UNDERGRADUATE STUDENT ATTITUDE AND ACCEPTANCE OF COMPUTER ENHANCED INSTRUCTION IN A COLLEGE NUTRITION COURSE

by

Geraldine E. Iwanski

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Carol Seaborn, PhD, RD, CD

The Graduate College
University of Wisconsin-Stout
July, 2000

The Graduate College
University of Wisconsin – Stout
Menomonie, Wisconsin 54751

ABSTRACT

	Iwanski	Geraldine	E
(Writer)	(Last Name)	(First)	(Initial)

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The purpose of this study was to determine whether computer enhanced instructions (CEI) was more favorable to student acceptance than traditional transparency over-heads. Eighty-two undergraduate students enrolled in the Nutrition for Hospitality course participated in the study. Students were presented lectures utilizing over-head transparencies alternating with lectures using computer- generated images, which would be duplicates of the pictures and content of the transparencies. The survey instrument presented as a Likert scale with students rating their preference of presentation method for seventeen statements. The survey instrument was completed early in the semester, at midterm and at the end of the semester. Statistical analyses were completed using t-tests. When the students rated questions 1 – 17 early

in the semester, the most notable finding was the non-significant difference between the transparencies and computer images for the statement; “allowed me to keep up easier”. However, the ratings for the sixteen remaining survey statements were highly significant ($p=0.0001$) indicating that subjects strongly preferred the computer images rather than the transparencies. Similar results were found at mid-semester and at the end of the semester for all sixteen statements with students intensely preferring the computer enhanced instruction. These results confirm that CEI was significantly preferred when compared to traditional instruction. The implication for the nutrition educator is that incorporating multimedia into the nutrition classroom appears to contribute to increased student enthusiasm and satisfaction. This may translate into higher evaluations of both the course and the instructor.

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1. INTRODUCTION

We are living in a technology driven world. It is fair to say that most of us utilize technology in the majority of our daily living activities from the remote control and compact disc player to fax machines and lap top computers. Computers are now so commonplace in advanced countries of the world that their absence is more remarkable than their presence. To the younger generation computers have become a natural part of their environment; they are almost akin to furniture - undistinguished among a display of electronic appliances, gadgets and home electronic devices. Because the trend towards the use of technology in education continues to accelerate, computers have become a standard part of many aspects of schooling and can be found in most classrooms.

As more and more activities in the classroom are delivered with the use of computers, teachers are beginning to understand that these tools are more complex and more capable than other media such as filmstrips or overheads. Computer systems are increasingly being used to integrate what once were stand-alone devices e.g., video and audio. Educators are now introducing more and various forms of software and computer driven media into their classroom activities (Tolhurst 1995).

Hypertext, hypermedia, multimedia, and integrated media are examples of the kinds of organizational, retrieval, and presentation systems that are being incorporated. These creative presentation systems are producing a great deal of excitement among educators. At the same time, there is confusion as to how to best incorporate these systems in to existing academia (Allred and Locatis 1989).

As educational institutions rely on computers to modify the teaching and learning processes, critics of multimedia debate the effectiveness of technology in education. The effectiveness of multimedia depends on how it was used in relation to instruction. In studies where multimedia was used to supplement regular instruction, gains in achievement were fairly consistent. When multimedia was substituted for traditional instruction, achievement results were mixed (Williams and Brown 1990). Schools that have included technology into the traditional curriculum report to have higher student attendance and lower drop out rates, which in turn leads to greater academic results (Fisher 1999).

Some researchers suggest that the use of technology in the classroom can enhance student learning. A university of Michigan study reported that when computers are available to students, the children gained the equivalent of 3 months of instruction per school year. Twenty years of research show that multimedia enhanced learning produces at least 30% more learning in 40% less time at 30% lower cost. When a computer is used for multimedia methods of instruction, retention is raised to 80% in contrast to 40% for discussion methods or 20% with the traditional lecture approach using visual aids (White and Kuhn 1997). Other reports suggest that multimedia presentations can improve students' understanding, enthusiasm, class attendance and satisfaction. A study performed by Butler and Mautz (1996) examined the impact of a multimedia presentation on recall in a controlled setting. The results indicate that multimedia does not uniformly lead to higher recall, but that students who prefer to represent information graphically (as did the majority of the subjects in the study) benefit from the multimedia presentation. In addition, more positive attitudes towards the presenter and presentation style are associated with multimedia. Subjects in the multimedia group enjoyed the presentation more, found it more understandable and believed that it taught them concepts better than did the subjects in the traditional group. Further review of the literature indicates that students in a computer-enhanced course understood course materials better than students in earlier course sections without the benefit of computer enhancement. Others report that students are more motivated and attend class more regularly (Butler and Mautz 1996).

When technology is fundamental to and firmly established into the curriculum, it can be a powerful tool in helping students achieve higher levels of expertise. Technology extends the scope and depth of existing curriculum beyond what can be offered with traditional print resources. It appears that some concepts and understandings are better illustrated and understood with the use of multimedia. Research has identified that students prefer to attend classes that utilize multimedia presentations because they find class to be more interesting and exciting with multimedia.

Multimedia offers remarkable opportunities and equally remarkable challenges for teaching nutrition. To enhance technological efforts in nutrition education educators must become familiar with new computer technologies. In addition, teachers in this new computer technology-intensive environment need to continue to develop their computer skills in order to be successful. Nutrition educators are also encouraged to examine the opportunities and challenges of new technologies to enhance their work/teaching styles.

2. RESEARCH HYPOTHESIS

A review of scientific and popular literature indicates that computer enhanced instruction (CEI) has become an accepted method of teaching throughout all levels of education. Computer enhanced instruction users believe that CEI is as effective as traditional instruction in helping students learn to do the following:

1. Allowing for better understanding of the material.
2. Facilitating interaction between student and instructor.
3. Making better use of examples and illustrations.
4. Holding attention longer.
5. Easier to comprehend and to retain information.
6. Allowing for easier note taking.
7. Stressing important and relevant information.

Therefore, the null hypothesis for this study is that undergraduate students enrolled in an introductory nutrition course would not accept and prefer computer enhanced instruction over traditional overheads to assist in their understanding of lecture concepts.

3. STATEMENT OF THE PROBLEM

The purpose of this study was to describe the variation in computer enhanced instruction attitudes and preference within a group of undergraduate students enrolled in an introductory nutrition course as measured by a survey instrument.

The specific objectives of the study were:

1. To determine if responses of the nutrition class starting at the beginning of the semester were significantly different compared to responses at midterm and at the end of the semester to the instructional method used.

2. To determine if the response to the type of presentation varied by gender over the course of the semester.

3. To determine if responses of preference among students, classified as freshmen, sophomores, juniors and seniors, varied over the course of the semester.

4. To determine if the number of respondents preferring the computer enhanced instruction was significantly different than the number of respondents preferring transparencies.

4. REVIEW OF THE LITERATURE

4.1 Learning Defined

Learning is a method of creating new knowledge building upon current knowledge. As learning occurs, increasingly well-structured and qualitatively different foundations of knowledge develop. Planned knowledge is not just a product of the amount of information received, but emulates exposure to an environment for learning where there are opportunities for problem solving, interpreting, working in unfamiliar environments requiring transfer, and making connections between pertinent concepts. The conclusion to be made for the design of effective learning is as important as what is learned (Jones and Baxter 1999).

4. 2 Learner Characteristics

Individuals vary in their aptitudes for learning, their willingness to learn, and the styles or preferences for how they learn (Jonassen and Grabowski 1993). Review of the literature indicates learning takes place faster in an environment of multisensory reinforcement. While some students learn best by listening to the instructor, other students understand ideas most easily when they are presented visually. Research has found that 60 percent of people think in terms of visuals, 30 percent in terms of sounds, and 10 percent in terms of feelings (Gribas, Sykes, and Dorochoff 1996).

For the learner there are likely to be three different influences that have an impact on cognitive change: the learners existing knowledge and experience, the learners style or inclination to learning, as well as their acquired and individual approach to learning (Wild and Quin 1998). Learning styles and learning approaches represent two different viewpoints on student learning processes, each of which appear to influence scholastic success (Murray-Harvey 1994). Also, both are based on concepts that provide a structure for understanding how students learn and why there are differences between student's learning, in terms of learning outcomes.

Differences in learning styles are a result of such things as past life experiences and the demands of the present environment. Varying preferences for learning conditions combine to provide an individual learning style profile. For example, there is some insinuation that learners have a preference for the representational format they tend to think in. Indeed, learners have been distinguished on whether they are visual, auditory, or kinaesthetic learners. In addition, since preferences are largely pre-determined, a learner's learning style will inevitably be resistant to change, suggesting that teachers need to be aware of these differences and should address learners' preferred learning styles when planning to integrate technology into their classrooms (Murray-Harvey 1994).

4.3 Learning Styles

Learning styles of individual students are important to consider when using computer-enhanced instruction. The method may not be suitable for all learners. A study preformed by Oughton and Reed (2000) found that learning style and prior knowledge play an important role in how students learn with and about hypermedia.

One way to classify learning style is through brain atmosphere dominance. People with left-brain dominance are believed to be primarily auditory learners, and those with right brain dominance are believed to be primarily visual learners (Springer and

Deutsch 1981). Benedict and Coffeild (1989) studied the effect brain dominance has on learning through multimedia and traditional lecture. The same content was presented to each group using the two different methods. The data revealed that students with right-brain dominance scored higher in the multimedia group and left brain dominance students scored higher in the lecture group.

