter but also about cognitive processes (Keefe, 1991). Gregorc and Ward (1977) stated that if individual needs were addressed, learning outcomes would be greatly improved. Instructors must learn the differences that exist among

learners rather than assume that all learners learn the same way (Keefe). External information is processed through the network of perceptual modalities. Most students learn with some of their specific modalities (Reiff, 1992). Stronck (1980) found that the kinesthetic/tactual learners try things out, touch, feel, and manipulate; kinesthetic/tactual learners express their feelings physically; auditory learners talk about what to do when they learn and respond well to lecture and discussion; and visual learners learn by seeing. The instruction should be geared to the proper modalities of different learners. If not, some learners will begin to lose confidence (Reiff). Planning learning-style-based instruction involves diagnosing individual learning styles, profiling group preferences, determining group strengths and weaknesses, examining subject contents; analyzing students' prior knowledge, remediating weak points, assessing current instructions and modifying the learning environment, and developing personalized learning experiences (Keefe). A better understanding of learning style would help instructors and the learners (Reiff).

Integrating Technology into Classroom

With the fast development of computing technology, new ways of information accessing, representing, processing, and communicating have appeared in higher education (Kozma, 1991, 1994). Means and Olson (1997) demonstrated that there was a strong association between new technologies and changes in curriculum and instruction. The use of instructional technology has become a part of an instructional shift toward constructivist approaches to teaching and learning (McGhee & Kozma, 2001). Learning has moved beyond rote memorization, instead, learning has become a process of knowledge recreation (Scardamalia & Bereiter, 1994). Technology plays an important role in this change. Newby, Stepich, Lehman, and Russell

(1996) suggested that people need to reconstruct their own knowledge. It is technology that will provide the learning opportunities that emphasize reflection and information exchange with other learners in the construction of knowledge (Rodriguez, 1996). “Significant and mounting evidence shows that technology improves students' mastery of basic skills, test scores, writing, and engagement in school” (Dwyer, 1996, p. 24). Technology can also help meet the needs of all types of learners and give instructors solutions to the issue of learning styles by providing different instruction to enhance the new learning environments (Kozma & Croninger, 1992).

Technology is generally viewed as a supporting means to increase student involvement with complex and authentic tasks within classrooms (Sheingold, 1990). Instructors are faced with a lot of challenges under this new environment. Ginsburg (1998) proposed four ways to integrate technology into learning experience: technology as curriculum, delivery mechanism, complement to instruction, and instructional tool. Morton (1996) suggested that technology integration is not simply seeing the computer as an instructional tool. Technology can be integrated when it is used in a supportive and immersing manner in curriculum objectives and engaging students in active learning. It is not a separate activity but a part of the daily activities taking place in the classroom (Dias, 1999). Technology integration happens in a particular type of learning environment in learner-centered classrooms according to Jonassen (1995). He identified seven types of environment that make learning meaningful: a.) active: learners participate in mindful processing of information, b.) constructive: learners integrate new ideas into their prior knowledge to make sense or meaning, c.) collaborative: learners work in learning communities in which each member contributes to the group's goals, d.) intentional: learners are trying to achieve cognitive goals and objectives, e.) conversational: learners benefit from being part of knowledge-building communities in which learners exchange ideas and build on each

other's knowledge, f.) contextualized: learners encounter learning assignments that are situated in real-world tasks or simulated through problem-based activities, and g.) reflective: learners reflect on the processes completed and the decisions made during the learning activity and articulate what they have learned.

For the last few years, instructors have been struggling with new technologies and their integration (Dias, 1999). Rogers' (1995) diffusion of innovation theory explains the slow process of innovations and new strategies. Diffusion is "the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas" (Rogers, p. 5). To integrate technology into classroom instruction and learning environment is not an easy job. According to Sandholtz et al. (1997), technology integration includes five stages: entry, adoption, adaptation, appropriation, and invention. Each stage has its own change patterns and support requirements. Integrating technology is a growth process. Technical support and training are necessary at all stages to help integrate technology into instruction and new learning environment (Dwyer, Ringstaff, & Sandholtz, 1990; Sandholtz, Ringstaff & Dwyer).

With more research on learning in multimedia environments, there will be a growing understanding of how learning with media takes place (Daniels, 1996; Kozma, 1991). The continuous growth of technology will reshape the learning environments. The current development of wireless technology and virtual technology suggests a new wave of technology integration. However, effective integration of technology with the learning environment and instruction in class must be explored further (Heinich, Molenda, & Russell, 1996).

Classroom Environment Theories

Historically, classroom environment studies are based on Levin's (1936) and Murray's (1938) research on classroom instruction. Levin asserted that an individual's behavior could be influenced by various factors such as character, motivation, cognitive structure, and ways of perceiving within the environment. Murray developed the needs-press theory, which is a description of the relationship between individual needs and environmental press. According to systems theory (Miller, 1971), a classroom is an open system that "is working to achieve certain goals and that has a large amount of internal interactions and interdependence" (Schmuck & Schmuck, 1989, p. 26). The classroom influences and is influenced by its members and surrounding environment.

The classroom is a shared perception of students and teachers (Moos, 1980). It can be useful in predicting the learner's academic achievement, growth, and school satisfaction. Ransinki (1990) argued that classroom environment should facilitate learning. A positive classroom environment should be a supportive learning unit. However, as the research noted, adult learning environments are different from those of traditional learners (Knowles, 1983; Li, 1999).

Studies on adult learning found that real-world-related learning environments could enhance learning (Knowles, 1983). Knowles' theory of andragogy has four assumptions on adult learners: adults tend to be self-directed; adults have a rich reservoir of experience that can serve as a resource for learning; adults tend to have a life, task- or problem centered orientation to learning; and adults are generally motivated by internal factor as opposed to external subject matter orientation (Knowles). Brookfield (1986) further developed approaches to facilitate adult learning. The central principle was that the facilitator should be nurturing, encourage

self-directing behaviors among learners, and develop critical thinking and collaborative instruction (Glickman, Gordon, & Ross-Gordon, 1995). Some studies show that a certain number of variables, such as learner's characteristics and institutional environment, can influence learner-centered learning (Pratt, 1988). Imel (1994) stated that learners' physical and psychological needs should meet to create supportive learning. An ideal adult learning climate fosters the sense of support and partnership.

Classroom environment has been studied extensively in the past 30 years (Li, 1999). Predominantly, two inventories are used in these assessments: Moos' Classroom Environment Scale and Darkenwald's Adult Classroom Environment Scale. Moos' research contributed significantly to the conceptual framework of classroom environment, in that his observations on social environment of classroom revealed that the socio-ecological system influenced both instructors' behavior and learners' behavior (Darkenwald, 1987). Moos (1980) identified three theoretical domains in classroom environment: relationship domain, personal growth or goal-orientation domain, and system-maintenance and change domain. His research on classroom environment is supported by research on learners' achievements and instructional methods (Brown, 1991). Darkenwald's adult classroom environment scale was designed to assess the adult classroom social environment (1987). Based on the previous research done in classroom environment (Levin, 1936; Moos; Murray, 1938), he extracted seven dimensions in classroom social environment of adult learners: involvement, affiliation, teacher's support, task orientation, personal goal attainment, organization and clarity, and student influence (Darkenwald, 1989).

CHAPTER 3

METHODS

Overview

This chapter includes a description of the research design, the population, the sampling procedure and sample, the survey instrument, the validity and reliability, the pilot study, procedures for data collection, and analysis of data.

Research Design

This study investigated students' perceptions of multimedia classrooms at ETSU regarding learning achievements, instructional technologies, learning styles, and instructors' methods. A quantitative approach was employed from a descriptive and comparative perspective. The study was conducted using survey methodology. Questionnaires and surveys are often used in educational research for collecting information that is not always directly observable (Gall, Borg, & Gall, 1996). Surveys in multimedia classrooms were used to collect data on students' perceptions of multimedia classrooms at ETSU in terms of learning achievements, instructors' methods, instructional technologies, and general perceptions by age, gender, and discipline of study at ETSU. The VARK (Fleming, 2002a) learning style survey was employed to calculate students' learning styles in multimedia classrooms and traditional classrooms.

A pilot study was conducted to determine the validity and reliability of the survey instrument before the final survey was administered. One group of participants in the pilot study was doctoral students in a research class offered in the Department of Educational

Leadership and Policy Analysis in a traditional classroom. Another group of participants in the pilot study was enrolled in a course offered in a multimedia classroom from the Department of Curriculum and Instruction. Each participant was asked to record the time that it took to complete the survey and to provide comments and suggestions on the format and contents of the survey. The feedback was used to modify survey items and formats. Additionally, four experts and researchers in instructional technology and multimedia classrooms from the College of Education and the Office of Information Technology at ETSU critiqued the survey's format and contents. After the pilot study and examination of feedback from the surveys, some items were adjusted and two distinct surveys in multimedia classrooms and traditional classroom were finalized. Copies of final surveys for multimedia and traditional classrooms are included in Appendix A and Appendix B. Surveys used in the multimedia and traditional classrooms in the pilot study are also included in Appendix C and Appendix D.

Population

East Tennessee State University is a public institution of higher learning with a student population of approximately 11,000. The population for this study was ETSU students enrolled in multimedia classes or traditional classes with multimedia counterparts on main campus during spring semester 2002. ETSU students take classes in traditional classrooms as well as multimedia classrooms. There were 5 multimedia classrooms on the main campus at ETSU: Sam Wilson 315, Rogers Stout 101, Wilson Wallis 205, Warf-Pickel 209A, and Lamb 206. The Office of Institutional Effectiveness and Development at ETSU estimated that there are about 300 traditional classrooms at ETSU.

Sample

The sample for this study was selected using purposeful sampling. ETSU had 5 multimedia classrooms on the main campus in which 43 classes were taught spring semester 2002. In this research, in order to find the differences in students' perceptions of multimedia classrooms and traditional classrooms, only students enrolled in courses taught in both formats with the same syllabus, later referred as the same teaching contents in this study, were surveyed. Therefore, two groups, multimedia classroom and traditional classroom, were created for group comparison and data analysis to determine the differences among students in multimedia classrooms and traditional classrooms regarding technologies, instructors' methods, learning achievements, and learning styles. Among these classes, ITV classes and the same section with different titles were excluded because these classes were delivered differently in the ways they were in multimedia classrooms and traditional classrooms. For example, some were for independent study or special cohort. Only courses meeting the criterion were selected. The following courses, taught in both multimedia classrooms and traditional classrooms, were selected: ENTC 4060 (Project Scheduling), sections 001 and 002; ECON 2080 (Quantitative Methods for Business II), sections 001, 002, 003, and 201; ACCT 2010 (Principles of Accounting I), sections 001, 002, 003, 004, 005, and 201; MGMT 3100 (Production/Operation Management), sections 001, 002 and 201; and MGMT 3220 (Management of Information System), sections 003 and 201 (for detailed listings, see Appendix E). Using students enrolled in those classes in both formats yielded a population of 528.

In order for courses to be chosen for this study, they had to be delivered in both multimedia classrooms and traditional classrooms. Some were delivered in both multimedia classrooms and traditional classrooms by the same instructor. All of the courses that met these

criteria were offered in the School of Business and the College of Applied Science and Technology at ETSU.

Research Questions and Related Hypotheses

Research questions and hypotheses were based on the focus of this study. Research question 1 compared the differences in students' perceptions of technology satisfaction in multimedia classrooms and traditional classrooms. Technologies in multimedia classrooms and traditional classrooms were different. No null hypothesis was established for the testing of statistically significant difference. However, group means and standard deviations were calculated determining students' degree of technology satisfaction to examine the differences in students' perceptions of technology satisfaction in their corresponding classrooms. Research question 2 addressed students' perceptions of learning achievements in multimedia classrooms. Research question 3 investigated students' perceptions of instructors' methods in class. Research question 4 focused on the students' general perceptions of multimedia classrooms according to gender, age, and discipline of study. Research question 5 examined students' differences in their different backgrounds of prior computer knowledge and use. Research question 6 addressed students' general perceptions of multimedia classrooms as perceived by students with different learning styles. The research questions and their related null hypothesis are presented below.

1. Are students who take classes in multimedia classrooms satisfied with the technology provided, as compared with students who take classes in traditional classrooms?
2. Do students who take classes in multimedia classrooms perceive their learning achievements differently than do those who take classes in traditional classrooms?

H0: In the population, there is no difference in students' perceptions of learning achievements as perceived by students who take classes in multimedia classrooms, as compared with those who take classes in traditional classrooms.

3. Do students who take classes in multimedia classrooms perceive the instructors' methods differently than do those who take classes in traditional classrooms?

H0: In the population, there is no difference in the perception of instructors' methods as perceived by students who take classes in multimedia classrooms, as compared with students who take classes in traditional classrooms.

4. Are there differences in the general perceptions of multimedia classrooms between students who take classes in multimedia classrooms and those who take classes in traditional classrooms grouped by gender, discipline of study, and age?

H01: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who take classes in multimedia classrooms and those who take classes in traditional classrooms grouped by gender.

H02: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who take classes in multimedia classrooms and those who take classes in traditional classrooms grouped by discipline of study.

H03: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who take classes in

multimedia classrooms and those who take classes in traditional classrooms grouped by age.

5. Is there difference in students' prior computer knowledge and use between students who take classes in multimedia classrooms and those who take classes in traditional classrooms?

H0: In the population, there is no difference in the prior computer knowledge and use between students who take classes in multimedia classrooms and students who take classes in traditional classrooms.

6. Is there difference in students' general perceptions of multimedia classrooms between students with different learning styles taking classes in multimedia classrooms and those with different learning styles taking classes in traditional classrooms?

H0: In the population, there is no difference in students' general perceptions of multimedia classrooms as perceived by students with different learning styles taking classes in multimedia classrooms and those with different learning styles taking classes in traditional classrooms.

Instrumentation

Two parallel surveys were developed to obtain students' perceptions of multimedia classrooms and traditional classrooms regarding learning achievements, instructors' methods, and instructional technologies employed in instruction using the multimedia classroom and traditional classroom. The two different surveys were administered to all students selected for

the study. For students in multimedia classrooms, the survey instrument used was composed of two parts: VARK and perceptions survey for multimedia classrooms. For students in traditional classrooms, the survey instrument used was composed of two parts as well: VARK and perceptions survey for traditional classrooms. Copies of the survey instruments were included in the appendices (see Appendix A and Appendix B).

The VARK learning style inventory questionnaire (Fleming, 2002a) was employed to determine the students' learning styles. VARK stands for visual, aural, read/write, and kinesthetic learning styles. The instrument is made up of 13 items that indicate the learners' learning preferences. Choices from 'a' through 'd' represent V(visual), A(ural), R(ead/Write), and K(inesthetic) learning styles, respectively. Learning styles were measured on a different scoring sheet where the frequencies of V, A, R, and K were calculated (see Appendix M). Consequently, students' learning styles were calculated and determined by the most frequent distribution of one of four scores based on their different distributions.