Another method of determining learning styles is through the use of Kolb's Learning Style Instrument. The learning style instrument is a 12-item self-report questionnaire that identifies students' preferred methods for perceiving and processing information and categorizes four basic ways of relating to the world as four types of learning styles: Accommodators, Assimilators, Convergers, and Divergers (Jonassen and Grabowski 1993). Accommodators learn through concrete experience and active experimentation. They carry out tasks and are easily adaptable. Assimilators are abstract conceptualizers and rely on reflective observation. They are strong in inductive reasoning and creating theoretical models. Convergers learn through abstract conceptualization and active experimentation. Their strengths are problem solving, decision making, and practical application of ideas. Divergers rely on concrete experience and reflective observation. They are highly imaginative and aware of relationships (Oughton and Reed 2000).

According to Kolb's classification, research has found that accommodators and divergers would benefit most from multimedia due to the concrete experiences multimedia programs provide (Khoiny 1995). Brudenell and Carpenter (1990) studied the attitudes of 40 nursing students towards computer-assisted instruction (CAI). Thirty-five percent of that group were divergers and 24% were accommodators. For that particular group of students, over half may have benefited from CAI. The other two learning style groups, assimilators and convergers, may have success with well designed, stimulating patient case studies. In another study, Carrier (1987) found that differences in learning styles were associated with preferences for type, frequency, and intensity of instructional feedback. Furthermore, it was found that computer based instruction was most effective when different learning styles and preferences were accommodated.

4.4 Multimedia Instruction Methods

As the use of educational technology increases, the terminology to describe learning technologies has expanded. The term learning technologies can be defined as "the use of electronic technologies to deliver information and facilitate the development of skills and knowledge" (Bassi, Cheney and Van Buren 1997). To many people this term creates some confusion because it combines a presentation method (how information is presented to learners, i.e., interactive TV, multimedia, audio, or video) with a delivery method (CD-ROMs, the Web, and audiotapes). In addition, a number of instructional methods (how information is taught to learners) can be used for any type of learning technology. Some instructional methods include computer-enhanced lectures, games or group discussions. Despite this confusion, all can agree that a unifying characteristic of learning technologies is that they seek to enhance the flexibility of learning options via electronic means (Bassi, Cheney and Van Buren 1997).

For those trying to understand the vocabulary of high-speed growing technology, the following definitions are offered as a means to eliminate any reader confusion (Ross and Moeller 1996).

Multimedia: A computer application that uses more than one medium (i.e., texts, graphs, motion video, still video, animation and sound) to deliver information.

Interactive multimedia: An extension of multimedia in that the users are given a chance to interact with the computer. However, users do not always have control over the sequence of information. Many times users are only able to control how long they spend on each screen.

Hypertext: The dissemination of text via electronic means. Hypertext consists of a segment of information that provides links to additional information allowing the user to immediately access related information. Users have the ability to control structure and content as well as pace and sequence. Hypertext should not be confused with multimedia or interactive multimedia, with hypertext the only medium involved in text.

Hypermedia: A combination of the features of multimedia, interactive multimedia and hypertext that can provide the viewers control over the sequence and content of the presentations.

Computer assisted instruction (CAI): This type of instruction can consist of drill and practice techniques, tutorial or dialogue. With drill and practice the computer is used to reinforce concepts introduced in the classroom. With the tutorial technique, the computer is used to introduce concepts as well as reinforce them. Dialogue presents lessons and practice exercises that allows the learner to ask questions (Williams and Brown 1990).

Computer enhanced instruction (CEI): Although a single established definition of CEI has not been formalized, effective CEI can be defined as the use of computers to enhance or enrich instruction as in lectures, demonstrations or simulations.

4.5 Presentation Components of Multimedia

Multimedia is made up of a number of communication channels; each having their own advantages and disadvantages. Velleman and Moore (1996) report that in order for any multimedia system to be successful, these channels must be in balance; using each for what it does best and not letting one channel dominate over the others.

One of the greatest benefits of the first communication channel, video, is its ability to take students beyond the classroom. Video can focus our attention through editing, and can manipulate time and space through time-lapse, slow motion, microscopic, or telescopic views. When these tools are used properly, a video presentation can be more compelling than direct observation.

Animation is another communication channel of multimedia. Animation can be defined as making objects on the screen change or move in real time. Research has shown that motion on the screen is important to holding viewer attention. Because of this, animation plays a major role in multimedia design.

A third channel of multimedia is narration. When it comes to narration, it appears as if engineers of multimedia have overlooked the value of oral presentations. A spoken narrative can be very effective in attaining attention when illustrated with animations and accompanied by an outline of key points.

Finally, one of the last multimedia channels is sound. The use of sound goes beyond narration with the ability to enrich the multimedia environment. Sound effects can contribute validity to animated objects or they can lighten the mood of a presentation that has grown too serious. In addition, sounds can make mnemonic morphs more memorable.

A growing body of research has identified students choosing to take different paths and using different media while acquiring information that allows them to perform at equivalent levels. For example, females have been shown to review videodisc segments more frequently and spend more time on tasks compared to the males in an interactive video learning environment. When an investigation of students' choice of media from within a hypermedia program was researched, results concluded that 56% of the students chose visual media, 30% chose text, while 14% chose auditory media (Ayersman 1996).

4.6 Technology In The Classroom

Computer technology provides an influential and multifaceted tool that can change the way we teach and the way students learn. In turn, there is an improved ability to search for abstract or complex material with increased student comprehension and interest (Matheson and Achterberg 1999).

Instructors should consider the nature of technology and the potential range of its uses in higher education. One potential use of computer-enhanced instruction at the college level is to complement lecture courses in ways in which the computer-enhanced instruction program reviews, reinforces, or adds to materials presented in class. This is accomplished by integrating a variety of media sources such as words, graphs, sound and visuals. The result is an improved ability to present abstract or complex material with increased student comprehension and interest (Kolasa and Miller 1996).

An expert in developmental education performed a meta-analysis of 500 individual studies examining the effect of computer-aided or computer-based instruction. The researchers concluded that students usually learn more in classes in which they receive computer-based instruction and that they learn their lessons in less time with computer based instruction (Skinner 1997).

Supporters of technology in the classroom often argue that a significant benefit of new technologies, as opposed to traditional texts, is that they allow students to learn in their own style and at their own pace. An additional argument is that CD-ROMs provide media and visually rich material that is more likely to correspond effectively with students' individual learning styles (Beerman, Brown and Evans 1998).

Presentation programs offer college teachers the possibility of preparing educational materials that combine the visual as well as the auditory modes of learning. If the presented materials read clearly, the design incorporates a visual analogy, and the graphic presentation uses sound principles of emphasis and harmony, computer-enhanced instruction can dramatically portray new ideas (Gribas, Sykes, and Dorochoff 1996).

Learning is a continuous process. However, the way instructors teach and students learn must be constantly reevaluated and updated. Teachers should be aware of the importance of using visuals to enhance information. Computer-enhanced instruction can be successful if faculty chooses to become leaders in the adoption of the use of technology to enhance lectures or presentations. The potential of technology is the ability of all students to learn at the highest levels with the greatest resources in order to have the promise of a future of real opportunity.

4.7 Lecturing with Technology

Research shows significant links between multimedia instruction and achievement in traditional subject matter. Schools that integrate technology into the traditional curriculum have higher student attendance and lower drop out rates, which leads to greater academic results (Fisher 1999).

It is believed that technology will continue to increase and become a standard part of the educational model. As this occurs, educators will have to put some of their traditional teaching techniques to the side to make room for multimedia. The old model of faculty lecture/student note taking has shown to be unsuccessful in making efficient use of faculty time for allocating information to large groups of learners or for learning by students with diverse backgrounds and skills (Nantz and Lundgren 1998).

Because students bring a wide variety of skills, backgrounds, interests, learning styles, and motivations to the classroom, the challenge for teachers is to try to match the presentation material to such a diverse audience. Technology can address this problem in several ways. At a basic level, the variety of presentations provides a change of pace from a chalkboard or overhead projector. For example, a teacher could use technology to produce energetic animations, utilize computer models for complex systems, or to visualize three-dimensional data. Another advantage of using various forms of multimedia is that complicated topics can be explained and understood better with the aid of pictures, graphs, animations and simulations (Kussmaul, Dunn, Bagley and Watnik 1996).

Yet another benefit of multimedia is the option to present complex concepts in small, chronological steps as a means to improve students' ability to comprehend information in a meaningful way. This concept is especially important for introductory classes that have students with assorted backgrounds and interests. Compared to the traditional presentation methods, multimedia has the capacity to offer instructors control over how and when information is presented to students (Beerman 1996).

How often is computer technology used in instruction? Data from a study of 765 colleges and universities indicates that only a small percentage (10%) of faculty use computers in their classes (Beerman, 1996). This small number could be due to instructor computer phobia, nonbelievers, or to the high expense associated with computer based multimedia.

Teachers need to be aware of possible and probable uses of technology in order to be able to identify techniques and methods that will further educational goals. Computer-enhanced instruction, computer-assisted instruction and a variety of internet-based resources are being used at colleges and universities all over the country. Andrew Carnegie authored a report titled *The Fourth Revolution* that proposes two criteria for deciding if technology should be used in education: 1) The teaching learning task to be preformed should be essential to the course to which it is applied. 2) The task could not be performed as well, if at all, for the students without the technology.

Carnegie also describes a number of reasons for using technology in education that are still true today. For example, the number and variety of students and their interests have increased straining the abilities of colleges and universities. There has been a comparable increase in the amount of academic knowledge, resulting in more disciplines and more information. Thus, educators need to access this information better and to select an appropriate subset of material to teach and learn. At the same time, technology can help students take a more active role in their learning by allowing them to use different instructional modes or methods (Kussmaul, Dunn, Bagley and Watnik 1996).

Other research indicates that a number of universities and colleges have become captivated with multimedia instruction as a means to improve student satisfaction, performance and learning. Research performed by George and Sleeth (1996) concluded that technology/multimedia use in classes significantly motivates students by increasing student interest, involvement, enjoyment, and liking for the material covered in class.

Further review of the literature indicates that technology use does appear to increase student satisfaction. George and Sleeth report that such motivation would not necessarily lead to better student performance on tests or papers, but suggests that higher levels of technology help students to perceive that they remember facts along the way to achieve better performance on tests. Researchers have also found positive student responses to computer-aided presentations and have described multimedia presentations as a vast improvement over blackboard and overhead projectors (George and Sleeth 1996a).

Critics question if instructional technology actually enhances teaching and learning. There is a vast amount of literature that indicates instruction through computer technology resulted in higher test scores compared to instruction via conventional methods. Researchers found that college students taught by interactive multimedia had greater long-term retention compared to students taught by traditional classroom methods (Beerman 1996). The same research concluded that from the students' point of view, multimedia is effective. Beerman also observed that students taught with multimedia attend class more frequently and appear to be more interested than students taught without multimedia.

Additional findings from a study conducted by Fitzgerald and Semrau (1998) support the belief that hypermedia is good for instruction. Undergraduate and graduate students who made use of the comprehensive hypermedia environment demonstrated that they could and would modify the use of their programs. Rank in school, previous computer experience, and learning style of field independents/dependence were variables that established differences among the learners. The research data identified that the hypermedia learning environment provided equally effective instruction for learners regardless of their differences. It is evident that educational technology and electronic multimedia will continue to grow at a rapid rate. Lectures that were once supplemented with chalkboards and transparencies can now be complemented with a large screen projection system that can handle the computer and the Internet (Nantz and Lundgren 1998). With newly developed presentation software, educators are able to place their lectures onto the computer, along with new graphics and sound to create an engaging classroom presentation (Fisher 1999).

The use of technology can lead to more active learning and adventurous teaching. By integrating technology sources into the classroom, courses can become more exciting and stimulating and possibly meet the needs of students with different learning styles.

4.8 Multimedia Verses Traditional Instruction

In a teacher-oriented classroom where the instructor is the only resource, students are given applicable information on specific course content. It appears, however, that insignificant achievements result from students' equivalent lack of attention span, motivation and first-time comprehension of material. It is thought that this may be accredited to the lack of variety of teaching strategies.

Traditional instruction is the kind of teaching that has existed in most schools for many years. It involves classes or labs using conventional lecture/demonstration instructional methods to teach students. Much of it is high quality, yet much is also questionable.

Research indicates that attention tends to lapse some 10 to 18 minutes into the lecture. Therefore, it is desirable to include some activities that reengage students. This is one clear advantage of computer-enhanced instruction; it is possible to incorporate animation, text and sound directly into the lecture as a means to gain attention, motivate and captivate students (Sotone and Mayer Escoe 1999).

Traditional instruction can be defined as an oral presentation given to a class by a teacher. For most of their lives, college and university students have been in educational systems that have used the traditional lecture method of delivering instruction (Havice 1998). Teachers are often comfortable with the traditional methods because it enables them to remain in control of content and time.

Traditional lecture methods can also be very linear in scope and sequence. Most textbooks provide charts outlining the entire academic course so that teachers know the direction of learning. However, this type of traditional instruction has had limited success in meeting the fast paced, high quality demands of today's learning environment (Takacs, Reed, Wells, and Dombrowski 1999).

As with any instructional method there are advantages and disadvantages. Advantages of the conventional academic techniques are the ability to maintain teacher control, the usefulness in introducing new materials, utilization in conjunction with other teaching techniques, and its efficiency for presenting to large groups as well as content areas containing many facts.

Distinct disadvantages are also associated with traditional instructional methods. These include student boredom, difficulty in accounting for individual learning differences, the prerequisite of advanced speaking skills of the teacher, and the difficulty of producing learning transfer to new situations. Additional problems include one-way communication (teacher to students), lack of enthusiasm and student involvement, lack of motivation for extra or advanced learning, and lack of development of concepts and other aids leading to true understanding.

Multimedia technology can present a fresh look at course material, leading to more engaging presentations. It can also often lead to the discovery of more effective ways of communicating information by the use of animations and simulations that may not be part of the instructors normal presentation style (Savage and Vogel 1996).

Review of the literature indicates an added benefit of computer-enhanced instruction is improved class discussion. For example, preparing discussion questions ahead of time and incorporating them into the lecture screens has been shown to improve discussion. In an effort to make students pay more attention to discussion, the instructor types the students' answers into the notepad space of the screen. Having their answers written on the screen appears to increase the importance of the questions and, thus students are less likely to tune out and not participate in discussion (Sotone and Mayer Escoe 1999).

An additional advantage of computer lectureware is that the visual aspects can be engaging to students who are raised in a video world. Students tend to see interest in more clearly presented materials, which can thus enhance learning (Sotone and Mayer Escoe 1999).

Electronic productions eliminate clunky interruptions from the conventional slide wheel as one slide replaces another. With electronic productions images can be programmed to dissolve into the next, or scrolling text or graphics may lead into the next frame. The overall result is a full-action presentation that keeps the audience engaged (Bell 1996).

One of the many benefits of multimedia is that it can offer students an opportunity to be active participants in the learning process. In contrast to lecture, multimedia can help develop critical thinking and problem solving skill by providing students an opportunity to apply their knowledge. Despite the reported advantages and benefits offered by high-tech presentations, 75% of instructor's still use traditional tools, such as slides and transparencies to supplement lecture presentations (Bell 1996).

The decision to use a new innovation as a replacement to or an enhancement of traditional instruction can be difficult. In most cases, the decision depends on which approach can provide more effective outcomes. Research conducted by Liao (1998) found that hypermedia might be more effective when used as a supplement to traditional instruction. For example, a number of researchers have evaluated the effects of note taking on learning. Note taking requires working memory, and the working memory capacity may vary from student to student. When a large volume of information is presented, working memory capacity can be overloaded and useful note taking becomes difficult (Sotone and Mayer Escoe 1999). With the traditional transparency or slide presentation, it is easy to put a lot of information on one page, which is time consuming for students to copy. Research suggest that students will try to write everything presented, even if they are told that it is not necessary or that it is in the book. A better approach would be to use computer-enhanced instruction to develop a note outline containing some of the materials with space for students to write other things. This has the dual advantage of saving copying time and of helping students to organize notes. The final product is a clearer set of notes (Sotone and Mayer Escoe 1999).

A computer-based system can add interest and new aspects to nutrition education. Research performed by Sotone and Mayer (1999) has found consistent positive feedback from their students who have experienced some form of multimedia instruction.

Review of the literature identifies the use of hypermedia as an instructional resource being compared to alternative instructional strategies where more traditional methods (lectures) have been used. Conclusions from comparative studies range from no significant difference in students' performance levels to differences significantly favoring the use of hypermedia-enhanced instruction (Ayersman 1996). Researchers also examined learning style and attitudes toward instruction of undergraduate economics students using hypermedia instruction, hypermedia instruction with lecture, and lecture only. Results concluded that students had similarly positive perceptions toward the hypermedia instruction (Ayersman 1996). In addition, a study performed by Perry and Perry (1998) concluded that their subjects preferred to attend class that utilizes multimedia presentations and that they found class more interesting and more enjoyable with multimedia. The subjects also felt that multimedia was able to hold their attention better than other presentation methods. Their final conclusion was that multimedia can affect student learning in a positive manner. Study participants reported that when multimedia was used more material was covered, they learned better, they were able to understand difficult concepts better and they retained course material better (Perry and Perry 1998).

Student reaction to animation has been elevated due to the unexpected motion of graphics that has been reported to add interest to the lecture but more importantly because it also makes sense of the concept (Savage and Vogel 1996). For some instructors animation may lead to the introduction of entirely new types of presentations, but for others the technology may be used to improve traditional methods.

It is noted that the computer is a remarkable piece of technology that provides individuals with new tools for apprehending and editing information of all types. A faculty member preparing a lecture or conference presentation can use digitalized photos or video, they can select specific elements of the source that are most useful to them, cut and paste images as needed and add sound or text wherever appropriate. Opening a lecture presentation with a colorful animation complete with musical accompaniment is now much easier than in the past; these kinds of manipulations of different forms of information were nearly impossible or impractical before the advent of multimedia computers (Savage and Vogel 1996).

Multimedia is able to gain students attention through the use of sight, sound, and response. It can also be very motivating because it deviates from the everyday workbooks and texts with which students are all too familiar. Multimedia tools provide students, teachers and professors the ability to create interactive and exploratory classroom experiences that has been reported to improve attitudes (Takacs, Reed, Wells and Dombrowski 1999).

The flexibility of multimedia enables the instructor to customize presentations by adding or subtracting information. Multimedia technology offers traditional instruction some needed excitement. One of the major difficulties that teachers face is motivating students, and multimedia appears to facilitate motivation for both the student and the instructor (Gatlin-Watts and Arn 1998).

4.9 Images and Instruction

How people perceive information is related to how knowledge is stored in our memory (Benner 1988). As people utilize certain learning tasks, they constantly compare the knowledge already stored in memory to new situations. However, learning is conditional to the student's ability to form precise schematic representations (Bennett and Dwyer 1994). Schematic misrepresentation of visual information may lead to inaccurate storage and retrieval (Bennett and Dwyer 1994). In this regard, visualization is used to compensate for knowledge deficiency for students with less prior knowledge in a specific area.