The second part of the survey, the perceptions inventory, was based on the guidelines by Gall et al. (1996). A Likert-type scale was used to measure the perceptions of students regarding instructional technologies, instructors' methods, and learning achievements. Each item had 5 possible responses: a): strongly agree, b): agree, c): neutral, d): disagree, and e): strongly disagree. Values ranging from 5 (a) to 1 (e) were assigned. Demographic data on academic standing, gender, age, and discipline of study were also collected for use in the analysis of the data.

The values of each item were used to calculate values of 5 subscales of Technology Satisfaction, Learning Achievements, Instructors' Methods, Prior Computer Knowledge and Use, and General Perceptions, created to hold summative values of their related question items for

data analysis, as a result of summation. Figure 1 is a presentation of the 5 subscales in multimedia classrooms and traditional classrooms.

The multimedia classroom perceptions survey contained 23 questions focused on instructional technologies, instructors' methods, learning achievements, and general perceptions, including one open-ended question, Question 24, intended to enable students to provide other data not covered by the previous questions. Questions 1 through 4 were used to collect demographic data.

The traditional classroom perceptions survey contained 22 questions focused on instructional technologies, instructors' methods, learning achievements, and general perceptions, including one open-ended question, Question 23, intended to enable students to provide other data not covered by the previous questions. Questions 1 through 4 were used to collect demographic data.

The VARK survey was part of both questionnaires. The 13 questions were used to obtain students' learning styles: V, A, R, K representing visual, aural, read/write, and kinesthetic learning styles respectively.

The differences between the two surveys used are directly related to the fact that the two types of classrooms are equipped differently. Therefore, research question on technologies provided in classrooms were designed differently according to their individual characteristics. The rest of research questions had the same content items.

Students in multimedia classrooms took multimedia classroom survey questions, whereas students in traditional classrooms took traditional classroom survey questions. Copies of the two survey instruments are included in the Appendices (See Appendix A and B). Detailed explanation of calculations is presented in the Data Analysis section of this chapter.

Figure 1:

Five Subscales in Multimedia Classrooms and Traditional Classrooms

| Subscale | Classrooms | Number | Items |
|--------------------------------|-------------|--------|---|
| Technology Satisfaction | Multimedia | 5—9 | Internet connection on the desk, Smartboard system, acoustics, video conferencing equipment and projector, PC, Mac, Cassette player, VCR player, VHS, DVD player, touch panel monitor |
| | Traditional | 5—8 | Blackboard/whiteboard, acoustics, overhead and its related equipments, audio and video equipments |
| Learning Achievements | Multimedia | 10—12 | Perception of learning outcomes in multimedia classroom, perception of learning enhancement in multimedia classroom, expectation of learning outcome in multimedia classroom |
| | Traditional | 9—11 | Preference of instructor's technology usage in classroom, perception of learning enhancement using technology in classroom, expectation of learning outcome in multimedia classroom |
| Instructors' Methods | Multimedia | 13—17 | Content delivery by technology, organization, individual needs and interests, individual's participation and interaction, interest retention of learners |
| | Traditional | 12—16 | Content delivery by technology, organization, individual needs and interests, individual's participation and interaction, interest retention of learners |
| Prior Computer Knowledge & Use | Multimedia | 18—20 | Computer skills, computer usage, access to computers |
| | Traditional | 17—19 | Computer skills, computer usage, access to computers |
| General Perceptions | Multimedia | 21—23 | Perception of Technology Access Fee, preference on instructor's using technology in class, choice of taking class in multimedia classrooms in future. |
| | Traditional | 20—22 | Perception of Technology Access Fee, preference on instructor's using technology in class, choice of taking class in multimedia classrooms in future |

Pilot surveys were completed by two groups as described above using the instruments. Their feedback was used to modify the survey. Detailed procedures are described in the Pilot Study section of this chapter. The final formats of surveys were included in the appendices (See Appendix A and B).

Validity and Reliability

Content Validity

VARK's content validity is established on the four conceptual domains of learning preferences of learners: visual, aural, read/write, and kinesthetic. Fleming stated that VARK "is not a simple semantic choice" (personal communication, January 2002). According to Fleming, other learning style inventories are biased to cultural and linguistic interpretation because they are based upon the meanings of words and choices (personal communication, January 2002). Students from Lincoln University, New Zealand reported that VARK categories can match their learning preferences and they employ the learning strategies VARK recommended to enhance their learning (Fleming, 1995). Those who had a strong Read/Write preference chose to use writing and reading strategies and those who had strong aural preference chose to use talking and discussion with others (Fleming, personal communication, January 2002).

Predictive Validity

Fleming (personal communication, January 2002) stated that "VARK does not have predictive validity because it was designed as an advisory tool for student and faculty development." VARK was not treated as a diagnostic or predictive tool. However, he reported that students using VARK can select the proper study methods to succeed in their

learning pursuit based on the VARK's recommendations. When students and faculty are matched in their VARK preferences, the learning is more likely to be facilitated. One of findings of VARK is that, "While students and faculty have a low preference for aural learning situations, the lecture was still the dominant instructional mode, faculty and student learning preferences differ, students can make the best of a given learning situation by employing study strategies based on their preferred modes" (Fleming, personal communication, January 2002). The use of VARK can provide a stimulant to faculty discussion about learning and students' critical thinking about the learning process. Meanwhile VARK also offers students strategies which enables them to study to the best outcomes based on their own learning preferences.

Reliability

The following statements were made about VARK's reliability by the author.

The questionnaire was not designed to be reliable in terms of consistency of scores over a long period of time. Instead, the questionnaire was designed to provide students with effective learning strategies to use on their learning preference(s). Over the course of a student's career it is likely that some modes will become strengthened, some will dominate and others may be under utilized, therefore it is difficult to say that a student taking this test each year for twelve consecutive years will obtain similar scores each year. On the other hand if a test-retest occurs within a few weeks it is likely that the scores received will be similar. (N.D. Fleming, personal communication, January 2002)

Longitudinal studies of individuals are needed to test the reliability of VARK (Fleming, personal communication, January 2002). Fleming hypothesized that individual VARK preferences would change with age and experience. VARK preferences are dynamic rather than static in the long term. Individuals in the long term might have more than one learning preference and with age and experience difference. With increased age and experience, learners learn to adapt to various modes to multiple preferences.

Fleming (personal communication, January 2002) analyzed the 1999 data in the website (n=4,704) to examine whether the 4 learning styles, Visual, Aural, Read/Write, and Kinesthetic, were independent. The correlation testing found no strong correlation among the categories across all data. Principal components analysis showed that there are no strong correlations between the variables or combinations of the variables where V, A, and R take 35%, 31%, and 18% of the total variation respectively. V, A, R, and K are relatively independent and they all account for the total variance. Canonical variate analysis indicates the independence of VARK variables. Confidence region in this analysis shows no interactions among these four variables.

Perception Survey Reliability

The reliability of the second part of the instrument, the perception survey, was measured using Cronbach's Coefficient Alpha. Hatcher and Stepanski (1994) suggested that a rule of thumb is that a Cronbach's Alpha score of .70 could be accepted as an indicator of reliability. The reliability of the instruments used in this research was based on the value of 0.70. The results of the Cronbach's Coefficient Alpha for the multimedia classroom survey and traditional classroom survey were calculated after the pilot survey. The value of Cronbach's Coefficient Alpha in the pilot survey proved to be reliable for both the multimedia classrooms survey ($\alpha=0.89$) and traditional classrooms survey ($\alpha=0.76$). Furthermore, the results of the Cronbach's Coefficient Alpha for the multimedia classroom survey ($\alpha=0.85$) and traditional classroom survey ($\alpha=0.75$) were also calculated after the final survey. They proved reliable based on the Cronbach's Coefficient Alpha value of 0.70. Therefore, this instrument was accepted for this research. Extra alphas of specific subscales in this study for both pilot survey and final survey in multimedia classrooms and traditional classrooms were reported in Table 1.

Table 1

Cronbach Alphas for Surveys in Multimedia Classroom and Traditional Classroom: Pilot Survey and Final Survey

| Subscale | Cronbach Alphas | | | |
|--------------------------------|----------------------|-----------------------|----------------------|-----------------------|
| | Pilot Survey | | Final Survey | |
| | Multimedia Classroom | Traditional Classroom | Multimedia Classroom | Traditional Classroom |
| Technology satisfaction | .86 | .86 | .73 | .69 |
| Learning Achievements | .75 | .76 | .92 | .80 |
| Instructors' Methods | .91 | .79 | .83 | .85 |
| Prior Computer Knowledge & Use | .80 | .79 | .84 | .81 |
| General Perceptions | .82 | .79 | .73 | .71 |
| Overall | .89 | .76 | .85 | .75 |

Pilot Study

A pilot study was conducted before the final survey. One group of participants in the pilot study was doctoral students in a research class from the Department of Educational Leadership and Policy Analysis in a traditional classroom. Another group of participants in pilot study was one class in a multimedia classroom from the Department of Curriculum and Instruction. Meanwhile, four experts and researchers in instructional technology and multimedia classrooms from the College of Educational and the Office of Information Technology at ETSU were invited to critique the surveys. A letter (see Appendix F) was distributed together with the survey (see Appendix C and Appendix D) to the pilot study participants. Instructions in the letter asked participants to record the length of time needed to

complete the survey and their critiques on the survey on another piece of formatted paper provided (see Appendix G). Their critiques, suggestions, and comments were taken into the final modification and development of the surveys. Copyright information was added to the final survey and the numbering problem was corrected. Survey item 18 for multimedia classroom and survey item 15 for traditional classroom were modified. Fifteen surveys were sent out in traditional classroom and 11 (73.3%) usable surveys were collected. Fifteen surveys were sent out in multimedia classroom and 8 (53.3%) usable surveys were collected.

Data Collection

After this study was approved by ETSU's Institutional Review Board (see Appendix N), data collection began. The survey was conducted during April and May 2002. First, a letter (see Appendix H) was sent to the departmental chairs of the departments offering the 23 classes selected for the study. The letter asked their permission and cooperation with this study. After obtaining their permission to conduct the survey, another letter (see Appendix I) was sent to the instructors teaching these classes to get their permission and cooperation in their classes. Follow-ups were also used to get more students participation. Last, after the pilot test, the schedule for survey was determined to conduct the survey based on the class schedule. Survey administration was conducted by the instructors or the researcher of this study. Final surveys with students consent form (see Appendix J) were sent out to classes selected. Before the survey, survey administrators were required to ask students to read the contents on the consent form and understood all rules set by IRB of ETSU. Students were asked to sign on the consent form before they took the survey. All surveys in multimedia classrooms and traditional classrooms were finally collected by the researcher.

Data Analysis

The data analysis included the following: analysis to determine the differences in satisfaction with new technologies in multimedia classrooms and in traditional classrooms; analysis to determine the differences in learning achievements in multimedia classrooms and in traditional classrooms; analysis to determine the differences in perception of instructors' methods in multimedia classrooms and in traditional classrooms; analysis to determine the differences in general perceptions of multimedia classrooms in terms of different groups of gender, discipline of study, and age; analysis to determine the differences in prior computer knowledge and use; and analysis to determine the differences in general perceptions of multimedia classrooms regarding learning styles. All comparative analyses were completed between two groups: multimedia classrooms and traditional classrooms.

Before data analysis, surveys in multimedia classrooms were labeled from '1' to '187' and they were put in envelopes marked by 'MC' representing multimedia classrooms; surveys in traditional classrooms were labeled from '1' to '110' and they were put in envelopes marked by 'TC' representing traditional classrooms. Survey data in multimedia classrooms and traditional classrooms were typed into 2 different tables using Microsoft Office Excel. These 2 tables were imported into SAS (v.8.02) for further data analysis.

Answers from a: 'Strongly Agree', b: 'Agree', c: 'Neutral', d: 'Disagree', and e: 'Strongly Disagree', in each question item were assigned values from 5 to 1 for SAS (v.8.02) analysis. Five subscales, Technology Satisfaction: questions 5 through 9 in multimedia classrooms and 5 through 8 in traditional classrooms; Learning Achievements: questions 10 through 12 in multimedia classrooms and 9 through 11 in traditional classrooms; Instructors'

Methods: questions 13 through 17 in multimedia classrooms and 12 through 16 in traditional classrooms; Prior Computer Knowledge and Use: questions 18 through 20 in multimedia classrooms and 17 through 19 in traditional classrooms; and General Perceptions: questions 21 through 23 in multimedia classrooms and 20 through 22 in traditional classrooms, were calculated as a result of summation by the values of their question items mapped to research questions.

The responses of students in both the traditional and the multimedia classrooms were analyzed with nonparametric Mann-Whitney U test and Kruskal-Wallis test using Statistical Analysis System (SAS v.8.02) software. Gall et al. (1996) recommended that “The Mann-Whitney U test can be used to determine whether the distributions of scores of two independent samples differ significantly from each other” (p. 402) and, “If more than two groups of subjects are to be compared, a nonparametric one way analysis of variance (the Kruskal-Wallis test) can be used” (p. 403). Mann-Whitney U test and Kruskal-Wallis test were chosen in this study because the distributions of students in multimedia classrooms and traditional classrooms were different and between and within-groups comparisons in multimedia classrooms and traditional classrooms were needed. Chi-square test was also used for extra data analysis of the relationship between students’ learning styles and different classrooms. All statistical tests were two-tailed and conducted using a 0.05 level of significance ($\alpha=0.05$). Further details for data analysis and conclusions were presented in Chapter 4.

Summary

The methodology and procedures used in this study were presented in this chapter. It presented the basis and methodological framework for the determination of the population, the procedures used to develop and refine the survey instrument, and the procedures and tools used to collect and analyze data.

CHAPTER 4

RESULTS

Introduction

The analyses that are presented here are based on data collected from 297 (56.3%) valid surveys out of a population of 528 students in multimedia classrooms and traditional classrooms identified by the same teaching contents or the same teaching contents with the same instructor delivered in both multimedia classrooms and traditional classrooms during spring semester 2002 at East Tennessee State University. Of these students, 187 (67.0%) out of 279 were in multimedia classrooms and 110 (44.2%) out of 249 in traditional classrooms. The lower response rate in the traditional classroom survey was influenced by the fact that the instructor of three of the traditional classrooms had students turn in the survey after class. The return rate for these students was lower than other classes (where the survey was completed during class) even after numerous requests were made to students to return the surveys. The overall return rate of 56.3% was accepted as being sufficient for the purpose of this study.

Courses selected in multimedia classrooms and traditional classrooms were: ENTC 4060 (Project Scheduling), sections 001 and 002; ECON 2080 (Quantitative Methods for Business II), sections 001, 002, 003, and 201; ACCT 2010 (Principles of Accounting I), sections 001, 002, 003, 004, 005, and 201; MGMT 3100 (Production/Operation Management), sections 001, 002 and 201; and MGMT 3220 (Management of Information System), sections 003 and 201. Most students were in the School of Business and the College of Applied Science and Technology as the result of sampling method. A limitation related to this was discussed in Chapter 3.

Twelve course sections (71.0%) out of 17 sections listed were taught by the same instructor with the same teaching contents (syllabus) in both multimedia classrooms and traditional classrooms. The rest of 5 course sections (29.0%) listed here were taught by different instructors with the

same teaching contents (syllabus) in multimedia classrooms and traditional classrooms. The classes included in the study with enrollments and instructors listed are in Appendix E.

After data analysis, it became apparent that there was a wide variation in the number of students for each discipline represented (range = 1 to 84) (see Appendix O). For the purpose of this study, disciplines of study were collapsed into 5 categories: Arts and Sciences, Applied Science and Technology, Business, Education, and Public and Allied Health. These categories reflect the college structure at East Tennessee State University. Arts and Sciences included English, Spanish, Psychology, History, and Undeclared. Applied Science and Technology included Industrial Technology, Construction Technology, Interior Merchandising, and Digital Media. Business included Accounting, Business Management, Human Resources Management, Marketing, Finance, and Economics. Education included Education and Physical Education. Public and Allied Health included Health and Medicine.

The survey solicited students' perceptions of multimedia classrooms regarding their learning achievements, instructor's instructional methods in class, and instructional technologies in multimedia classrooms at East Tennessee State University during spring semester 2002. Also, the VARK learning style survey was used to determine the students' learning styles for further analysis on the differences in general perceptions as perceived by students with different learning styles in multimedia classrooms and traditional classrooms. Additionally, students were asked to provide demographic information and write in their extra comments on multimedia classrooms in an open-ended question item.

Descriptive information regarding respondents' profiles is presented in the first part of this chapter. Data analyses of the research questions and hypotheses are presented in the

second part of the chapter. A summary of data analyses of the research questions and hypotheses are presented in the last part of the chapter.

Respondents

These students were almost evenly divided with regards to gender (52% were males and 48% were females). About 83% were juniors or seniors and only 2% were freshmen. Sixty-eight percent were traditional college age students. Few were found in the age group of over 40. About 80% were students from business and 12% were from Applied Science and Technology. Demographic characteristics are represented in Table 2.

Table 2

Frequency and Percentage of Students Grouped by Academic Standing, Gender, Age, and Discipline of Study

| Grouped by | | Frequency | Percentage |
|---------------------|------------------------------|-----------|------------|
| Academic Standing | Freshman | 5 | 2 |
| | Sophomore | 40 | 14 |
| | Junior | 117 | 39 |
| | Senior | 131 | 44 |
| | Graduate | 4 | 1 |
| Gender | Female | 142 | 48 |
| | Male | 155 | 52 |
| Age | 18-23 | 201 | 68 |
| | 24-30 | 56 | 19 |
| | 31-39 | 25 | 8 |
| | 40-49 | 14 | 5 |
| | 50-59 | 1 | 1 |
| | 60 over | 0 | 0 |
| Discipline of Study | Arts and Sciences | 16 | 5 |
| | Applied Science & Technology | 37 | 12 |
| | Business | 237 | 80 |
| | Education | 4 | 1 |
| | Public Health | 3 | 1 |

Respondents' learning styles were identified by using VARK survey with 13 questions. The choices in answers represent visual (V), aural (A), read/write (R), and kinesthetic (K)

learning styles separately. It was observed that the majority of students in both multimedia classrooms and traditional classroom had either visual or read/write learning styles with half predominantly visual learning style and about 35% read/write learning style. Kinesthetic learning style was far less identified among these students (8%). Among 187 students in multimedia classrooms, 47% were found to have visual learning styles and 37% were found to have read/write learning style; among 110 students in traditional classrooms, 55% were found to have visual learning style and 30% were found to have read/write learning style. Chi-square test, discussed in the Data Analyses section in this chapter, was conducted to examine whether there is a relationship between two different formats of classrooms and learners with different learning styles. It was found that there was no relationship between two different formats of classrooms and learners with different learning styles ($p=0.20$). The distribution of learning styles was not significantly different between multimedia classrooms and traditional classrooms. The distribution of VARK learning styles in multimedia classrooms and traditional classrooms is displayed in Table 3:

Table 3:

Distribution of VARK Learning Styles in Multimedia Classrooms and Traditional Classrooms

| Learning Style | Classroom | | | | | |
|----------------|------------|-----------|-------------|-----------|-----------|-----------|
| | Multimedia | | Traditional | | Total | |
| | Frequency | (Percent) | Frequency | (Percent) | Frequency | (Percent) |
| A(ural) | 26 | 8.75 | 12 | 4.40 | 38 | 12.79 |
| K(inesthetic) | 3 | 1.01 | 5 | 1.68 | 8 | 2.69 |
| Read/Write | 70 | 23.57 | 33 | 11.11 | 103 | 34.68 |
| V(visual) | 88 | 29.63 | 60 | 20.20 | 148 | 49.83 |
| Total | 187 | 62.96 | 110 | 37.04 | 297 | 100.00 |

Data Analyses

Six research questions guided this study and 7 derivative null hypotheses were tested using SAS (v.8.02). The research questions and their related hypotheses are examined in the following sequential order.

Research Question 1: Are students who take classes in multimedia classrooms satisfied with the technology provided, as compared with students who take classes in traditional classrooms?

Research Question 1 was analyzed to determine whether differences existed in students' satisfaction with the technology in multimedia classrooms as compared with traditional classrooms. The technologies in multimedia classrooms were internet connection on desk, Smartboard system, acoustics, video conferencing equipment and projector, PC, Mac, cassette player, VCR player, DVD player, and touch panel monitor. The technologies in traditional classrooms were blackboard or whiteboard, acoustics, presentation equipment, such as overhead projector, and audio and video equipment. Because technologies were different in both multimedia classrooms and traditional classrooms, the difference in Technology satisfaction cannot be compared by testing for statistically significant difference. However, technology satisfaction can be examined by comparing mean and standard deviation between multimedia classrooms and traditional classrooms.

Students were satisfied with the acoustics, visual presentation equipment, and other equipment cabined in multimedia classrooms (see Table 4). However, there was considerable variation ($SD=1.29$) in satisfaction with the Smartboard system.

Table 4:

Technology Satisfaction in Multimedia Classroom

| Technology Satisfaction in Multimedia Classroom | | |
|--|------|-----------|
| Items | Mean | Std. Dev. |
| I am satisfied with Internet connection on desk. | 3.35 | 0.87 |
| I am satisfied Smartboard system. | 3.06 | 1.29 |
| I am satisfied with acoustics. | 3.96 | 0.74 |
| I am satisfied with visual presentation equipment. | 3.89 | 0.84 |
| I am satisfied with other equipments cabinetted. | 3.90 | 0.80 |

Also, Table 5 is a presentation of data indicating that students were satisfied with blackboard/whiteboard, acoustics, and presentation equipments in traditional classrooms. However, there was considerable variation ($SD=1.08$) in satisfaction towards audio and video equipment.

Table 5:

Technology Satisfaction in Traditional Classroom

| Technology Satisfaction in Traditional Classroom | | |
|--|------|-----------|
| Items | Mean | Std. Dev. |
| I am satisfied with blackboard/whiteboard. | 3.79 | 0.80 |
| I am satisfied with acoustics. | 3.97 | 0.57 |
| I am satisfied with presentation equipment. | 3.79 | 0.80 |
| I am satisfied with other audio and video equipment. | 3.31 | 1.08 |

The subscale called Technology Satisfaction in multimedia classrooms was obtained by adding the 5 items together; another subscale of Technology Satisfaction in traditional classrooms was also obtained by adding the 4 items together. These two separate means and standard deviations were calculated to compare and determine whether there were differences between students' satisfaction with technologies in multimedia classrooms and traditional classrooms. The result of these two calculations is reported in Table 6.

Table 6:

Means and Standard Deviations of Technology Satisfaction in Multimedia Classrooms and Traditional Classrooms

| Classroom | Sum | N | Mean Score | Std. Dev. |
|-------------|------|-----|------------|-----------|
| Multimedia | 3397 | 187 | 3.64 | 0.91 |
| Traditional | 1635 | 110 | 3.72 | 1.00 |

The degree of students' satisfaction with technology in multimedia classrooms fell into the category of 'agree'. The degree of students' overall satisfaction with technologies in traditional classrooms fell into the same category as multimedia classrooms. These calculations indicated that there was virtually no difference, although the mean score of traditional classrooms was higher than that of multimedia classrooms, between the students' satisfaction with technologies in multimedia classrooms and the students' satisfaction with technologies in traditional classrooms.

Research Question 2: Do students who take classes in multimedia classrooms perceive their learning achievements differently than do those who take classes in traditional classrooms?

Research Question 2 was examined to determine whether there were differences in students' perceptions of learning achievements in multimedia classrooms to compare with traditional classrooms. The learning achievements consisted of learning outcomes in multimedia classrooms, learning enhancement in multimedia classrooms, and expectations of learning outcomes in multimedia classrooms.

The data display in Table 7 indicated that in multimedia classrooms students' perception of learning achievements in multimedia classrooms was graded as 'agree'. In traditional classrooms, students' perceptions of learning achievements in multimedia classrooms was also graded as 'agree'.

Table 7:

Perceptions of Learning Achievements in Multimedia Classrooms

| Perceptions of Learning Achievements in Multimedia Classrooms | | | |
|---|-------------|------|-----------|
| Items | Classroom | Mean | Std. Dev. |
| I learn more when taught in MC. | Multimedia | 3.45 | 0.96 |
| | Traditional | 3.53 | 1.03 |
| Having a class in MC improves my learning. | Multimedia | 3.51 | 0.94 |
| | Traditional | 3.66 | 0.92 |
| I expect higher grades in MC. | Multimedia | 3.23 | 0.95 |
| | Traditional | 3.28 | 0.87 |

Note: MC stands for multimedia classroom.

The null hypothesis associated with this research question is the following:

H0: In the population, there is no difference in students' perceptions of learning achievements as perceived by students who take classes in multimedia classrooms, as compared with those students who take classes in traditional classrooms.

A Mann-Whitney U test was conducted to determine whether there was significant difference between students' perception of learning achievements using multimedia classrooms. The results are displayed in Table 8.

Table 8:

Mann-Whitney U Test for Students' Perception of Learning Achievements in Multimedia Classrooms

| Class | Rank Sums | n | Mean Score | z-score | 2-tailed p |
|-----------------------|-----------|-----|------------|---------|------------|
| Multimedia Classroom | 27147.50 | 187 | 155.50 | | |
| Traditional Classroom | 17105.50 | 110 | 145.73 | .31 | .31 |

The Mann-Whitney U test showed that there was no significant difference between the students' perceptions of learning achievements as perceived by students in multimedia classrooms and those in traditional classrooms who use multimedia classrooms. The null hypothesis was retained.

Research Question 3: Do students who take classes in multimedia classrooms perceive the instructors' methods differently than do those who take classes in traditional classrooms?

Research Question 3 was investigated to determine whether there was difference in students' perception of the instructors' methods in multimedia classrooms to compare with

traditional classrooms. The instructors' methods in multimedia classrooms and traditional classrooms included contents delivery using technology, class organization, attention to learners' needs and interests, learners' participation and interactivity, and retention of learners' interest.

The data reported in Table 9 indicated that students' perceptions of the instructors' methods in multimedia classrooms was graded from 'agree' to 'strongly agree'. On the other hand, students' perceptions of the instructors' methods in traditional classrooms was graded from 'neutral' to 'agree' scale. Perception of the instructors' methods in multimedia classrooms was scored higher than that of the instructors' methods in traditional classrooms.

Table 9:

Perceptions of Instructors' Methods in Multimedia Classrooms and Traditional Classrooms

| Perceptions of Instructors' Methods | | | |
|---|-------------|------|-----------|
| Items | Classroom | Mean | Std. Dev. |
| My instructor delivers contents by using different technologies. | Multimedia | 4.05 | 0.76 |
| | Traditional | 3.42 | 1.06 |
| My instructor is well organized. | Multimedia | 4.23 | 0.77 |
| | Traditional | 3.96 | 0.90 |
| My instructor is interested in individual needs & interests. | Multimedia | 4.08 | 0.76 |
| | Traditional | 3.87 | 0.96 |
| My instructor encourages participation & interacts with everyone. | Multimedia | 4.11 | 0.76 |
| | Traditional | 4.28 | 0.92 |
| My instructor holds my interest. | Multimedia | 3.98 | 0.89 |
| | Traditional | 3.66 | 1.03 |

The null hypothesis derived from this research question is below.

H0: In the population, there is no difference in the perception of the instructors' methods as perceived by students who take classes in multimedia classrooms, as compared with students who take classes in traditional classrooms.

A Mann-Whitney U test was employed to determine whether there were significant differences between students' perceptions of instructors' methods in multimedia classrooms and traditional classrooms. The result of this test is presented in Table 10.

Table 10:

Mann-Whitney U Test for Students' Perceptions of Instructors' Methods in Multimedia Classrooms and Traditional Classrooms

| Classroom | Rank Sums | n | Mean Score | z-score | 2-tailed p |
|-------------|-----------|-----|------------|---------|------------|
| Multimedia | 30292.50 | 187 | 161.99 | .0006 | .0007 |
| Traditional | 13960.50 | 110 | 126.91 | | |

The Mann-Whitney U test indicated that there did indeed exist a disparity between the students' perceptions of instructors' methods in multimedia classrooms and traditional classrooms. The null hypothesis was rejected. Students' perception of instructors' methods in multimedia classrooms was scored higher than those of instructors' methods in traditional classrooms.

Research Question 4: Are there differences in the general perceptions of multimedia classrooms between students who take classes in multimedia classrooms and those who take classes in traditional classrooms grouped by gender, discipline of study, and age?

Research Question 4 was analyzed to determine whether there were differences in the general perceptions of multimedia classrooms between students in multimedia classrooms and those in traditional classrooms categorized by gender, discipline of study, and age. The general perceptions of multimedia classrooms were consisted of perception of Technology Access Fee to build multimedia classrooms, preference of technology in multimedia classroom, and decision to take course in multimedia classroom in future.

The null hypotheses associated with this research question are presented as the following:

H01: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who take classes in multimedia classrooms and those who take classes in traditional classrooms grouped by gender.

The data display in Table 11 indicated that students' general perceptions of multimedia classrooms was graded from 'agree' to 'strongly agree'. There was not much disparity between female and male regarding general perceptions of multimedia classrooms. However, the data indicated a positive preference to multimedia classrooms by both females and males from multimedia classrooms and traditional classrooms.

Two separate Mann-Whitney U tests were conducted based on female and male's classifications to determine whether there were significant differences in students' general perceptions of multimedia classrooms in multimedia classrooms and traditional classrooms. The results of these two tests are reported in Table 12.

The results of Mann-Whitney U tests showed that there were no significant differences in students' general perceptions of multimedia classrooms by females and males in multimedia classrooms and traditional classrooms. The null hypotheses were retained.