Visual information is a powerful tool in education. Many concepts, rules, and procedures cannot be explained without graphical information. Images have the ability to clarify ideas and concepts for instructional purposes. Images have long been used to bring consistency and precision; bring unseen or remote materials, locations, events, processes across time and space; reinforce text and oral presentations, provide concreteness and practicality to instructional events (Lockee, Moore and Moore 1999).

In going a step further, the combination of text, animation and hypertext headlines has been shown to result in greater recall, reasoning, and understanding. The theory of dual coding provides a partial explanation of why many think that hypermedia-enhanced instruction can be effective for learning. The theory suggests that if each student is able to process information through both verbal and imaginable systems, then providing information that has suitable meaning to both of those systems would seem to enhance one's ability to store and retrieve information. The theory concludes that the new information would then have two memory codes opposed to one memory code, and, if they are contextually related, one may help to trigger the other. These multimodal approaches to education are thought to be particularly effective for supporting students with diverse styles and preference for learning (Ayersman 1996).

Research conducted has consistently provided verification that the use of images can enhance instruction and support learning. With an emphasis on dual coding of verbal and graphical information, Mayer and his colleague focused research attention on the sequence of presenting words and graphics (Mayer and Anderson 1991; Mayer and Sims, 1994). Their findings support using animation that elicits effective visual and verbal information processing. In another aspect, much research effort has also been focused on the cognitive activities stimulated by animation. Reiber extensively examined the effects of computer-animated graphics in physics instruction at different grade levels (Reiber, Boyce and Assad 1990). Reiber and his research partners speculated that animated presentations provide clear and precise external illustrations to help students visualize those physical laws which involve changes in speed and the path of travel.

Images to support instruction come in an assortment of options, level of complexities, color and level of movement. Images can be in the form of a cartoon, or as line drawings. They can be complex as in blueprints and as detailed photographs. The image can be drawn, photographed, digitized, and created in three-dimension. They can be stationary or be in stop-action, high-speed or normal speed motion. Images can show the unseen as in x-rays or as animation that demonstrate processes and internal workings. Image content can be of anything real or imagined and their quality can be on a range from high resolution to hand drawn (Lockee, Moore and Moore 1999).

Many researchers argue for and against the level of practicality and complexity in instructional images. Some researchers believe that the more cues images have, the more learning will take place. The image cues in question include ones that direct attention, highlight content and motivate the learner. Researchers that study learning have long discussed the significance of images used in connecting oral and verbal channels. A majority of these researchers and theorists support the theory of “the more visual cues the better” to strengthen, support, and illustrate the content in the verbal or auditory channel (Lockee, Moore and Moore 1999).

4.10 Improved Visualization and Animation

Before the advent of computer technologies, it was only possible to combine still and/or moving images, text and sound through the simultaneous use of several different tactics such as slide projectors, motion picture projectors and audio playback machines. Today, with the aid of existing computer technology, all of these inputs can be presented and used together in the form of multimedia (Lockee, Moore and Moore 1999).

In multimedia instruction, animation has been found effective and helpful to illustrate complex structural, functional, and procedural relationships among objects and events. Much of the terminology used in an introductory nutrition course can be complex and difficult for students to relate to. Producing mental images from verbal explanations is difficult if the material is new and unfamiliar. The use of images and animations makes it easier for students to conceptualize information (Beerman 1996). Research conducted reveals that visual explanations have a positive effect on knowledge gains and accuracy. By presenting an accurate model of interpretation, animation can help students to form accurate schematic representations. The ability to display images and animations of actual biological functions also helps to keep students interested during class. Images available on CD-ROM libraries and laser videodiscs are easily incorporated into presentations. Furthermore, lecturers can use computer software to create their own images and animations (Tuck, Pearson and Harshaw 1995).

4.11 Designing Multimedia Images

The pragmatic challenge for instructional quality of instructional designers is to use the power of computer graphics in ways that can be empirically justified (Mayer and

Anderson 1992). The extensive diversity in the differential effects of designs according to learner characteristics and learning tasks provided should be considered thoroughly (Large 1996).

When discussing the effectiveness of animation, it is necessary to consider the features of animation and the type of knowledge content the animation is intended to present and express (Reiber, Boyce and Assad 1990). Lockee, Moore and Moore (1999) state that multimedia instructional images, designed for a specific need, should be planned with certain design principles in mind. These principles include: each image being developed with a single idea or concept in mind, keeping detail as an essential element, components of an image having meaning and value to the audience being served, and the knowledge level and background of the target audience known to design proper instructional images. These images also need to be esthetically pleasing using design principles of simplicity, harmony (image components relate to and compliment each other) and organization (arrangement and layout-elements to direct eye focus and attention).

Review of the literature indicates that gender differences in interacting with computer-based learning materials may be an important consideration when specific design strategy is implemented. A number of studies present verification that females and males are different in perceiving visual information. The research also addresses a variation in the development of hemisphere and level of special ability among males and females (ChanLin 1999). Carr and Jessup (1997) observed gender differences in children’s use of learning strategies. They found that girls tend to use overt strategies and boys tend to use covert strategies in learning. Gender differences in the development of skills and knowledge are also believed to surface as a function of their social rationale. Boy’s dominance in the classroom and their preference for competition may push them to acquire more complex strategies and metacognition. In contrast, girls are more concerned with the feedback from the instructional setting.

An understanding of the audience is important to the designer of the image in order to design the correct image intended for the audience. In creating the image the designer must know what the subject will do as a result of being exposed to the image. Selection of the right “type” of image should be based on the previously noted principles of complexity, use of color, size, etc. (Kolasa and Miller 1996).

Lines, shapes, tones, texture, white space and boundaries are the assortment of components that make up images. There are three different types of images: the representational, analogic and the arbitrary. Representational images are used to attract attention and to motivate. Examples of arbitrary images include graphs and charts. These visuals are used to present concepts that lend themselves to numerical analysis. Analogic images promote understanding by translating a concept into a related visual form (Gribas, Sykes, and Dorochoff 1996). Additional components important to consider in the development of multimedia images include text, graphics, color, motion, and still pictures. Text appears to make up the bulk of most computer-based instructional images. Therefore, legible text is an important instructional issue. Graphs are essential to the presentation of instructional content because of their ability to visualize large amounts of complex data. The use of symbols and symbolic representations are important instructional shortcuts in the design of instructional graphs and images.

Color has also been a major element of instructional images. Studies have shown that the use of color can enhance instructional goals of many content areas (Lockee, Moore and Moore 1999). Review of the literature regarding the instructional use of color suggests; that the application of meaningful tasks appears related to the interaction between the viewer and the materials; that in externally paced materials color appeared secondary to other significant features; if color was central to the concept presented, it assisted learning; the value of color in recall is highly task related; and cues facilitate achievement in complex self-paced materials in which the tasks are visual in nature (Dwyer and Lamberski 1983).

The image characteristic of movement is also a powerful instructional component. Motions can bring concepts to life and can illustrate processes and connections. The movement of an image can also be important in showing real life activities as in “how to do it” instructions. However, too much movement may hinder the message’s potential instructional advantages (Dwyer and Lamberski 1983).

The size of an image or text is important for the understanding of a concept. If the image is too small crucial detail and connections can be lost or difficult to differentiate. On the other hand, images too large may loose resolution and thus its clarity. The value of text within an image is especially dependent on size of both readability and ease of understanding (Lockee, Moore and Moore 1999).

4.12 Student Attitude Towards Multimedia Instruction

In recent years, schools have become captivated with multimedia instruction as a means to improve student satisfaction, performance and learning. Survey results from

500 liberal arts majors indicate positive student responses to computer aided presentations and reported multimedia presentations a large improvement over blackboard and overhead presentations (George and Sleeth 1996a).

This is mentioned because student perceptions and attitudes are important indicators of success for multimedia instruction techniques. Generally speaking, positive attitudes are reported following hypermedia-based learning situations. A survey analysis of 300 business majors supported the debate that technology-assisted instruction influences student attitudes (George and Sleeth 1996a). Additional research has found students with positive attitudes toward CBI scored significantly better on posttests than students with negative attitudes. These results suggest that positive attitudes promote or motivate learning (Ross and Moeller 1996).

Researchers have also discovered that students using a form of multimedia as a tool for learning have experienced an increased sense of control and increased levels of intrinsic motivation. Undergraduate students in a computer architecture course identified computer simulations as being helpful in understanding concepts and making learning more concrete (George and Sleeth 1996a). Further research by George and Sleeth (1996a) found that technology use in the classroom is capable of motivating students by increasing learning, enjoyment, and interest in the material. Such motivation gives the impression that higher levels of technology helps students to (perceive that they) remember facts along the way to better performance on exams (George and Sleeth 1996a).

4.13 Instructor Technology Phobia

Researchers define phobia as anxiety produced reactions involving avoidance of public scrutiny. Computer anxiety is a person's tendency to experience a level of uneasiness over his or her impending use of technology that is disproportionate to the threat technology presents. The response modes to aversion of multimedia may appear as a general anxiety to use of technology (cyberanxiety) (George and Sleeth 1996b).

Cyberphobia may result from an inadequate introduction of multimedia. Implementation problems may come from a poorly organized introduction of new technology and/or not involving the teachers, who are actually doing the instructions, in planning and design (George and Sleeth 1996b). The involvement of teachers and administers in the planning and implementation phase has been found to be a crucial requirement for the success of multimedia in nutrition education.

New ideas (new technologies, new ways of doing something, etc.) often meet with resistance. Faculty resistance to multimedia is no exception. Review of the literature indicates that many university faculty members feel that multimedia is expensive, takes too much time, and isn't worth their valuable time and effort (Perry and Perry 1998).