Table 11:

General Perceptions of Multimedia Classrooms by Gender

| General Perceptions of Multimedia Classrooms by Gender | | | | |
|--|-------------|--------|------|-----------|
| Items | Classroom | Gender | Mean | Std. Dev. |
| It is important that ETSU use Technology Access Fee to develop MC. | Multimedia | F | 4.09 | 1.03 |
| | | M | 3.93 | 0.97 |
| | Traditional | F | 3.93 | 0.94 |
| | | M | 3.75 | 0.94 |
| I would prefer to take a course from an instructor using technology. | Multimedia | F | 3.84 | 0.94 |
| | | M | 3.91 | 0.85 |
| | Traditional | F | 3.93 | 0.82 |
| | | M | 3.87 | 0.81 |
| I would take another course in MC. | Multimedia | F | 4.05 | 0.89 |
| | | M | 4.02 | 0.81 |
| | Traditional | F | 3.91 | 0.83 |
| | | M | 4.13 | 0.81 |

Note: MC stands for multimedia classroom; F stands for female; M stands for male.

H02: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who take classes in multimedia classroom and those who take classes in traditional classroom grouped by discipline of study.

Table 12:

Mann-Whitney U Test for Students' General Perceptions of Multimedia Classrooms by Gender in Multimedia Classrooms and Traditional Classrooms

| Class | | Rank Sums | N | Mean Score | z-score | 2-tailed p |
|-----------------------|---|-----------|-----|------------|---------|------------|
| Multimedia Classroom | F | 6409.0 | 86 | 74.52 | .37 | .37 |
| | M | 7887.50 | 102 | 77.33 | .79 | .79 |
| Traditional Classroom | F | 3387.0 | 57 | 68.19 | .37 | .37 |
| | M | 4202.50 | 53 | 79.29 | .79 | .79 |

Note: F stands for female; M stands for male.

In this research, item 4 was designed to solicit student's discipline of study by writing down their academic majors. Their answers were found too diverse. Additionally, some academic majors were small in size. Therefore, academic majors were grouped together to yield valid data analysis based on the college level divisions at East Tennessee State University as discussed in Chapter 3. The five categories were: Arts and Sciences, Applied Science and Technology, Education, Business, and Public and Allied Health.

Data presented in Table 13 indicated that most students in these five areas of study had positive general perceptions of multimedia classrooms from 'agree' to 'strongly agree'. Furthermore, students from Education and Public and Allied Health had higher general perceptions of multimedia classrooms than others.

Table 13:

General Perceptions of Multimedia Classrooms by Discipline of Study

| Items | Business | | Applied Science & Technology | | | | Arts & Sciences | | | | Education | | | | Public & Allied Health | | | | | |
|--|-----------|----------|------------------------------|----------|-----------|----------|-----------------|----------|-----------|----------|-----------|----------|-----------|----------|------------------------|----------|-----------|----------|-----|-----|
| | MC | | TC | | MC | | TC | | MC | | TC | | MC | | TC | | | | | |
| | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>S</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | | |
| It is important that ETSU use Technology Access Fee to develop MC. | 3.0 | 1.0 | 3.8 | 1.0 | 3.2 | 0.0 | 4.1 | 1.0 | 4.0 | 0.9 | 3.6 | 0.2 | 4.6 | 0.8 | 4.6 | 0.8 | 4.3 | 0.4 | 3.9 | 0.6 |
| I would prefer to take a course from an instructor using technology. | 3.8 | 0.9 | 3.9 | 0.9 | 3.8 | 0.3 | 4.0 | 0.9 | 4.3 | 0.6 | 3.3 | 1.1 | 4.9 | 0.6 | 4.8 | 0.8 | 3.5 | 0.4 | 4.6 | 0.6 |
| I would take another course in MC. | 3.1 | 0.9 | 3.8 | 0.9 | 4.1 | 0.1 | 3.9 | 0.7 | 3.2 | 0.3 | 3.7 | 0.1 | 4.2 | 0.9 | 4.4 | 0.8 | 4.4 | 0.4 | 4.7 | 0.6 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

Two separate Kruskal-Wallis tests were conducted to determine whether there were significant differences in students' general perceptions of multimedia classrooms between those in multimedia classrooms and those in traditional classrooms grouped by categories of discipline of study. The results of the tests are displayed in Table 14.

Table 14:

Kruskal-Wallis Test for Students' General Perceptions of Multimedia Classrooms by Discipline of Study in Multimedia Classrooms and Traditional Classrooms

| Discipline of Study | Classroom | Sums | N | Mean Score | Chi-square | P |
|------------------------------|-----------|--------|-----|------------|------------|------|
| Arts & Sciences | MC | 71.0 | 7 | 10.1 | 4.65 | 0.59 |
| | TC | 108.0 | 9 | 12.0 | 9.38 | 0.15 |
| Business | MC | 1717.0 | 159 | 10.8 | 4.65 | 0.59 |
| | TC | 1098.0 | 78 | 13.9 | 9.38 | 0.15 |
| Education | MC | 43.0 | 3 | 14.3 | 4.65 | 0.59 |
| | TC | 12.0 | 1 | 12.0 | 9.38 | 0.15 |
| Public & Allied Health | MC | 28.0 | 2 | 14.0 | 4.65 | 0.59 |
| | TC | 14.0 | 1 | 14.0 | 9.38 | 0.15 |
| Applied Science & Technology | MC | 221.0 | 16 | 13.8 | 4.65 | 0.59 |
| | TC | 212.0 | 21 | 10.6 | 9.38 | 0.15 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

The Kruskal-Wallis tests showed that there were no significant differences in students' general perceptions of multimedia classrooms among students from different areas of discipline of study: Arts and Sciences, Business, Education, Applied Science and Technology, and Public

and Allied Health in multimedia classrooms and traditional classrooms. The null hypotheses were retained.

Data Analysis for General Perceptions of Multimedia Classrooms between Students from Business and Applied Science and Technology and Students from Other Disciplines of Study

In this study, the majority of students were from Business and Applied Science and Technology. In order to examine the differences in students' general perceptions of multimedia classrooms between students from Business and Applied Science and Technology and students from other disciplines of study, including Education, Arts and Sciences, and Public and Allied Health, a hypothesis was established: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who are from Business or Applied Science and Technology and students who are from other disciplines of study. Kruskal-Wallis test was conducted to determine if there were differences in students' general perceptions of multimedia classroom as perceived by students from Business and Applied Science and Technology and students from other disciplines of study in multimedia classrooms and in traditional classrooms. Final results of Kruskal-Wallis tests are presented in Table 15.

Table 15:

Kruskal-Wallis Test for Students' General Perceptions of Multimedia Classrooms by Business and Applied Science and Technology and other Disciplines of Study in Multimedia Classrooms and Traditional Classrooms

| Discipline of Study | Classroom | Sums | N | Mean Score | Chi-square | P |
|---|-----------|--------|-----|------------|------------|------|
| Applied Science & Technology & Business | MC | 1938.0 | 175 | 11.1 | 4.63 | 0.51 |
| | TC | 1310.0 | 99 | 13.3 | 9.10 | 0.08 |
| Other Disciplines of Study | MC | 142.0 | 12 | 11.8 | 4.63 | 0.51 |
| | TC | 134.0 | 11 | 12.2 | 9.10 | 0.08 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

The results of Kruskal-Wallis tests showed that there were no significant differences in students' general perceptions of multimedia classrooms among students from Business and Applied Science and Technology and students from other disciplines of study.

H03: In the population, there is no difference in the general perceptions of multimedia classrooms as perceived by students who take classes in multimedia classrooms and those who take classes in traditional classrooms grouped by age.

Age groups in this research were 18-23, 24-30, 31-39, 40-49, 50-59, and 60 over. No students aged over 60 participated in the survey. Based on the survey results and the size of age groups, 4 age groups were further modified: 18-23, 24-30, 31-39, and 40 and over (40-49, 50-59, and 60 over were combined to 40 and over) based on traditional college students' age and non-traditional students' age as discussed in Chapter 3.

Table 16 includes data indicating that most students in these 4 age groups had positive general perceptions of multimedia classrooms with 'agree' to 'strongly agree' being their primary responses on the scale.

Two separate Kruskal-Wallis tests were performed to determine whether there were significant differences in students' general perceptions of multimedia classrooms between multimedia classrooms and traditional classrooms grouped by these 4 age groups. The results of the tests are displayed in Table 17.

The Kruskal-Wallis tests showed that there were no significant differences in students' general perceptions of multimedia classrooms among students from different age groups: 18-23, 24-30, 31-39, and 40 and over in multimedia classrooms and traditional classrooms. The null hypotheses were retained.

Table 16:

General Perceptions of Multimedia Classrooms by Age Group

| Items | 18-23 | | 24-30 | | 31-39 | | 40-49 | | | | | | | | | |
|--|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| | MC | | TC | | MC | | TC | | | | | | | | | |
| | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | | | | | | | | |
| It is important that ETSU use Technology Access Fee to develop MC. | 4.1 | 1.0 | 3.9 | 1.0 | 3.8 | 1.1 | 3.8 | 0.9 | 4.0 | 0.9 | 3.9 | 0.8 | 3.6 | 1.2 | 3.9 | 0.4 |
| I would prefer to take a course from an instructor using technology. | 4.0 | 0.9 | 3.9 | 0.9 | 3.5 | 0.9 | 4.0 | 0.5 | 4.1 | 0.7 | 4.2 | 0.7 | 4.0 | 0.5 | 3.6 | 0.5 |
| I would take another course in MC. | 4.2 | 0.8 | 4.0 | 0.9 | 3.7 | 0.9 | 4.1 | 0.6 | 4.0 | 0.7 | 4.1 | 0.8 | 4.2 | 1.2 | 3.7 | 0.8 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

Table 17:

Kruskal-Wallis Test for Students' General Perceptions of Multimedia Classrooms by Age Group

in Multimedia Classrooms and Traditional Classrooms

| Age | Classroom | Sums | n | Mean Score | Chi-square | p |
|---------|-----------|---------|-----|------------|------------|------|
| 18-23 | MC | 12732.5 | 127 | 100.3 | 6.38 | 0.09 |
| | TC | 4110.0 | 74 | 55.5 | 1.27 | 0.74 |
| 24-30 | MC | 3067.5 | 40 | 76.7 | 6.38 | 0.09 |
| | TC | 916.5 | 16 | 57.3 | 1.27 | 0.74 |
| 31-39 | MC | 1121.0 | 12 | 93.4 | 6.38 | 0.09 |
| | TC | 773.5 | 13 | 59.5 | 1.27 | 0.74 |
| 40-over | MC | 657.0 | 8 | 82.1 | 6.38 | 0.09 |
| | TC | 305.0 | 7 | 43.6 | 1.27 | 0.74 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

Research Question 5: Is there a difference in students' prior computer knowledge and use between students who take classes in multimedia classrooms and those who take classes in traditional classrooms?

Research Question 5 was analyzed to determine whether there was a difference in students' prior computer knowledge and use in multimedia classrooms and traditional classrooms. The prior computer knowledge and use included familiarity with computing applications, frequency of using computer, and accessibility to computer.

Students' prior computer knowledge and use clustered around 'agree' (see Table 18).

There was not a large difference in students' prior computer knowledge and use between students in multimedia classrooms and those in traditional classrooms. However, students who were in multimedia classrooms had more access to computers "whenever necessary".

Table 18:

Students' Prior Computer Knowledge and Use in Multimedia Classrooms and Traditional Classrooms

| Students' Prior Computer Knowledge and Use | | | | |
|--|-------------|------|-----------|--|
| Items | Classroom | Mean | Std. Dev. | |
| I have the knowledge and skills to use computer applications for class projects and presentations. | Multimedia | 4.14 | 0.74 | |
| | Traditional | 4.12 | 0.76 | |
| I often use computer assisted or other computer based applications outside of class. | Multimedia | 3.90 | 0.91 | |
| | Traditional | 3.91 | 0.43 | |
| I have access to a computer whenever necessary. | Multimedia | 4.40 | 0.76 | |
| | Traditional | 3.35 | 0.79 | |

The null hypothesis connected with this research question is presented as the following:

H0: In the population, there is no difference in the prior computer knowledge and use between students who take classes in multimedia classrooms and students who take classes in traditional classrooms.

A Mann-Whitney U test was performed to determine whether there was a significant difference between students' prior computer knowledge and use in multimedia classrooms and traditional classrooms. The results of this test are displayed in Table 19.

Table 19:

Mann-Whitney U Test for Students' Prior Computer Knowledge and Use in Multimedia

Classrooms and Traditional Classrooms

| Classroom | Rank Sums | n | Mean Score | z-score | 2-tailed p |
|-------------|-----------|-----|------------|---------|------------|
| Multimedia | 28031.0 | 187 | 149.90 | | |
| Traditional | 1622.0 | 110 | 147.47 | .81 | .81 |

The results of Mann-Whitney U test showed that there were no significant differences between the students' prior computer knowledge and Use between students in multimedia classrooms and traditional classrooms. The null hypothesis was retained.

Research Question 6: Are there differences in students' general perceptions of multimedia classrooms among students with different learning styles taking classes in multimedia classrooms and students with different learning styles taking classes in traditional classrooms?

Research question 6 was examined to determine whether there was difference in the general perceptions of multimedia classrooms among students with different learning styles in multimedia classrooms and traditional classrooms. The general perceptions of multimedia classrooms were consisted of Technology Access Fee to build multimedia classrooms, preference of technology use by instructors in multimedia classroom, and decision to take course in multimedia classroom in future. Students' learning styles were measured by VARK learning style inventory survey. They were divided into four groups: V, A, R, and K representing visual, aural, read/write, and kinesthetic respectively.

The null hypothesis connected with this research question is as the following:

H0: In the population, there is no difference in the students' general perceptions of multimedia classrooms as perceived by students with different learning styles taking

classes in multimedia classrooms and students with different leaning styles in traditional classrooms.

The data in Table 20 indicated that most students with these four learning styles had positive general perceptions of multimedia classrooms and responded to the scale from 'agree' to 'strongly agree'.

Two Kruskal-Wallis tests were performed to determine whether there were significant differences in the general perceptions of multimedia classrooms by students with different learning styles in multimedia classrooms and traditional classrooms. The results of the tests are presented in Table 21.

The results of Kruskal-Wallis tests indicated that there were no significant differences in the general perceptions of multimedia classrooms among students with learning styles: V, A, R, and K in multimedia classrooms and those in traditional classrooms. The null hypotheses were retained with p values of .09 and .42 in multimedia classrooms and traditional classrooms respectively which were higher than the preset p value at .05.

Data Analysis for the Relationship between Learning Styles and Classrooms

It was found that students with these four different learning styles: V(visual), A(ural), R(ead/Write), and K(inesthetic), distributed evenly among multimedia classrooms and traditional classrooms. In order to study the relationship between four types of learning styles and two formats of classrooms, a hypothesis: In the population, there is no relationship between students' learning styles and classes, was established. Chi-square test was conducted to investigate the relationship between four different types of learning styles and two formats of classrooms. With calculated Chi-square value of 4.59 and Kendall's Tau-b value of 0.06, there was no significant relationship between learning styles and classroom type.

Table 20:

General Perceptions of Multimedia Classrooms by Different Learning Styles: VARK

| Items | V(visual) | | | | A(ural) | | | | R(ead/Write) | | | | K(inesthetic) | | | |
|--|-----------|----------|-----------|----------|-----------|----------|-----------|----------|--------------|----------|-----------|----------|---------------|----------|-----------|----------|
| | MC | | TC | | MC | | TC | | MC | | TC | | MC | | TC | |
| | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> | \bar{X} | <i>s</i> |
| It is important that ETSU use Technology Access Fee to develop MC. | 4.1 | 1.0 | 3.8 | 1.0 | 4.2 | 1.0 | 3.8 | 0.9 | 3.8 | 1.0 | 3.9 | 1.0 | 4.0 | 1.0 | 4.0 | 1.0 |
| I would prefer to take a course from an instructor using technology. | 3.9 | 0.9 | 3.82 | 0.8 | 4.0 | 0.8 | 4.0 | 0.6 | 3.8 | 0.9 | 3.9 | 0.8 | 3.0 | 0.0 | 4.6 | 0.6 |
| I would take another course in MC. | 4.1 | 0.9 | 3.83 | 0.9 | 4.2 | 0.8 | 4.3 | 0.8 | 3.9 | 0.8 | 4.2 | 0.7 | 3.3 | 0.6 | 4.6 | 0.6 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

Table 21:

Kruskal-Wallis Test for General Perception of Students with Different Learning Styles in
Multimedia Classrooms and Traditional Classrooms

| Learning Style | Classroom | Sums | N | Mean Score | Chi-square | p |
|----------------|-----------|--------|----|------------|------------|------|
| V(visual) | MC | 8714.5 | 88 | 99.0 | 6.44 | 0.09 |
| | TC | 3116.5 | 60 | 51.9 | 2.84 | 0.42 |
| A(ural) | MC | 2739.5 | 26 | 105.4 | 6.44 | 0.09 |
| | TC | 720.5 | 12 | 60.0 | 2.84 | 0.42 |
| R(ead/write) | MC | 5995.0 | 70 | 85.6 | 6.44 | 0.09 |
| | TC | 1899.5 | 33 | 57.6 | 2.84 | 0.42 |
| K(inesthetic) | MC | 129.0 | 3 | 43.0 | 6.44 | 0.09 |
| | TC | 368.5 | 5 | 73.7 | 2.84 | 0.42 |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

Summary

Descriptive and comparative analyses of the data generated from 297 students out of a population of 528 enrolled in spring semester 2002 in multimedia classrooms and traditional classrooms were presented in Chapter 4. The descriptive analysis included demographic information concerning age, gender, discipline of study, and academic standing. Most students in this study were juniors or seniors; female students and male students were divided evenly; the age group fell mainly in 18-23, and their disciplines of study were mostly in Business and Applied Science and Technology. Learning styles of these students measured by VARK survey showed that most students were in the category of V(visual) and R(ead/Write) learning styles.

Furthermore, the frequency distributions of survey items related to six research questions were summarized before statistical analyses were employed to determine if there were significant differences of students' perceptions of multimedia classroom between students in multimedia classrooms and students in traditional classrooms regarding learning achievements, instructional technologies, instructors' methods, and learning styles. It was found that most students had positive perceptions of multimedia classrooms. Finally, this chapter included comparative analyses for determining the differences of students' perceptions of multimedia classrooms as perceived by those students in multimedia classrooms and traditional classrooms regarding learning achievements, instructional technologies, instructors' methods, and learning styles. The data analyses showed that there were no significant differences in students' perceptions of multimedia classrooms in terms of technologies, learning achievements, gender, discipline of study, age, prior computer knowledge and use, or learning styles. However, there were significant differences in students' perceptions of multimedia classrooms regarding instructors' methods in class.

CHAPTER 5

CONCLUSIONS

This chapter is the conclusion of the study and includes the findings of the study, conclusions, and recommendations derived from this study.

Previous research that focused on the learning effectiveness of students in multimedia classrooms was limited (Cardenas, 1998; Lyons, Kysilka, & Pawlas, 1999). The primary purpose of this study was to investigate students' perceptions of multimedia classrooms at East Tennessee State University and to offer educators and administrators the opportunity to know more about students' perceptions of multimedia classrooms.

The sample for this study consisted of 528 students who were enrolled in courses taught in both multimedia traditional classrooms during spring semester 2002. Two hundred ninety-seven valid surveys were collected which represented a return rate of 56.3%, a rate determined to be acceptable for the purpose of this study. This study measured students' perceptions of multimedia classrooms using two survey instruments in multimedia classrooms and traditional classrooms. Students' learning styles were calculated by using Fleming's (2002a) VARK survey.

Findings

The following findings are presented as the result of the data analysis and consequent interpretations of data generated from the returned surveys.

Most respondents were from the School of Business (80%) and the College of Applied Science and Technology (12%). The majority of students were juniors and seniors.

Approximately half were female students and most were from 18 to 23 years old.

Analysis of the learning styles using VARK survey showed that almost 50% students had a visual learning style and another 35% had a read/write learning style. Few students with aural or kinesthetic learning styles were identified. The proportion of students with a visual learning style or a read/write learning style was evenly divided between students in multimedia classrooms and traditional classrooms.

Most students' perceptions of multimedia classrooms ranged from 'agree' scale to 'strongly agree' scale. No negative perceptions of multimedia classrooms were identified.

A summary of the findings for Research Questions 1, hypotheses related to Research Question 2 through 6, and 2 hypotheses for extra data analyses are presented below.

Research Question 1. Are students who take classes in multimedia classroom satisfied with the technology provided, as compared with those students who take classes in traditional classroom?

No differences were identified based on the data analysis of means and standard deviations. Students in multimedia classrooms ranked technologies in multimedia classrooms from 'neutral' to 'agree' and it was the same with students in traditional classrooms who ranked technologies in traditional classrooms. There was not much disparity identified in students' perceptions of technologies in multimedia classrooms and in traditional classrooms. However, there was more variation in students' ratings of satisfaction with Smartboard system in multimedia classrooms and visual and aural equipment in traditional classrooms.

Hypothesis 1. In the sample, there is no difference in the perception of learning achievements as perceived by students who use multimedia classrooms to compare with traditional classrooms.

The null hypothesis was retained. Students in multimedia classrooms had the same perceptions of their learning achievements as those in traditional classrooms. Students in multimedia and traditional classrooms had positive perceptions of multimedia classrooms regarding learning achievements.

Hypothesis 2. In the sample, there is no difference in the perception of instructors' methods as perceived by students who use multimedia classrooms to compare with traditional classrooms.

The null hypothesis was rejected. Students evaluated their instructors' methods differently. Students in multimedia classrooms indicated greater satisfaction with the instructors' methods in multimedia classrooms compared to those in traditional classrooms as perceived by students in traditional classrooms.

Hypothesis 3. In the sample, there is no difference in the general perceptions of multimedia classrooms as perceived by students in multimedia classrooms and traditional classrooms grouped by gender.

The null hypothesis was retained. In multimedia classrooms and traditional classroom, female students and male students had positive general perceptions of multimedia classrooms. Female students did not perceive multimedia classrooms differently than male students in terms of general perceptions.

Hypothesis 4. In the sample, there is no difference in the general perceptions of multimedia classrooms as perceived by students in multimedia classroom and traditional classroom grouped by discipline of study.

The null hypothesis was retained. Students in different areas of study had the same positive general perceptions of multimedia classrooms. They did not have different general perceptions of multimedia classrooms substantially though they were from different areas of discipline of study. Specifically, students from Business and Applied Science and Technology and students from Education, Arts and Sciences, and Public and Allied Health had the same general perceptions of multimedia classrooms.

Hypothesis 5. In the sample, there is no difference in the general perceptions of multimedia classrooms as perceived by students who are from Business and Applied Science and Technology and students from other disciplines of study.

The null hypothesis was retained. No differences were identified in the general perceptions of multimedia classrooms as perceived by students from Business and Applied Science and Technology and students from other disciplines of study, including Education, Arts and Sciences, and Public and Allied Health.

Hypothesis 6. In the sample, there is no difference in the general perceptions of multimedia classrooms as perceived by students in multimedia classrooms and traditional classrooms grouped by age.

The null hypothesis was retained. Students from different age groups in multimedia classrooms and traditional classrooms had positive general perceptions of multimedia classrooms. Different age groups did not have different general perceptions of multimedia classrooms as perceived by those in multimedia classrooms and those in traditional classrooms.

Hypothesis 7. In the sample, there is no difference in the prior computer knowledge and use between students who use multimedia classrooms and students who use traditional classrooms.

The null hypothesis was retained. Students in multimedia classrooms were found to have almost the same prior computer knowledge and use as those in traditional classrooms. Students in multimedia classrooms perceived their prior computer knowledge and use the same as those students in traditional classrooms. Moreover, students in multimedia classrooms and traditional classrooms were found that they had good prior computing knowledge and use.

Hypothesis 8. In the sample, there is no difference in the general perceptions of multimedia classrooms as perceived by students with different learning styles in multimedia classrooms and traditional classrooms.

The null hypothesis was retained. Students with four learning styles had the same positive general perceptions of multimedia classrooms. Students in multimedia classrooms and traditional classroom with different learning styles were not found to have different general perceptions of multimedia classroom.

Hypothesis 9. In the sample, there is no relationship between students' learning styles and different formats of classes.

The hypothesis was retained. Students with four different learning styles distribute evenly in multimedia classrooms and traditional classrooms. Choosing to take a course in multimedia classrooms or in traditional classrooms was not determined by students' different learning styles.

Conclusions

Though no survey studies could be totally free of bias and account for all possible factors which affect data from human subjects, there are some conclusions can be drawn from this study of the students' perceptions of multimedia classrooms at East Tennessee State University regarding learning achievements, instructors' methods, technologies in multimedia classrooms, and learning styles of these students.

1. The majority of students in multimedia classrooms have positive perceptions of technologies provided in multimedia classrooms and physical configurations as well. These cutting-edge technologies include internet connection on the desk, Smartboard system, acoustics, video conferencing equipment, projector mounted in the ceiling, touch panel monitor, and cabineted equipments like PC, Mac, cassette player, VCR player, DVD player, and video and audio working station. These technologies are adopted based on the learners' new needs in this information age. They provide learners the opportunities to use emerging technology to enhance their learning process. This further supports Wilson's (1993) description of learning enhancement technologies in classrooms. Meanwhile, as some researchers like Brubaker (1998) and Lackney (1998) stated that educational facilities must meet the learners' needs and social trends, technologies in multimedia classrooms at ETSU satisfy students' learning needs to enhance and enrich their educational experience. Though students in traditional classrooms were also satisfied with the technologies provided in class, students in both classrooms had strong positive remarks on new technologies. These are some comments from students on technologies in multimedia classroom in the survey: "It's good and the use of more technologies makes attention last."; "I

enjoy looking at current financial reports and discussing them in class. It makes the acct. info. seem more real life and less textbook (reports from internet).”; “The room is satisfactory. The AV system sounds like a jet takes off just outside the door.”; “Multimedia classes are easier to pass because computer slides can be used to project on a screen and allows everyone to see them.”; “I learn better with computer technology being used, rather than written on a board. The presentation is near.”; “Using Word, Excel, and Power Point gives students advantage.”

Students are satisfied with the physical environment as well such as seating, floor, lighting, and air-conditioning. These comfortable physical configurations were considered a part of technology integrated in these multimedia classrooms by the Office of Information and Technology at East Tennessee State University (ETSU, OIT, 2002, Equipment, para. 1). Students said: “Class is much more comfortable too.”; “Air conditioning is a nice feature new models are equipped with.”; “I love this classroom because the table(s) and chairs are very comfortable and (it) provide(s) a good learning environment. I would like for more rooms to be like this.”; “The seats are more comfortable than other classrooms. Also room temp(erature) is more comfortable. With the increased in comfort I feel I have learned more.”; “The seats are very good and we have plenty of room(s) to work and are not crowded in unlike other classes.”; “Multimedia classrooms always seem more comfortable!”

However, students had varied perceptions towards Smartboard system in multimedia classrooms and visual and aural equipment in traditional classrooms

2. Students in multimedia classrooms did not perceive their learning achievements differently as compared with students in traditional classrooms. In this study,

students in multimedia classrooms and traditional classrooms with the same teaching contents or the same teaching contents and the same instructor were compared.

However, no differences were found in the data analysis regarding students' learning achievements. This finding supports Clark's (1983, 1994) notion of non-significant difference in instructional technology. He stated that it was the instructional methods having effect on learning process rather than delivery media. Students perceived their learning achievements in multimedia classroom as "ultimately how much you learn in a class is based on the class, the student and the teacher."; "Just because you have a lot of technology in the room doesn't mean that a student will learn more."; "I learn the same in the expensive multimedia classroom than any other (class)room."

3. Students in multimedia classrooms had different perceptions of instructors' methods in class as compared with students in traditional classrooms. With the technologies provided in multimedia classrooms, instructors in multimedia classrooms must know well how to integrate instructional technology properly into their class presentation. They are required to be well prepared and organized after professional training. Instructional technology is an enhancement tool for their teaching. Students prefer more multimedia based delivery than traditional class teaching (Bialo & Sivin-Kachala, 1996, 2001). Bialo and Sivin-Kachala's summarized description of the researches in instructional technology indicated that the integration of different multimedia formats in teaching can increase students' self confidence and self esteem, and motivation to learn. The classes delivered with multimedia are more student-centered, more interactive, and use more task, problem-solving oriented, and

exploratory learning approaches. The findings of this study further confirm the research in media studies, e.g., Najjar (1996), Hofstetter (1997), and McGhee and Kozma (2001). Students made numerous comments that the instructors' instructional methods in multimedia classrooms were different or better than those instructors in traditional classrooms: "Technology can help in the learning process, but it is the instructor that actually makes difference."; "I do like taking classes in this type of room. With the different ways to teach helps me learn more."; "It is easier for students to identify with and appreciate teachers who are knowledgeable about computers and multimedia teaching tools."; "... .. Often, unlike this class, professors seem to know the capabilities of these classrooms and how to adequately use the equipment."; "It's much more interesting and easier to pay attention when the instructor uses something other than leading from the textbook, I can read it on my own." These comments further supported Bialo and Sivin-Kachala's (1996, 2001) research findings regarding the effectiveness of instructional technology in education that the effectiveness of instructional technology is mostly determined by the instructors' role, curriculum design, and students' role in class.

4. Female students had basically the same perceptions of multimedia classrooms as did male students in multimedia classrooms and traditional classrooms. Research in gender differences in instructional technology have focused on social and experiential effect, accessibility of technology (Bain et al., 1999; Hattie & Fitzgerald, 1987), and cognitive and psychosocial domains (Linn & Hyde, 1989). This study contradicts previous research findings that there are gender differences in perception of instructional technology.