Resistance to change occurs when there is a change in customary behavior, culture and structure. Two types of resistance can be identified, behavioral and systematic. Behavioral resistance occurs as active opposition to change, while systematic resistance arises out of passive incompetence to change. When incorporating technology-assisted instruction into nutrition education one should account for the two types of resistance as a means to relieve fears of instructors and to educate them to use technology effectively (George and Sleeth 1996b).

Technology resistance is not an uncommon problem. Dell Computer Corp. conducted a survey revealing 55% of the population harboring fear of some form of technology. Another 36% of people who use computers at their office feel that their skill levels are inadequate. These numbers don't necessarily reflect faculty phobia, but it should be recognized that instructors might harbor some form of fear or anxiety to use technology in their classroom where they are the focus of the student's attention (George and Sleeth 1996b).

Some instructors resist multimedia due to the belief and fear that the new technology may possibly replace human teachers. This may, in fact, be true when the learner is strongly motivated, mature, and disciplined. However, multimedia replacing a teacher is most unlikely to be true for instruction in an introductory nutrition course for a widespread group of college undergraduates (Velleman and Moore 1996).

Educators that support multimedia have remarked that CEI and other computer-mediated instruction require a new way of looking at higher and continuing education. To be successful instructors must adopt a new role, transforming themselves from lecturer to coach. With the advent of multimedia, the instructor is no longer the gatekeeper of information. Although some professionals fear loss of control of information or power, others welcome the opportunities multimedia provides to enhance the educational process for their students (Kolasa and Miller 1996).

To enhance technological efforts in nutrition education educators must become familiar with new computer technologies. In addition, teachers in this new computer technology-intensive environment need to continue to develop their computer skills in order to be successful. Nutrition educators are also encouraged to examine the opportunities and challenges of new technologies to enhance their work/teaching styles.

5. SUMMARY

In summary, theoretical and experimental research indicates that higher-order thinking and problem solving are complex activities. What we know about human cognition is that it involves processing incoming external information and encoding this information within memory. Learning can be viewed as the process of modifying these knowledge structures for a specific purpose. Problem solving is something that humans do constantly on a daily basis. It involves understanding and representing the problem and then using the different types of knowledge available and the strategies that have been developed to determine a solution to the problem.

Computers have been hailed as being cognitive tools and have been identified as being beneficial components to higher education. They afford us the opportunity to design effective learning environments for students. Also, if properly used, they allow us to provide students with meaningful tasks that enable them to develop higher order thinking skills and problem solving skills that are deemed as necessary for students' success.

6. METHODOLOGY

The following chapter explains the research design and techniques utilized in conducting this study. The purpose of this study was to identify undergraduate student preference of computer enhanced nutrition education verses traditional lecture. A survey instrument was developed to allow the researcher to collect information.

6.1 Subject Selection

Subjects involved in the study consisted of freshmen, sophomore, junior and senior college students registered for the Nutrition for Hospitality course at the University of Wisconsin - Stout. The undergraduate students were asked to voluntarily complete a presentation survey to evaluate their preference of a specific presentation method. Each subject was advised that their participation was strictly voluntary, reassured that they would not be identified and that there would be no repercussions for not participating.

6.2 Survey Instrument

The survey instrument (Appendix A) provides three areas to collect demographic information such as sex, grade classification, and a four number code for matching surveys collected throughout the semester. The presentation method evaluation scale presents as a 5-point Likert Scale in which seventeen statements are assessed. Students were asked to circle one of the following responses: 1 = best accomplished by the computer, 2 = good by computer, 3 = each were about the same, 4 = good by transparencies, 5 = and best by transparencies. A section for additional comments was included at the bottom of the survey.

6.3 Research Procedure

The survey tool was reviewed by the Chair of the University of Wisconsin-Stout Institutional Review Board for the Protection of Human Subjects in Research. A letter provided to the researcher from the chair of the committee is found in Appendix B. This letter indicates that the survey was determined to be exempt from review relative to being conducted in an established educational setting and involving normal educational practices. The chair determined that the measures taken to protect human subjects were adequate to protect all people involved.

The subjects of this research project consisted of volunteer students enrolled in the 1997 fall semester of the Nutrition for Hospitality class at the University of Wisconsin- Stout, Menomonie Wisconsin. The class was made up of freshmen, sophomore, junior and senior undergraduate students. Throughout the semester the subjects had experienced two types of presentation methods during the lecture hour. The lecturer would alternate the presentation method every other unit. The class instructor distributed the survey to the students at three weeks after the start of the semester, again at midterm and once again at the end of the semester. Approximately 82 surveys were collected each time throughout the semester.

6.4 Data Analysis

The presentation surveys were collected and examined. The surveys were grouped together according to the four-digit code found at the top of the survey. It was anticipated that there would be a need to omit some of the surveys relative to incomplete survey information, failure to answer questions accurately (i.e.: circling more than one answer per question) and incomplete participation throughout the semester. By the end of the semester there were a total of 82 grouped subject surveys. After careful review 24 surveys were omitted due to the above situations, leaving 222 surveys to be statistically analyzed.

The data collected via the survey instrument was statistically analyzed using the following measurements:

1. Frequency counts
2. Means
3. Percentages
4. Standard deviations

   Independent group t-test on items 1 –17 early in the semester, at midterm, and at the end of the semester using gender (males/females) as independent variables.

5. One-way analysis of variance with a Student Newman-Keuls Multiple Range test on items 1-17 early in the semester, at midterm, and at the end of the semester using grade classification (freshman, sophomore, junior, senior) as the independent variable.

6. One-way analysis of variance with repeated measures on items 1-17 early in the semester, at midterm, and at the end of the semester for the single groups of respondents.

7. A one-sample binomial test between the proportion of respondents preferring the computer to the proportion of respondents preferring transparencies on items 1-17 early in the semester, at midterm, and at the end of the semester.

7. RESULTS

7.1 Response Rate

A total of 246 presentation surveys were collected from the 1997 fall semester of the Nutrition for Hospitality undergraduate course. According to demographic data of gender and grade classification, the following data were obtained. There were a total of 82 respondents. Of this total 33 (40%) were male, 39 (48%) were female and 10 (12%) of the subjects did not report their gender. The percentages of respondents by gender are illustrated in Figure 1.

There were 72 respondents reporting grade classification. The distribution of participants based on grade classification is shown in Figure 2. The percentages of freshmen, sophomore, juniors and seniors were 23, 35, 23, and 7, respectively. Twelve percent did not report their grade classification.

7.2 Preference of Computer to the Preference of Transparencies

The survey respondents were asked to evaluate the lecture presentation at the start of the semester, mid term and at the end of the semester. The survey instrument included the following seventeen statements associated with the acceptance of the presentation method used for alternating units: 1) Allowed for better understanding of the material, 2) Visual quality was easier to read, 3) Room lighting was most conducive to learning, 4) Facilitated interaction between student and instructor, 5) Made better use of examples and illustrations, 6) Increased skills, knowledge, and ability to think, 7) Held my attention longer, 8) Easier for me to comprehend and retain information, 9) Allowed for easier note taking, 10) Most attractive, 11) Most effective, 12) Allowed me to keep up easier,

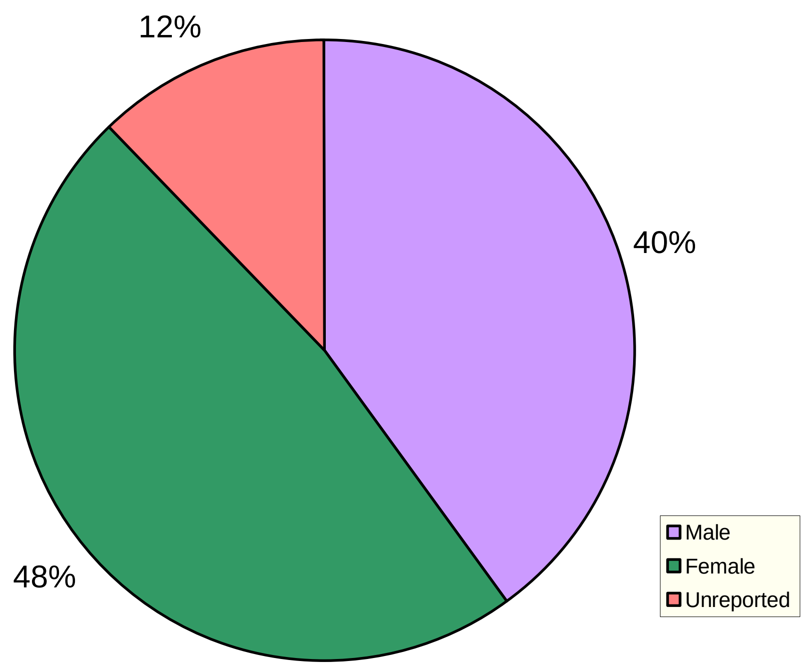

Figure 1. Survey Respondents By Gender (n=82)