5. Students from different age groups had the same perceptions of multimedia classrooms. Though previous research in learner types found differences in the effectiveness of instructional technology (Anand & Zaimi, 2000; Lucini, 1998), this research does not support their findings. However, some students from 31-39, 40-49, and 50 over age groups said, “I don't see the positive aspects. I don't have a computer to use with the internet connection. I don't (see) the technology used enough to justify the cost. It shows to be wasted \$\$ on a lot of niche to us.”; “The multimedia classroom doesn't seem that effective.”; “Multimedia classrooms are a waste of money. Learning is enhanced by the teacher's ability to teach rather than the teaching environment.”
6. Students from five different disciplines of study (Business, Applied Science and Technology, Arts and Sciences, Education, and Public and Allied Health), with different backgrounds of prior computer knowledge and use had the same perceptions of multimedia classrooms. Additional data analysis grouping students in Business and Applied Science and Technology and comparing them with students in other disciplines of study, including Education, Arts and Sciences, and Public and Allied Health, did not find any differences in prior computer knowledge and use. Several researchers have looked at the relationships between curriculum and instructional technology (Bissell & Simpson, 1993; Ferretti & Okolo, 1997; Newbold, 1993; Webster, 1990; Weir, 1992) and found differences in computer literacy between students from different disciplines. However, this study did not find the differences in students' computer knowledge and use from different disciplines of study, specifically between Business and Applied Science and Technology and other

disciplines of study, including Education, Arts and Sciences, and Public and Allied Health.

7. Students with different learning styles measured by Fleming's (2002a) VARK survey had the same perceptions of multimedia classrooms. Most students had visual and read/write learning styles from multimedia classrooms and traditional classrooms with somewhat more in multimedia classrooms. This finding coincided with Fleming's (1995) survey findings of learners that the majority of learners use visual and read/write ways and strategies to learn and survive in their learning experience. Moreover, fewer students with aural learning styles were identified. In the classes surveyed, traditional lecturing delivery was the dominant instructional method. This finding supported Fleming's (personal communication, January 2002) study on the relationship between students and instructors with aural learning style and instructor's delivery method. Finally, the findings of this study indicated that students having class in multimedia classrooms were not based on their learning preferences.

Recommendations

The following recommendations are proposed for future research in multimedia classroom, VARK learning styles, and administrators and policy makers of East Tennessee State University. This study investigated students' perceptions of multimedia classrooms regarding technologies provided, learning achievements of students, instructors' methods, and general perceptions of multimedia classrooms in terms of gender, discipline of study, age groups, and learning styles. It is ultimately hoped that more comprehensive and systematic studies could be

conducted in the future to let educators have better understanding about the effectiveness of multimedia classrooms from learners. Furthermore, it is also hoped that the administrators and policy makers of East Tennessee State University could have the opportunity to understand more about multimedia classrooms and improve them to enhance students' learning in the future.

Recommendations for Future Research

1. Studies with larger and more diverse populations of multimedia classrooms from more higher learning institutions and adult learning settings would contribute more to the area of the effectiveness of multimedia classrooms for learners. Moreover, studies with more diversified disciplines of study would reveal more on the effectiveness of multimedia classroom for different learners. This descriptive and comparative study presented the descriptive and comparative findings. This study only focused on East Tennessee Sate University's multimedia classrooms in the School of Business and the College of Applied Science and Technology on the main campus.
2. Studies using both quantitative and qualitative methods could be conducted to uncover more about the effectiveness of multimedia classrooms for learners. Because this study is restricted to the perceptions of learners of multimedia classrooms, a qualitative study employing interviews, case studies, and focus groups could get more understanding about multimedia classrooms from learners. Though this study used one open-ended question item in the survey, it is still not enough to get more opinions about multimedia classrooms from learners.

3. Studies on media attributes could be conducted to reveal more about multimedia presentation tools in multimedia classrooms. The media attributes study in recent years offered a deeper understanding of the effectiveness of instructional technology in learning. It is strongly suggested that the study of media attributes realized in multimedia classrooms be conducted to find out more about the effects of multimedia presentation tools in multimedia classrooms.
4. Studies on instructors' instructional methods could be conducted to unveil the impacts of instructional technology employed by instructors in class on students' learning procedures and outcomes. This study found the differences in students' perceptions of instructors' methods between multimedia classrooms and traditional classrooms. The instructors' methods in multimedia classrooms and traditional classrooms included contents delivery using technology, class organization, attention to learners' needs and interests, learners' participation and interactivity, and retention of learners' interest. The instructors' methods in multimedia classrooms were scored higher than that of the instructors' methods in traditional classrooms. Therefore, a separate study on instructors' methods could be conducted to discover more about the effectiveness of instructional technology employed by instructors in multimedia classrooms.
5. Studies on students' motivation to enroll in multimedia classrooms could be conducted. In this research, students had the options to take the same course either in multimedia classroom or traditional classroom. However, this study did not

address the students' motivation to enroll in multimedia classrooms. Therefore, studies on students' motivation to enroll in multimedia classrooms could contribute to a better understanding of why students' enroll in these classes.

Recommendation for VARK Research

1. Studies of the relationship between VARK learning styles and media preferences could be conducted to reveal more about how students with different learning styles prefer different media formats. Though this study did not find the differences in students' perceptions of multimedia classrooms with four different learning styles, a separate study could be conducted to discover whether there is a relationship between media formats and learning styles. This kind of research will contribute to the area of the effectiveness of instructional technology as well because it addresses the mapping issue between media formats and learners' media preferences.

Recommendations for East Tennessee State University

1. More multimedia classrooms can be set up to enhance students learning at East Tennessee State University. Students expressed strong remarks on having more multimedia classrooms in the last survey item in both multimedia classrooms and traditional classrooms. In this study, it was found out that most students in multimedia classrooms were satisfied with the technologies provided. Moreover, most students had positive perceptions of multimedia classrooms. The majority

of students like multimedia classrooms at East Tennessee State University. They have positive comments towards having multimedia classrooms such as “Multimedia is a wise decision. We need more.”; “Effective communication! Makes it easier to learn.”; “I like the multimedia rooms. I think they bring a lot to the classroom.”; “We need more multimedia classrooms in the business building.”

2. Training sessions or workshops on teaching in multimedia classroom can be an important part of instructor’s professional development at East Tennessee State University. This research found that students in multimedia classrooms and traditional classrooms had different perceptions of instructors’ methods in class. When different formats of media realized by technologies are employed properly by the instructors, students’ learning process can be greatly enhanced (Bialo & Sivin-Kachala, 2001). Kosakowski (1998) also suggested that instructors’ knowing how to manipulate the technologies in class determines their effectiveness of presentations and instructions for students.
3. Some equipments and physical settings could be modified for future multimedia classroom design. Students mentioned that, “These class rooms are nice but they are over-arted.”; “I don't feel that a room needs more than a projector for the computer to show the use of programs.”; “Multimedia classrooms are nice but costly. What we need are faster computers, color printers”. The focus of multimedia classroom design should be on visual and aural presentation tools and the higher capabilities of computing equipments instead of other fancy settings like carpeting and wiring. Students complain more about the internet connection on the desk. It is useless until they have laptops to access it. They asked for

further modifications on internet connection like, “We never used the internet connections. I had no use for them.”

4. Some policies regarding the using of multimedia classrooms need to be modified.

The first one is about its not allowing soft drinks to multimedia classrooms.

Students commented “Allow drinks in the classroom with some often restrictions besides only bottled ones.”; “Also, I didn't like not being able to bring a soft drink with me to class, as I come to night class from work.”; “Soft drinks should be ok.”

The second one is about the using of multimedia classrooms. Currently, only instructors who have been trained can use the multimedia classrooms and, then, only with a special, enciphered card. This also creates the problem of forcing students to wait outside the classroom until the instructor opens the door.

Students were often annoyed by these policies: “It is annoying to be kept in the hall to wait for instructors.” “We should be able to come in and sit it class before it starts, instead of lining the hallway like first graders.” “Most students arrive well before class time. It is high insulting to us to be made to stand in the hall. We are adults. We are too much to be treated like we are in kindergarten.

Treat your students with respect.” What they need is “24 hour lab access card.”

Policies for multimedia classrooms could be modified to accommodate students’ realistic needs in multimedia classrooms.

5. Technical support and maintenance are very important to the effective using of

multimedia classrooms. Instructors and students need immediate assistance when some pieces of presentation equipment do not work, which can guarantee the effective using of multimedia classrooms. At the same time, all the

equipment should be checked and maintained to work all the time in the place such as projector and Smartboard. The following quotations are from students' experiences: "When it works, it is very nice."; "Bulbs tend to burn out constantly in projector."; "If the Smartboard worked we would be able to use it and learn from it. It would be nice if it were fixed to work appropriately."; "The projectors in the multimedia classrooms shut off and stay off almost every class time. It is a problem when you are doing a presentation or trying to read something."; "Some of the equipment seems to only work part of the time instead of all of the time."; "Technology is great as long as the bulb does not blow or wear out. Apparently, it's a big deal to get bulbs changed."; "When technology works, it can be a very useful tool, but the problem is that technology has a tendency to not work when needed most."

6. Training sessions or workshops on multimedia classrooms for both instructors and students are also very important to the effective using of multimedia classrooms. Multimedia classrooms can be effective only when both instructors and students know how to use the technology and the capacity of technology in class. Though currently East Tennessee State University has successful training programs for multimedia classrooms, they are limited to those instructors who wish to use instructional technology in class presentation or have the need to use multimedia classrooms. However, it is strongly recommended that more training sessions or workshops be available to both instructors and students before taking class in multimedia classrooms. Students observed that "[multimedia classrooms are] good when both instructors and students are familiar with the

environment. If not, much of class is wasted learning how to use the equipment.”; “Helps if instructor is familiar with use of such technology, most are not and that becomes a waste of time.”; “Actually get to use the internet connection. Smartboard, VCR, DVD components instead of looking at them.”; “I don't think the instructors use as much as is available to them in the room.”; “And often, the equipment breaks or instructor has no idea how to use it.”

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APPENDICES

APPENDIX A

Multimedia Classroom Survey

Part One: Learning Styles Survey

The VARK Questionnaire – How Do I Learn Best? Choose the answer which best explains your preference and circle the letter. Please circle more than one if a single answer doesn't match your perception.

1. You are about to give directions to a person who is standing with you. She is staying in a hotel in town and wants to visit your house later. She has a rental car. I would:

- a. draw a map on paper
- b. tell her the directions
- c. write down the directions (without a map)
- d. collect her from the hotel in my car

2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. I would:

- a. look it up in the dictionary.
- b. see the word in my mind and choose by the way it looks
- c. sound it out in my mind.
- d. write both versions down on paper and choose one.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. I would:

- a. phone her immediately and tell her about it.
- b. send her a copy of the printed itinerary.
- c. show her on a map of the world.
- d. share what I plan to do at each place I visit.

4. You are going to cook something as a special treat for your family. I would:

- a. cook something familiar without the need for instructions.
- b. thumb through the cookbook looking for ideas from the pictures.
- c. refer to a specific cookbook where there is a good recipe.

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5. A group of tourists has been assigned to you to find out about wildlife reserves or parks. I would:
- drive them to a wildlife reserve or park.
 - show them slides and photographs
 - give them pamphlets or a book on wildlife reserves or parks.
 - give them a talk on wildlife reserves or parks.
6. You are about to purchase a new stereo. Other than price, what would most influence your decision?
- the salesperson telling you what you want to know.
 - reading the details about it.
 - playing with the controls and listening to it.
 - it looks really smart and fashionable.
7. Recall a time in your life when you learned how to do something like playing a new board game. Try to avoid choosing a very physical skill, e.g. riding a bike. I learnt best by:
- visual clues -- pictures, diagrams, charts
 - written instructions.
 - listening to somebody explaining it.
 - doing it or trying it.
8. You have an eye problem. I would prefer the doctor to:
- tell me what is wrong.
 - show me a diagram of what is wrong.
 - use a model to show me what is wrong.
9. You are about to learn to use a new program on a computer. I would:
- sit down at the keyboard and begin to experiment with the program's features.
 - read the manual which comes with the program.
 - telephone a friend and ask questions about it.
10. You are staying in a hotel and have a rental car. You would like to visit friends whose address/location you do not know. I would like them to:
- draw me a map on paper.
 - tell me the directions.
 - write down the directions (without a map).
 - collect me from the hotel in their car.

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11. Apart from the price, what would most influence your decision to buy a particular textbook?:
- I have used a copy before.
 - a friend talking about it.
 - quickly reading parts of it.
 - the way it looks is appealing.
12. A new movie has arrived in town. What would most influence your decision to go (or not go)?
- I heard a radio review about it
 - I read a review about it.
 - I saw a preview of it.
13. Do you prefer a lecturer or teacher who likes to use:?
- a textbook, handouts, readings
 - flow diagrams, charts, graphs.
 - field trips, labs, practical sessions.
 - discussion, guest speakers.

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Part Two: Multimedia Classroom Satisfaction Survey

Direction: Please circle the letter of the answer which best describes you.

- I am a:
a. Freshman b. Sophomore c. Junior d. Senior e. Graduate student.
- I am:
a. Female b. Male.
- My age group is:
a.18-23 b.24-30 c.31-39 d.40-49 e.50-59 f. 60 over.
- My academic major is:_____.(Please write in your major.)
- The internet connection on my desk in the multimedia classroom is satisfactory.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
- The Smartboard system in the multimedia classroom is satisfactory.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

7. The acoustics in the multimedia classroom are satisfactory.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
8. I am satisfied with the video conferencing equipments and Projector installed in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
9. The equipment (PC, Mac, Cassette Player, VCR Player, VHS, DVD Player, and Touch Panel Monitor) enhances my learning experience in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
10. I learn more when I am taught in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
11. Having a class in a multimedia classroom improves my learning.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
12. I expect higher grades when I am taking a class in a multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
13. My instructor delivers course contents by using different technologies in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
14. My instructor is well organized.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
15. My instructor is interested in individual needs and interests.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
16. My instructor encourages participation in discussion and interacts with everyone.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
17. My instructor holds my interest in class.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
18. I have the knowledge and skills needed to use appropriate computer applications for my class projects and presentations.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
19. I use computer-assisted instruction or other computer-based applications outside of class.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
20. I have access to a computer whenever necessary.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree

21. It is important that ETSU use the Student technology Access Fee to develop multimedia classroom to facilitate the use of technology.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

22. I would prefer to take a course from an instructor who uses technology in class.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

23. I would take another course in multimedia classroom.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

24. Do you have any other comments based on your personal experience and observation about multimedia classroom? If so, please provide them below.

APPENDIX B

Traditional Classroom Survey

Part One: Learning Styles Survey

The VARK Questionnaire – How Do I Learn Best? Choose the answer which best explains your preference and circle the letter. Please circle more than one if a single answer doesn't match your perception.

1. You are about to give directions to a person who is standing with you. She is staying in a hotel in town and wants to visit your house later. She has a rental car. I would:
 - a. draw a map on paper
 - b. tell her the directions
 - c. write down the directions (without a map)
 - d. collect her from the hotel in my car

2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. I would:
 - a. look it up in the dictionary.
 - b. see the word in my mind and choose by the way it looks
 - c. sound it out in my mind.
 - d. write both versions down on paper and choose one.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. I would:
 - a. phone her immediately and tell her about it.
 - b. send her a copy of the printed itinerary.
 - c. show her on a map of the world.
 - d. share what I plan to do at each place I visit.

4. You are going to cook something as a special treat for your family. I would:
 - a. cook something familiar without the need for instructions.
 - b. thumb through the cookbook looking for ideas from the pictures.
 - c. refer to a specific cookbook where there is a good recipe.

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5. A group of tourists has been assigned to you to find out about wildlife reserves or parks. I would:
- drive them to a wildlife reserve or park.
 - show them slides and photographs
 - give them pamphlets or a book on wildlife reserves or parks.
 - give them a talk on wildlife reserves or parks.
6. You are about to purchase a new stereo. Other than price, what would most influence your decision?
- the salesperson telling you what you want to know.
 - reading the details about it.
 - playing with the controls and listening to it.
 - it looks really smart and fashionable.
7. Recall a time in your life when you learned how to do something like playing a new board game. Try to avoid choosing a very physical skill, e.g. riding a bike. I learnt best by:
- visual clues -- pictures, diagrams, charts
 - written instructions.
 - listening to somebody explaining it.
 - doing it or trying it.
8. You have an eye problem. I would prefer the doctor to:
- tell me what is wrong.
 - show me a diagram of what is wrong.
 - use a model to show me what is wrong.
9. You are about to learn to use a new program on a computer. I would:
- sit down at the keyboard and begin to experiment with the program's features.
 - read the manual which comes with the program.
 - telephone a friend and ask questions about it.
10. You are staying in a hotel and have a rental car. You would like to visit friends whose address/location you do not know. I would like them to:
- draw me a map on paper.
 - tell me the directions.
 - write down the directions (without a map).
 - collect me from the hotel in their car.

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11. Apart from the price, what would most influence your decision to buy a particular textbook?:

- a. I have used a copy before.
- b. a friend talking about it.
- c. quickly reading parts of it.
- d. the way it looks is appealing.

12. A new movie has arrived in town. What would most influence your decision to go (or not go)?

- a. I heard a radio review about it
- b. I read a review about it.
- c. I saw a preview of it.

13. Do you prefer a lecturer or teacher who likes to use:?

- a. a textbook, handouts, readings
- b. flow diagrams, charts, graphs.
- c. field trips, labs, practical sessions.
- d. discussion, guest speakers.

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Part Two: Classroom Satisfaction Survey

Direction: Please circle the letter of the answer which best describes you.

1. I am a:
a. Freshman b. Sophomore c. Junior d. Senior e. Graduate student.
2. I am:
a. Female b. Male.
3. My age group is:
a. 18-23 b.24-30 c.31-39 d.40-49 e.50-59 f. 60 over.
4. My academic major is: _____.(Please write in your major.)
5. The blackboard/whiteboard in the classroom is satisfactory.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

6. The acoustics in the classroom are satisfactory.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
7. The presentation equipment (overhead, etc.) installed in the classroom is satisfactory.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
8. More audio and video equipment is needed for teaching and learning in the classroom.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
9. I could learn more if my instructor could use technology in the classroom.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
10. Having a class in a multimedia classroom improves my learning.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
11. I expect higher grades when I am taking a class in a multimedia classroom.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
12. My instructor delivers course content by using different technologies in the classroom.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
13. My instructor is well organized.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
14. My instructor is interested in individual needs and interests.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
15. My instructor encourages participation in discussion and interacts with everyone.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
16. My instructor holds my interest in class.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
17. I have the knowledge and skills needed to use appropriate computer applications for my class projects and presentations.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
18. I use computer-assisted instruction or other computer-based applications outside of class.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
19. I have access to a computer whenever necessary.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

20. It is important that ETSU use the Student technology Access Fee to develop multimedia classroom to facilitate the use of technology.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

21. I would prefer to take a course from an instructor who uses technology in class.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

22. I would take some courses in multimedia classroom in the future.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

23. Do you have any other comments based on your personal experience and observation about the differences between multimedia classroom and other classrooms? If so, please provide them below.

APPENDIX C

Pilot Survey A: Multimedia Classroom Survey

Part One: Learning Styles Survey

The VARK Questionnaire – How Do I Learn Best? Choose the answer which best explains your preference and circle the letter. Please circle more than one if a single answer doesn't match your perception.

1. You are about to give directions to a person who is standing with you. She is staying in a hotel in town and wants to visit your house later. She has a rental car. I would:

- a. draw a map on paper
- b. tell her the directions
- c. write down the directions (without a map)
- d. collect her from the hotel in my car

2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. I would:

- a. look it up in the dictionary.
- b. see the word in my mind and choose by the way it looks
- c. sound it out in my mind.
- d. write both versions down on paper and choose one.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. I would:

- a. phone her immediately and tell her about it.
- b. send her a copy of the printed itinerary.
- c. show her on a map of the world.
- d. share what I plan to do at each place I visit.

4. You are going to cook something as a special treat for your family. I would:

- a. cook something familiar without the need for instructions.
- b. thumb through the cookbook looking for ideas from the pictures.
- c. refer to a specific cookbook where there is a good recipe.

5. A group of tourists has been assigned to you to find out about wildlife reserves or parks. I would:

- a. drive them to a wildlife reserve or park.
- b. show them slides and photographs

- c. give them pamphlets or a book on wildlife reserves or parks.
 - d. give them a talk on wildlife reserves or parks.
6. You are about to purchase a new stereo. Other than price, what would most influence your decision?
- a. the salesperson telling you what you want to know.
 - b. reading the details about it.
 - c. playing with the controls and listening to it.
 - d. it looks really smart and fashionable.
7. Recall a time in your life when you learned how to do something like playing a new board game. Try to avoid choosing a very physical skill, e.g. riding a bike. I learnt best by:
- a. visual clues -- pictures, diagrams, charts
 - b. written instructions.
 - c. listening to somebody explaining it.
 - d. doing it or trying it.
8. You have an eye problem. I would prefer the doctor to:
- a. tell me what is wrong.
 - b. show me a diagram of what is wrong.
 - c. use a model to show me what is wrong.
9. You are about to learn to use a new program on a computer. I would:
- a. sit down at the keyboard and begin to experiment with the program's features.
 - b. read the manual which comes with the program.
 - c. telephone a friend and ask questions about it.
10. You are staying in a hotel and have a rental car. You would like to visit friends whose address/location you do not know. I would like them to:
- a. draw me a map on paper.
 - b. tell me the directions.
 - c. write down the directions (without a map).
 - d. collect me from the hotel in their car.
11. Apart from the price, what would most influence your decision to buy a particular textbook?:
- a. I have used a copy before.
 - b. a friend talking about it.
 - c. quickly reading parts of it.
 - d. the way it looks is appealing.

12. A new movie has arrived in town. What would most influence your decision to go (or not go)?

- a. I heard a radio review about it
- b. I read a review about it.
- c. I saw a preview of it.

13. Do you prefer a lecturer or teacher who likes to use:?

- a. a textbook, handouts, readings
- b. flow diagrams, charts, graphs.
- c. field trips, labs, practical sessions.
- d. discussion, guest speakers.

Part Two: Multimedia Classroom Satisfaction Survey

Direction: Please circle the letter of the answer which best describes you.

1. I am a:

- b. Freshman b. Sophomore c. Junior d. Senior e. Graduate student.

2. I am:

- c. Female b. Male.

3. My age group is:

- a.18-23 b.24-30 c.31-39 d.40-49 e.50-59 f. 60 over.

4. My academic major is: _____.(Please write in your major.)

4. The internet connection on my desk in the multimedia classroom is satisfactory.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

5. The Smartboard system in the multimedia classroom is satisfactory.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

6. The acoustics in the multimedia classroom are satisfactory.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

7. I am satisfied with the video conferencing equipment and Projector installed in multimedia classroom.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

8. The equipment (PC, Mac, Cassette Player, VCR Player, VHS, DVD Player, and Touch Panel Monitor) enhances my learning experience in multimedia classroom.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

9. I learn more when I am taught in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
10. Having a class in a multimedia classroom improves my learning.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
11. I expect higher grades when I am taking a class in a multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
12. My instructor delivers course content by using different technologies in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
13. My instructor is well organized.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
14. My instructor is interested in individual needs and interests.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
15. My instructor encourages participation in discussion and interacts with everyone.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
16. My instructor holds my interest in class.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
17. I have the knowledge and skills needed to use appropriate computer applications for my class projects and presentations.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
18. I often use computer assisted instruction or other computer based applications outside of class.
 - a. Often
 - b. Sometimes
 - c. Seldom
 - d. Never
19. I have access to a computer whenever necessary.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
20. It is important that ETSU use the Student technology Access Fee to develop multimedia classroom to facilitate the use of technology.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
21. I would prefer to take a course from an instructor who uses technology in class.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
22. I would take another course in multimedia classroom.
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree

23. Do you have any other comments based on your personal experience and observation about multimedia classroom? If so, please provide them below.

A large, empty rectangular box with a thin black border, intended for the respondent to provide their comments on multimedia classrooms.

APPENDIX D

Pilot Survey B: Classroom Survey

Part One: Learning Styles Survey

The VARK Questionnaire – How Do I Learn Best? Choose the answer which best explains your preference and circle the letter. Please circle more than one if a single answer doesn't match your perception.

1. You are about to give directions to a person who is standing with you. She is staying in a hotel in town and wants to visit your house later. She has a rental car. I would:

- a. draw a map on paper
- b. tell her the directions
- c. write down the directions (without a map)
- d. collect her from the hotel in my car

2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. I would:

- a. look it up in the dictionary.
- b. see the word in my mind and choose by the way it looks
- c. sound it out in my mind.
- d. write both versions down on paper and choose one.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. I would:

- a. phone her immediately and tell her about it.
- b. send her a copy of the printed itinerary.
- c. show her on a map of the world.
- d. share what I plan to do at each place I visit.

4. You are going to cook something as a special treat for your family. I would:

- a. cook something familiar without the need for instructions.
- b. thumb through the cookbook looking for ideas from the pictures.
- c. refer to a specific cookbook where there is a good recipe.

5. A group of tourists has been assigned to you to find out about wildlife reserves or parks. I would:

- a. drive them to a wildlife reserve or park.
- b. show them slides and photographs
- c. give them pamphlets or a book on wildlife reserves or parks.
- d. give them a talk on wildlife reserves or parks.

6. You are about to purchase a new stereo. Other than price, what would most influence your decision?
- the salesperson telling you what you want to know.
 - reading the details about it.
 - playing with the controls and listening to it.
 - it looks really smart and fashionable.
7. Recall a time in your life when you learned how to do something like playing a new board game. Try to avoid choosing a very physical skill, e.g. riding a bike. I learnt best by:
- visual clues -- pictures, diagrams, charts
 - written instructions.
 - listening to somebody explaining it.
 - doing it or trying it.
8. You have an eye problem. I would prefer the doctor to:
- tell me what is wrong.
 - show me a diagram of what is wrong.
 - use a model to show me what is wrong.
9. You are about to learn to use a new program on a computer. I would:
- sit down at the keyboard and begin to experiment with the program's features.
 - read the manual which comes with the program.
 - telephone a friend and ask questions about it.
10. You are staying in a hotel and have a rental car. You would like to visit friends whose address/location you do not know. I would like them to:
- draw me a map on paper.
 - tell me the directions.
 - write down the directions (without a map).
 - collect me from the hotel in their car.
11. Apart from the price, what would most influence your decision to buy a particular textbook?:
- I have used a copy before.
 - a friend talking about it.
 - quickly reading parts of it.
 - the way it looks is appealing.

12. A new movie has arrived in town. What would most influence your decision to go (or not go)?

- a. I heard a radio review about it
- b. I read a review about it.
- c. I saw a preview of it.

13. Do you prefer a lecturer or teacher who likes to use:?

- a. a textbook, handouts, readings
- b. flow diagrams, charts, graphs.
- c. field trips, labs, practical sessions.
- d. discussion, guest speakers.

Part Two: Classroom Satisfaction Survey

Direction: Please circle the letter of the answer which best describes you.

2. I am a:

- a. Freshman b. Sophomore c. Junior d. Senior e. Graduate student.

2. I am:

- a. Female b. Male.

3. My age group is:

- a.18-23 b.24-30 c.31-39 d.40-49 e.50-59 f. 60 over.

4. My academic major is:_____.(Please write in your major.)

2. The blackboard/whiteboard in the classroom is satisfactory.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

3. The acoustics in the classroom are satisfactory.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

4. The presentation equipment (overhead, etc.) installed in the classroom is satisfactory.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

5. More audio and video equipment is needed for teaching and learning in the classroom.

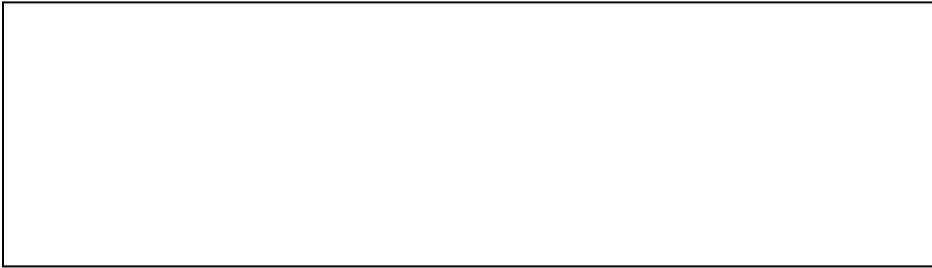
- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

6. I could learn more if my instructor could use technology in the classroom.

- a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

7. Having a class in a multimedia classroom improves my learning.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
8. I expect higher grades when I am taking a class in a multimedia classroom.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
9. My instructor delivers course content by using different technologies in the classroom.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
10. My instructor is well organized.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
11. My instructor is interested in individual needs and interests.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
12. My instructor encourages participation in discussion and interacts with everyone.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
13. My instructor holds my interest in class.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
14. I have the knowledge and skills needed to use appropriate computer applications for my class projects and presentations.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
15. I often use computer assisted instruction or other computer based applications outside of class.
a. Often b. Sometimes c. Seldom d. Never
16. I have access to a computer whenever necessary.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
17. It is important that ETSU use the Student technology Access Fee to develop multimedia classroom to facilitate the use of technology.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
18. I would prefer to take a course from an instructor who uses technology in class.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree
19. I would take some courses in multimedia classroom in the future.
a. Strongly Agree b. Agree c. Neutral d. Disagree e. Strongly Disagree

20. Do you have any other comments based on your personal experience and observation about the differences between multimedia classroom and other classrooms? If so, please provide them below.

A large, empty rectangular box with a thin black border, intended for the respondent to provide their comments on the differences between multimedia classrooms and other classrooms.