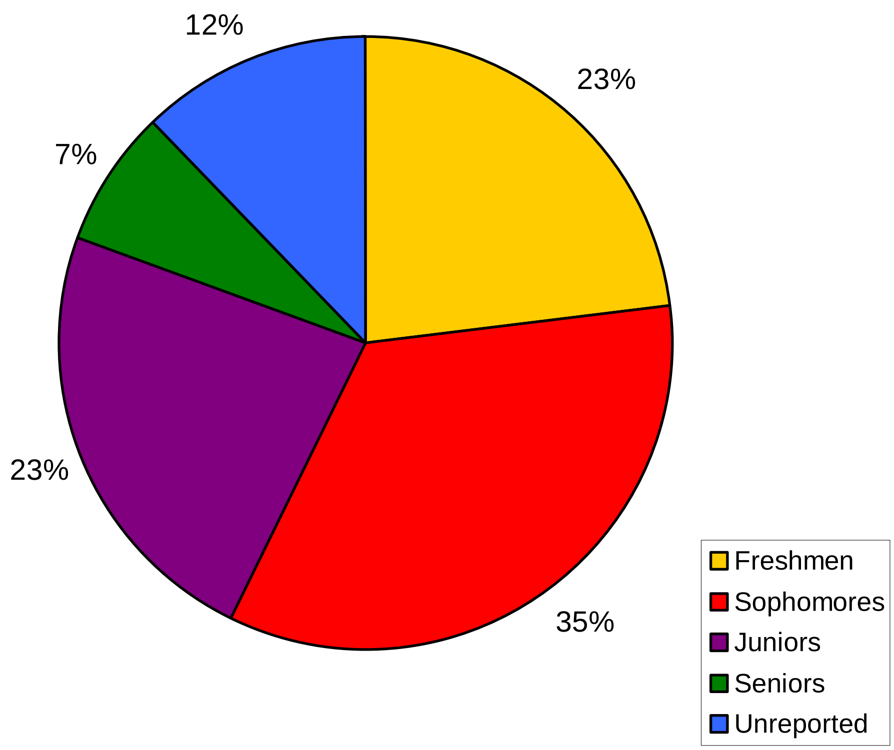

Figure 2. Survey Respondents By Class (n=82)

13) Got my attention, 14) Stressed important and relevant information, 15) Best organized, 16) Overall, I prefer (type of presentation method) in this class, 17) Which presentation method would you prefer in other classes?

The statements were rated using a 5-point Likert scale. Means were determined by the following values: 1 = best accomplished by computer, 2 = good by computer, 3 = each were about the same, 4 = good by transparencies, 5 = best accomplished by transparencies.

The results shown on Table 1 were statistically analyzed by using a one sample binomial test to evaluate the proportion of students that prefer the computer enhanced nutrition education to the proportion of students that prefer the lecture utilizing transparencies early in the semester, midterm and at the end of the semester. When the subjects rated questions 1 – 17 early in the semester, the most notable observation was the non-significant value reported for question number twelve; "allowed me to keep up easier" ($p=.6650$). Twenty-six students reported that they preferred the computer, which was not significantly different from the twenty-two students who preferred transparencies. However, the sixteen remaining survey statements were highly significant, indicating that the subjects preferred the computer presentation to the transparency presentation method at the start of the semester as indicated in Table 1. The data from respondents at midterm indicate that subjects strongly preferred the computer rather than transparencies on all seventeen statements. The same results are also seen at the end of the semester with students once again intensely preferring the computer-enhanced education to the presentation method of using transparencies.

Table 1
Proportion of Students that Prefer the Computer to the Proportion that Prefer Transparencies

Question	Early in Semester			Midterm			End of Semester		
	N1	N2	P value	N1	N2	P value	N1	N2	P value
Allowed for better understanding of the material.	36	4	0.0001	43	3	0.0001	49	4	0.0001
Visual quality was easier to read.	66	4	0.0001	61	0	0.0001	59	4	0.0001
Room lighting was most conducive to learning.	31	10	0.0001	25	7	0.0027	38	9	0.0001
Facilitated interaction between student and instructor.	20	8	0.0376	26	3	0.0001	35	8	0.0001
Made better use of examples and Illustrations.	68	3	0.0001	55	1	0.0001	57	7	0.0001
Increased skills, knowledge and ability to think.	33	6	0.0001	35	3	0.0001	43	8	0.0001
Held my attention longer.	49	8	0.0001	51	2	0.0001	56	9	0.0001
Easier for me to comprehend and retain information.	44	7	0.0001	47	2	0.0001	44	8	0.0001
Allowed for easier note taking.	47	14	0.0001	48	4	0.0001	49	13	0.0001
Most attractive.	72	2	0.0001	60	1	0.0001	61	5	0.0001
Most effective.	42	6	0.0001	44	2	0.0001	45	10	0.0001
Allowed me to keep up easier.	26	26	NS	26	9	0.0001	36	12	0.0001
Got my attention.	60	2	0.0001	49	0	0.0001	59	6	0.0001
Stressed important and relevant information.	33	6	0.0001	37	2	0.0001	44	7	0.0001
Best organized.	56	5	0.0001	48	3	0.0001	53	8	0.0001
Overall, I prefer_______in this class.	54	7	0.0001	52	3	0.0001	53	7	0.0001
Which presentation method would you prefer in other classes?	51	9	0.0001	50	3	0.0001	50	7	0.0001

N1 = Students that prefer the computer
N2 = Students that prefer transparencies
Means were determined:
Prefer the computer = 1 (Best accomplished by computer) + 2 (Good by computer)
Prefer transparencies = 4 (Good by transparencies) + 5 (Best by transparencies)
Responses were analyzed by a one-sample binomial test.

7.3 Comparison of Responses Over Time.

A one-way analysis of variance with repeated measures was used to determine significance in student survey responses at early semester, midterm and at the end of the semester. The results of this analysis are found in Table 2. The repeated measures determined if the students' preferences for computer or transparencies would change across time. Data analysis of the first survey statement shows that as the semester progressed, the response to "allowed for better understanding of the material" significantly shifted ($p=0.01$) to preference for the computer with means of 2.192, 1.912, and 1.771 for early in the semester, midterm and end of the semester, respectively.

Preference for the instructional presentation method regarding the statements "visual quality was easier to read" and "room lighting was most conducive to learning" did not change across time. There was a significant shift ($p=0.05$) favoring the computer presentation method for the survey statement "facilitated interaction between student and instructor". Means were 2.662 for early in the semester, 2.412 at midterm and 2.31 at end of the semester. In contrast to the previous survey statement a strong tendency ($p=0.067$) was found toward transparencies in the response to the statement "made better use of examples and illustrations". Although the tendency was toward transparencies there was a mean of 1.704 at the end of the semester indicating that the computer presentation method was still strongly favored among the subjects.

Like the results regarding the statement "visual quality was easier to read", the response to the statement "increased skills, knowledge and ability to think" did not change over the semester with the means of 2.325, 2.121, and 2.139 at the start of the semester, midterm and end of the semester respectively. Analysis of the statements "held my attention longer" (means of 1.962, 1.662, and 1.806 at the start of the semester, midterm and end of the semester, respectively) and "easier for me to comprehend and retain information" (means of 2.128, 1.691, and 2.069) showed a stronger preference for the computer at the midterm that at the start of the semester or at the end of the semester. A similar finding in the middle of the semester occurred for the statement "allowed for easier note taking" (p=0.05) with means of 2.192 at the beginning of the semester, 1.842 at midterm, and 2.042 at the end of the semester.

Throughout the semester the student's strong preference for the computer presentation method did not change regarding the statement "most attractive". Data analysis of the survey statement "most effective" shows a strong tendency (p=0.051) for favoring the computer at midterm (mean 1.821) more so than early in the semester (mean 2.156) or at the end of the semester (mean 2.111).

The student's preference of a presentation method regarding the statement "allowed me to keep up easier" leaned toward transparencies early in the semester with a mean of 2.948 and slowly progressed to the preference of the computer presentation method at the midterm with a mean of 2.529 and at the end of the semester with a mean of 2.403. From the start of the semester to the end of the semester there was no change in subject response to the statement "got my attention". Data analysis of the three time frames indicated that the subjects felt the computer presentation method was able to catch their attention more than the transparency presentation.

Data with reference to the survey statement "stressed important and relevant information", shows a shift (p=0.05) from preferring the transparency presentation at the start of the semester to a preference of the computer in the middle of the semester and

Table 2
Comparison of Responses Over Time

Question	Early in Semester			Midterm			End of Semester			
	N	mean[1]	SD	N	mean[1]	SD	N	mean[1]	SD	p=[2]
Allowed for better understanding of the material.	78	2.192	1.14	68	1.912	1.129	70	1.771	1.132	0.01
Visual quality was easier to read.	78	1.462	1.002	68	1.324	0.657	72	1.528	1.048	NS
Room lighting was most conducive to learning.	78	2.526	1.276	68	2.5	1.216	72	2.25	1.286	NS
Facilitated interaction between student and instructor.	77	2.662	1.276	68	2.412	1.011	71	2.31	1.294	0.05
Made better use of examples and Illustrations.	77	1.338	0.883	67	1.463	0.876	71	1.704	1.235	0.067
Increased skills, knowledge and ability to think.	77	2.325	1.163	66	2.121	1.13	72	2.139	1.217	NS
Held my attention longer.	78	1.926	1.294	68	1.662	1.016	72	1.806	1.307	0.05
Easier for me to comprehend and retain information.	78	2.128	1.283	68	1.691	1.069	72	2.069	1.293	0.01
Allowed for easier note taking.	78	2.192	1.495	68	1.824	1.158	72	2.042	1.505	0.05
Most attractive.	78	1.231	0.772	68	1.309	0.778	72	1.528	1.126	NS
Most effective.	77	2.156	1.236	67	1.821	1.072	72	2.111	1.338	0.051
Allowed me to keep up easier.	77	2.948	1.538	68	2.529	1.298	72	2.403	1.37	0.01
Got my attention.	78	1.577	0.947	68	1.618	0.989	72	1.681	1.197	NS
Stressed important and relevant information.	78	2.359	1.173	67	1.985	1.108	72	2.056	1.277	0.05
Best organized.	78	1.731	1.192	68	1.75	1.07	72	1.861	1.335	NS
Overall, I prefer_______in this class.	74	1.73	1.275	66	1.561	1.069	68	1.676	1.275	NS
Which presentation method would you prefer in other classes?	77	1.948	1.358	63	1.556	1.074	67	1.761	1.327	0.05

[1]means were determined by the following values.
1=Best accomplished by computer
2=Good by computer
3=Each were about the same
4=Good by transparencies
5=Best accomplished by transparencies
[2]One way analysis of varience with repeated measures at the beginning of semester/midterm/end of semester

then back to preferring transparencies once again at the end of the semester. Throughout the semester there was no change in subjects' response to "best organized", suggesting that the computer enhanced presentations were considered more organized than the transparency presentations. The same can be said regarding the statement "overall I prefer (method of presentation) in this class". When given the opportunity to chose which presentation method would be preferred in other classes, data analysis identifies a significant preference for computer enhanced presentations in other classes as the semester progressed ($p=0.05$). Means were 1.948, 1.556 and 1.761 for early in the semester, midterm and end of the semester, correspondingly.

7.4 Responses by Gender Throughout the Semester

An independent group t-test was used to determine significant differences between survey responses of gender throughout the semester using males and females as the independent variable. The result of this analysis is found in Tables 3 through 5 identifying responses early in the semester, at quarter break and at the end of the semester, respectively.

Early in the semester there was a strong tendency ($p=0.058$) for females (mean = 1.25) to perceive the computer as better for "visual quality was easier to read" than the males (mean = 1.75); for results see Table 3. A similar tendency was found ($p=0.093$) for females (mean = 1.1714) to favor the computer for the statement "made better use of examples and illustrations" more so than males (mean = 1.5625). Early in the semester females significantly ($p=0.035$) perceived the computer to increase their skills, knowledge and ability to think more so than males, means 2.1111 and 2.7097 correspondingly (see Figure 3). This preference was not evident at midterm or at the end of the semester (Tables 3 and 4). Data analysis early in the semester also identifies that the females significantly found (p=0.033) for the computer presentation as the most attractive (mean = 1.0278) compared to the males (mean = 1.4688). A strong tendency (p=0.075) occurred for females to perceive the computer to catch their attention (mean = 1.3889) more so than males (mean = 1.8125). For the remaining twelve survey statements, early in the semester, there were no differences in preference between the computer enhanced presentation method and the transparency presentation method among the genders, although the computer was strongly favored for both groups for all seventeen of the survey.

Table 4 reveals responses by gender at midterm. The survey statement "most attractive" as the only statistically significant response identified at the middle of the semester (p=0.036). Like early in the semester, at midterm the females perceived the computer enhanced presentation method as most attractive (mean = 1.0857) more so than the males (mean = 1.5357) (Figure 4).

Unlike responses from early in the semester and at midterm, data analysis from end of the semester responses (Table 5) identifies all survey statements 1-17 to be non-significant for gender including the statement for most attractive with means of 1.5897 for females and 1.4545 for males.

Table 3
Responses by Gender Early in Semester

	N		[1]mean		SE		t value	Two-tailed prob
Question	Female	Male	Female	Male	Female	Male		
Allowed for better understanding of the material.	36	32	2.3611	2.1875	0.174	0.222	0.62	NS
Visual quality was easier to read.	36	32	1.25	1.75	0.108	0.233	-1.94	0.058
Room lighting was most conducive to learning.	36	32	2.6111	2.625	0.208	0.241	-0.04	NS
Facilitated interaction between student and instructor.	36	31	2.6389	2.9032	0.16	0.214	-0.1	NS
Made better use of examples and Illustrations.	35	32	1.1714	1.5625	0.087	0.21	-1.72	0.093
Increased skills, knowledge and ability to think.	36	31	2.1111	2.7097	0.168	0.228	-2.15	0.035
Held my attention longer.	36	32	1.7778	2.3125	0.200	0.256	-1.67	NS
Easier for me to comprehend and retain information.	36	32	2.1667	2.2188	0.231	0.223	-0.16	NS
Allowed for easier note taking.	36	32	2.1667	2.4063	0.266	0.265	-0.64	NS
Most attractive.	36	32	1.0278	1.4688	0.028	0.196	-2.23	0.033
Most effective.	35	32	2.2286	2.2813	0.232	0.207	-0.17	NS
Allowed me to keep up easier.	35	32	3.1143	3.125	0.271	0.265	-0.03	NS
Got my attention.	36	32	1.3889	1.8125	0.134	0.198	-1.18	0.075
Stressed important and relevant information.	36	32	2.3333	2.5938	0.195	0.21	-0.91	NS
Best organized.	36	32	1.6667	1.9375	0.195	0.233	-0.9	NS
Overall, I prefer_______in this class.	34	30	1.7647	1.8	0.239	0.232	-0.11	NS
Which presentation method would you prefer in other classes?	35	32	1.9714	2.125	0.237	0.265	-0.43	NS

[1]means were determined by the following values.
1=Best accomplished by computer
2=Good by computer
3=Each were about the same
4=Good by transparencies
5=Best accomplished by transparencies
Responses were analyzed by an independent group t-test

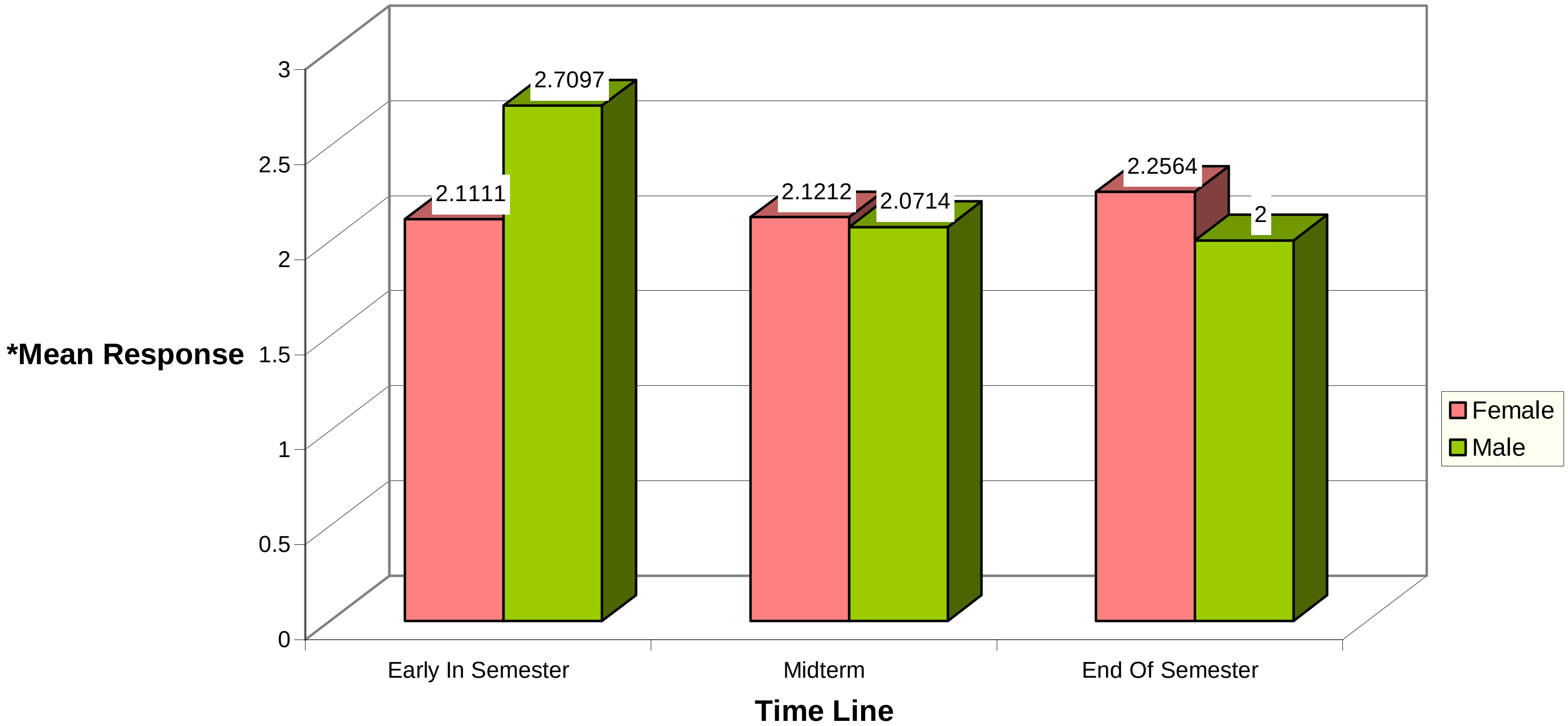

Figure 3. Increased Skill And Knowledge Response Comparing Females To Males

Table 4
Responses by Gender at Midterm

	N		[1]mean		SE		t value	Two-tailed prob
Question	Female	Male	Female	Male	Female	Male		
Allowed for better understanding of the material.	35	28	1.7714	2	0.184	0.23	0.079	NS
Visual quality was easier to read.	35	28	1.714	1.3929	0.087	0.13	-1.47	NS
Room lighting was most conducive to learning.	35	28	2.4857	2.5	0.19	0.256	-0.04	NS
Facilitated interaction between student and instructor.	35	28	2.4	2.3929	0.16	0.214	0.03	NS
Made better use of examples and Illustrations.	34	28	1.3235	1.6429	0.151	0.164	-1.43	NS
Increased skills, knowledge and ability to think.	33	28	2.1212	2.0714	0.193	0.23	0.17	NS
Held my attention longer.	35	28	1.4571	1.7857	0.138	0.226	-1.24	NS
Easier for me to comprehend and retain information.	35	28	1.5143	1.7857	0.171	0.214	-1	NS
Allowed for easier note taking.	35	28	1.8	1.8214	0.216	0.2	-0.07	NS
Most attractive.	34	28	1.0857	1.5357	0.063	0.196	-2.19	0.036
Most effective.	34	28	1.6471	1.8929	0.183	0.201	-0.9	NS
Allowed me to keep up easier.	35	28	2.4857	2.5714	0.237	0.238	-0.25	NS
Got my attention.	35	28	1.4286	1.7143	0.138	0.177	-1.29	NS
Stressed important and relevant information.	34	28	1.9412	2	0.193	0.212	-0.2	NS
Best organized.	35	28	1.6571	1.8214	0.196	0.186	-0.6	NS
Overall, I prefer_______in this class.	34	27	1.5294	1.4444	0.195	0.187	0.31	NS
Which presentation method would you prefer in other classes?	31	27	1.4516	1.5926	0.201	0.202	-0.49	NS