APPENDIX E

Class List

| Titles | Enrollments | Instructor | Classrooms |
|---------------|-------------|------------|------------|
| ENTC-4060-001 | 20 | Coffey | MC |
| ENTC-4060-002 | 25 | Hemphill | TC |
| ECON-2080-001 | 34 | Rochelle | TC |
| ECON-2080-002 | 29 | Shelley | MC |
| ECON-2080-003 | 32 | Shelley | MC |
| ECON-2080-201 | 30 | Rochelle | MC |
| ACCT-2010-001 | 41 | Becker | TC |
| ACCT-2010-002 | 40 | Becker | TC |
| ACCT-2010-003 | 27 | McKee | MC |
| ACCT-2010-004 | 40 | Becker | TC |
| ACCT-2010-005 | 32 | McKee | MC |
| ACCT-2010-201 | 20 | McKee | TC |
| MGMT-3100-001 | 37 | Brown | TC |
| MGMT-3100-002 | 37 | Swinehart | MC |
| MGMT-3100-201 | 38 | Swinehart | MC |
| MGMT-3220-003 | 18 | Jang | TC |
| MGMT-3220-201 | 34 | Quigley | MC |

Note: MC stands for multimedia classrooms; TC stands for traditional classrooms.

APPENDIX F

Letter to Pilot Study Participants

Feb. 2002
ETSU Box: 14022
Johnson City
TN/37614
Phone: 423-433-3472
E-mail: zsz3@etsu.edu

Dear Colleagues/Friends:

I am a doctoral candidate from the Department of Educational Leadership and Policy Analysis (ELPA) at East Tennessee State University (ETSU) under supervision of Dr. Hal Knight. My dissertation topic is on the students' perceptions of multimedia classroom at ETSU regarding learning achievements, instructional methods, and instructional technologies.

In order to obtain data from students, a survey is developed. Before the real survey is administered, a pilot survey is necessary to test its validity and reliability for further modifications. Your participation in this pilot survey and willingness to do the critique are greatly appreciated. I would be so honored by your professional expertise you offer.

The following is the detailed procedure:

1. record your time to complete the survey.
2. complete the survey.
3. criticize the survey.
4. fill in all your information on the document I provided.

Thank you so much!

Respectfully,

<<Signature>>

Shouhong Zhang

APPENDIX G

Pilot Study Critique Form

1. This survey took approximately _____ minutes to complete.
2. What suggestions you would offer on the format of this survey?
3. Which item(s) should be deleted?
4. Which item(s) should be added?
5. Which item(s) should modified?
6. Do you have any suggestions for improvement? If so, please share them. Thanks!

APPENDIX H

Letter to Chairs

Dr. <<First Name Last Name>>, Chair
Department of <<Department>>
College of <<College>>
P.O. Box <<Number>>
East Tennessee State University
Johnson City, TN 37614

Dear Dr. Last Name:

As you are well aware, ETSU has devoted a fairly large amount of resources from student TAF (Technology Access Fee) funds to increase the number of multimedia classrooms available on campus. While these improvements have certainly increased the access that students and faculty have to these kinds of facilities, there is little research that has addressed student perceptions of the educational gains to be made in multimedia classrooms versus traditional classrooms. There is even less research that explores the impact played by individual student learning styles on their perceptions of the effectiveness of multimedia classrooms.

As part of my dissertation research which is being supervised by Dr. Hal Knight, I want to survey students who are enrolled in courses that have both traditional and multimedia sections to ascertain student perceptions about the quality of their instruction and the impact that the technology has had on their study. Your department has a course, <<course name>>, that meets these requirements. I would like your permission to contact <<<instructor's name>>> and ask that he or she permit me to survey students in the class. The surveys will take

approximately <<number of minutes>>> minutes to complete. The survey and the accompanying informed consent forms have been approved by the ETSU IRB. Students may choose not to complete the surveys.

Please let me know by e-mail if I have your permission to contact <<name of instructor>>>. I would be pleased to provide you with a copy of the results of my study. Just mention that you would like a copy in your e-mail to me.

Thank you for your help with this research project.

Sincerely yours,

<<Signature>>

Shouhong Zhang

APPENDIX I

Letter to Instructors

Dr. <<First Name Last Name>>, Professor
Department of <<Department>>
College of <<College>>
P.O. Box <<Number>>
East Tennessee State University
Johnson City, TN 37614

Dear Dr. <<Last Name>>:

As you may be aware, ETSU has devoted a fairly large amount of resources from student TAF (Technology Access Fee) funds to increase the number of multimedia classrooms available on campus. While these improvements have certainly increased the access that students and faculty have to these kinds of facilities, there is little research that has addressed student perceptions of the educational gains to be made in multimedia classrooms versus traditional classrooms. There is even less research that explores the impact played by individual student learning styles on their perceptions of the effectiveness of multimedia classrooms.

As part of my dissertation research which is being supervised by Dr. Hal Knight, I want to survey students who are enrolled in courses that have both traditional and multimedia sections to ascertain student perceptions about the quality of their instruction and the impact that the technology has had on their study. This semester you are teaching a course, <<course name>>, that meets these requirements. I would like your permission to survey students in the class during <<timeframe>>. The surveys will take approximately <<number of minutes>> minutes

to complete. The survey and the accompanying informed consent forms have been approved by the ETSU IRB. Students may choose not to complete the surveys.

Please let me know by e-mail if I have your permission to administer the survey to your class.

There are several ways that I can do this: 1. you administer in class; 2. I administer in class; 3. I administer in class with your presence. I would be pleased to provide you with a copy of the results of my study. Just mention that you would like a copy in your e-mail to me.

Thank you for your help with this research project.

Sincerely yours,

<<Signature>>

Shouhong Zhang

APPENDIX J

Consent Form

This Informed Consent will explain about being a research subject in an experiment. It is important that you read this material carefully and then decide if you wish to be a volunteer.

PRINCIPAL INVESTIGATOR: Shouhong Zhang

TITLE OF PROJECT: Perceptions of students at East Tennessee State University regarding learning achievements, instructional methods, and instructional technologies in multimedia classrooms

PURPOSE: The purpose of this study is to obtain data from students enrolled in spring 2002 in multimedia classrooms and traditional classrooms at East Tennessee State University to compare the differences in students' perceptions regarding learning achievements, instructional methods, and instructional technologies.

DURATION: This survey will take 5 to 10 minutes to complete.

PROCEDURE: Survey is to be completed in class.

POSSIBLE RISKS/DISCOMFORTS: None.

POSSIBLE BENEFITS AND/OR COMPENSATION: Learning styles could be identified; ETSU could improve technology in classrooms.

CONTACT QUESTIONS: If you have any questions, problems or research-related medical problems at any time, you may call Shouhong Zhang or Dr. Hal Knight. You may call the Chairman of the Institutional Review Board for any questions you may have about your rights as a research subject.

CONFIDENTIALITY: Every attempt will be made to see that my study results are kept confidential. A copy of the records from this study will be stored in the Department of Educational Leadership and Policy Analysis and investigator's safe case for at least 10 years after the end of this research. The results of this study may be published and/or presented at meetings without naming me as a subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the East Tennessee State University Institutional Review Board, the Food and Drug Administration, and the ETSU Department of Educational Leadership and Policy Analysis have access to the study records. My records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.

VOLUNTARY PARTICIPATION: The nature demands, risks, and benefits of the project have been explained to me as well as are known and available. I understand what my participation involves. Furthermore, I understand that I am free to ask questions and withdraw from the project at any time, without penalty. I have read, or have had read to me, and fully understand the consent form. I sign it freely and voluntarily. A signed copy has been given to me. Your study record will be maintained in strictest confidence according to current legal requirements and will not be revealed unless required by law or as noted above.

SIGNATURE OF VOLUNTEER

DATE

SIGNATURE OF INVESTIGATOR

DATE

APPENDIX K

VARK

VARK

The VARK Questionnaire - English Version (version 3) How Do I Learn Best?

This questionnaire aims to find out something about your preferences for the way you work with information. You will have a preferred learning style and one part of that learning style is your preference for the intake and output of ideas and information.

Choose the answer which best explains your preference and circle the letter next to it. Please circle more than one if a single answer does not match your perception.

Leave blank any question which does not apply, but try to give an answer for at least 10 of the 13 questions

When you have completed the questionnaire, use the marking guide to find your score for each of the categories, Visual, Aural, Read/Write and Kinesthetic. Then, to calculate your preference, use the Scoring sheet (available in the “advice to teachers” section of the VARK web site).

1. You are about to give directions to a person who is standing with you. She is staying in a hotel in town and wants to visit your house later. She has a rental car. I would:
 - a. draw a map on paper
 - b. tell her the directions
 - c. write down the directions (without a map)
 - d. collect her from the hotel in my car

2. You are not sure whether a word should be spelled 'dependent' or 'dependant'. I would:
 - a. look it up in the dictionary.
 - b. see the word in my mind and choose by the way it looks
 - c. sound it out in my mind.
 - d. write both versions down on paper and choose one.

3. You have just received a copy of your itinerary for a world trip. This is of interest to a friend. I would:
 - a. phone her immediately and tell her about it.
 - b. send her a copy of the printed itinerary.
 - c. show her on a map of the world.
 - d. share what I plan to do at each place I visit.

4. You are going to cook something as a special treat for your family. I would:
- cook something familiar without the need for instructions.
 - thumb through the cookbook looking for ideas from the pictures.
 - refer to a specific cookbook where there is a good recipe.
5. A group of tourists has been assigned to you to find out about wildlife reserves or parks. I would:
- drive them to a wildlife reserve or park.
 - show them slides and photographs
 - give them pamphlets or a book on wildlife reserves or parks.
 - give them a talk on wildlife reserves or parks.
6. You are about to purchase a new stereo. Other than price, what would most influence your decision?
- the salesperson telling you what you want to know.
 - reading the details about it.
 - playing with the controls and listening to it.
 - it looks really smart and fashionable.
7. Recall a time in your life when you learned how to do something like playing a new board game. Try to avoid choosing a very physical skill, e.g. riding a bike. I learnt best by:
- visual clues -- pictures, diagrams, charts
 - written instructions.
 - listening to somebody explaining it.
 - doing it or trying it.
8. You have an eye problem. I would prefer the doctor to:
- tell me what is wrong.
 - show me a diagram of what is wrong.
 - use a model to show me what is wrong.
9. You are about to learn to use a new program on a computer. I would:
- sit down at the keyboard and begin to experiment with the program's features.
 - read the manual which comes with the program.
 - telephone a friend and ask questions about it.
10. You are staying in a hotel and have a rental car. You would like to visit friends whose address/location you do not know. I would like them to:
- draw me a map on paper.
 - tell me the directions.

- c. write down the directions (without a map).
- d. collect me from the hotel in their car.

11. Apart from the price, what would most influence your decision to buy a particular textbook?:

- a. I have used a copy before.
- b. a friend talking about it.
- c. quickly reading parts of it.
- d. the way it looks is appealing.

12. A new movie has arrived in town. What would most influence your decision to go (or not go)?

- a. I heard a radio review about it
- b. I read a review about it.
- c. I saw a preview of it.

13. Do you prefer a lecturer or teacher who likes to use:?

- a. a textbook, handouts, readings
- b. flow diagrams, charts, graphs.
- c. field trips, labs, practical sessions.
- d. discussion, guest speakers.

APPENDIX L

Permission Letter from Dr. N. D. Fleming

SHOUHONG ZHANG
ETSU BOX: 14022
Johnson City
TN 37614
U.S.A.

This is to certify that Shouhong Zhang of Johnson City, Tennessee is permitted to use the VARK Inventory in his dissertation.

Neil D Fleming
Copyright holder
VARK Inventory
50 Idris Road
Christchurch
NEW ZEALAND

APPENDIX M

VARK Scoring Chart (English)

VARK

The VARK Questionnaire - English Version Scoring Chart

Use the following scoring chart to find the VARK category that each of your answers corresponds to. Circle the letters that correspond to your answers.

e.g. If you answered b and c for question 3, circle R and V in the question 3 row.

| Question | a category | b category | C category | d category |
|----------|------------|------------|------------|------------|
| | A | R | V | K |

Scoring Chart

| Question | a category | b category | c category | d category |
|----------|------------|------------|------------|------------|
| | V | A | R | K |
| | R | V | A | K |
| | A | R | V | K |
| | K | V | R | |
| | K | V | R | A |
| | A | R | K | V |
| | V | R | A | K |
| | A | V | K | |
| | K | R | A | |
| | V | A | R | K |
| | K | A | R | V |
| | A | R | V | |
| | R | V | K | A |

Calculating your scores

Count the number of each of the VARK letters you have circled to get your score for each VARK category.

Total number of **V**s circled =

Total number of **A**s circled =

Total number of **R**s circled =

Total number of **K**s circled =

Calculating your preferences

Use the “Scoring Instructions” sheet (available in the “advice to teachers” section of the VARK web site) to work out your VARK learning preferences.

APPENDIX N

Approval Letter from IRB

Friday, March 29, 2002

Shouhong Zhang

Educational Leadership & Policy Analysis 70,550

RE: Perceptions of Students at East Tennessee State University Regarding Learning Achievements, Instructional Methods, and Instructional Technologies in Multimedia Classrooms

IRB No.: c01-190e

I reviewed the above-referenced study and find that it qualifies as exempt from coverage under the federal guidelines for protection of human objects as referenced as Title 45—Part 46.101.

If you feel it is necessary to call further IRB attention to any aspects of this study, please refer to the above-titled project and IRB number. I appreciate your bringing this project before the IRB for its concurrence of exempt status.

Sincerely,

(Signature)

James Fox, III, Ph.D.

Chair – ETSU CAMPUS

Institutional Review Board

Exemption Reference: 450CFR46.101(b)(1)

APPENDIX O

List of Disciplines of Study

| Discipline of Study | Number |
|----------------------------|--------|
| Accounting | 48 |
| Business Management | 84 |
| Construction Technology | 15 |
| Digital Media | 12 |
| Economics | 3 |
| Education | 3 |
| English | 3 |
| Finance | 54 |
| Health | 1 |
| History | 1 |
| Human Resources Management | 1 |
| Industrial Technology | 10 |
| Interior Merchandising | 1 |
| Marketing | 53 |
| Medicine | 2 |
| Physical Education | 1 |
| Psychology | 1 |
| Spanish | 1 |
| Undeclared | 3 |

VITA

SHOUHONG ZHANG

Personal Data: Date of Birth: April 5, 1972
 Place of Birth: Shandong, China
 Marital Status: Married

Education: Southwest China Normal University
 Chongqing, China
 English Teaching, B.A., 1995
 Sichuan International Studies University
 Chongqing, China
 Linguistics, M.A., 1999
 East Tennessee State University
 Johnson City, TN, U.S.
 Educational Leadership and Policy Analysis, Ed.D., 2002

Professional
Experiences: Lecturer, Southwest University of Finance and Economics
 Chengdu, China
 1995 – 1999
 Doctoral Fellow, East Tennessee State University
 Johnson City, TN, U.S.
 1999 – 2002