[1]means were determined by the following values.
1=Best accomplished by computer
2=Good by computer
3=Each were about the same
4=Good by transparencies
5=Best accomplished by transparencies
Responses were analyzed by an independent group t-test

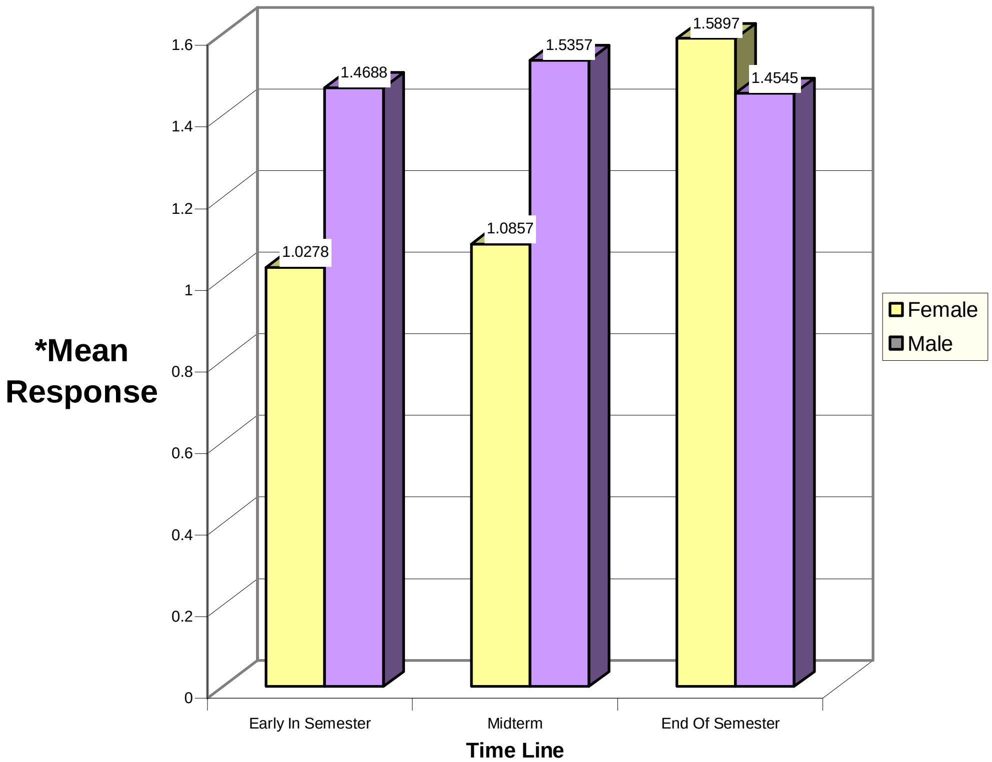

Figure 4. Most Attractive Response, a Comparison Of Females To Males

Table 5
Responses by Gender at End of Semester

	N		mean[1]		SE		t value	Two-tailed prob
Question	Female	Male	Female	Male	Female	Male		
Allowed for better understanding of the material.	39	31	1.6923	1.871	0.181	0.206	-0.65	NS
Visual quality was easier to read.	39	33	1.4103	1.6667	0.167	0.183	-1.04	NS
Room lighting was most conducive to learning.	39	33	2.1795	2.3333	0.187	0.249	-0.5	NS
Facilitated interaction between student and instructor.	39	32	2.3846	2.2188	0.213	0.223	0.53	NS
Made better use of examples and Illustrations.	39	32	1.7436	1.6563	0.232	0.166	0.31	NS
Increased skills, knowledge and ability to think.	39	33	2.2564	2	0.213	0.209	0.85	NS
Held my attention longer.	39	33	1.6667	1.9697	0.221	0.211	-0.98	NS
Easier for me to comprehend and retain information.	39	33	1.9487	2.2121	0.22	0.208	-0.86	NS
Allowed for easier note taking.	39	33	1.9744	2.1212	2.37	0.271	-0.41	NS
Most attractive.	39	33	1.5897	1.4545	0.207	0.157	0.52	NS
Most effective.	39	33	2.1795	2.0303	0.229	0.215	0.47	NS
Allowed me to keep up easier.	39	33	2.3846	2.4242	0.213	0.025	-0.12	NS
Got my attention.	39	33	1.6667	1.697	0.206	0.192	-0.11	NS
Stressed important and relevant information.	39	33	2.0513	2.0606	0.22	0.204	-0.03	NS
Best organized.	39	33	1.8974	1.8182	0.226	0.22	0.25	NS
Overall, I prefer_______in this class.	37	31	1.7568	1.5806	0.237	0.19	0.56	NS
Which presentation method would you prefer in other classes?	35	32	1.7429	1.7813	0.233	0.228	-0.12	NS

[1]means were determined by the following values.
1=Best accomplished by computer
2=Good by computer
3=Each were about the same
4=Good by transparencies
5=Best accomplished by transparencies
Responses were analyzed by an independent group t-test

7.5 Responses of Preference Between Student Classification

Table 6 compares responses of freshmen, sophomores, and juniors/seniors. At the beginning of the semester a significant difference (p=0.037) was found for only one statement, "stressed important and relevant information". The mean for the sophomores (mean = 2) was significantly more favorable to the computer than the juniors and seniors (mean = 2.833) for this statement. However there was no difference between the sophomores and the freshmen (mean = 2.5789).

A significant difference was found for only one statement at midterm. During this time the sophomores (mean = 1.1739) significantly preferred (p=0.035) the computer when given the statement "made better use of examples and illustrations" than the juniors/seniors (mean = 1.8261), but were not significantly different from the freshmen (mean = 1.375). At the end of the semester both freshmen (mean = 1.2632) and sophomores (mean = 1.5714) significantly favored the computer-enhanced presentation (p=0.031) over the juniors/seniors (mean =2.2083) when the same statement "made better use of examples and illustrations" was presented.

Analysis of the statements at the end of the semester also shows a significant difference between freshmen and juniors/seniors and sophomores and juniors/seniors (p=0.048) in response to the statement "increased skills, knowledge, and ability to think" with the juniors/seniors preference leaning toward the transparency presentation method. There was no difference between the freshmen (mean = 1.8947) and sophomores (mean = 1.8571) regarding this statement. Once again towards the end of the semester data analysis shows a significant difference between freshmen and juniors/seniors and sophomores and juniors/seniors (p=0.038) regarding the statement "held my attention longer”. The mean for sophomores (mean = 1.6429) was significantly more favorable toward the computer presentation method than juniors/seniors (mean =2.32).   However there was no difference between the freshmen (mean = 1.3684) and sophomores.

Table 6
Significant Responses of Preference Between Students Classified as Freshmen, Sophomores, Juniors/Seniors at Early Semester, Midterm and End of Semester

Early Semester ***Question**	Class	N	[1]mean	SEM	[2]p=
Stressed important and relevant information	Freshmen	19	2.5789[ab]	0.2791	0.037
	Sophomore	25	2[a]	0.2	
	Junior/Senior	24	2.8333[b]	0.2457	
Midterm ***Question**	Class	N	[1]mean	SEM	[2]p=
Made better use of examples and illustrations	Freshmen	16	1.375[a]	0.2016	0.035
	Sophomore	23	1.1739[ab]	0.1024	
	Junior/Senior	23	1.8261[b]	0.2323	
End of Semester ***Question**	Class	N	[1]mean	SEM	[2]p=
Made better use of examples and illustrations	Freshmen	19	1.2632[a]	0.1499	0.031
	Sophomore	28	1.5714[a]	0.1813	
	Junior/Senior	24	2.2083[b]	0.3404	
Increased skills knowledge and ability to think	Freshmen	19	1.8947[a]	0.2746	0.048
	Sophomore	28	1.8571[a]	0.2103	
	Junior/Senior	25	2.64[b]	0.2762	
Held my attention longer	Freshmen	19	1.3684[a]	0.2191	0.038
	Sophomore	28	1.6429[a]	0.2006	
	Junior/Senior	25	2.32[b]	0.3252	

*Responses absent from table were not significant as determined by One-Way analysis of variance with a student Newman-Keuls Multiple Range Test
[1]means were determined by the following values
1=Best accomplished by computer
2=Good by computer
3=Each were about the same
4=Good by transparencies
5=Best accomplished by transparencies
means sharing a common letter are not significantly different
[2] One-Way analysis of variance with a student Newman-Keuls Multiple Range Test on data if more than two graphs are involved in significant relations.

8. DISCUSSION

Student preference of computer enhanced nutrition education verses traditional lecture was investigated for undergraduate students enrolled in the 1997 fall semester of the Nutrition for Hospitality class at the University of Wisconsin-Stout, Menomonie Wisconsin. The survey instrument presented a 5-point Likert scale with subjects rating 17 statements associated with acceptance of the presentation. Throughout the semester the subjects had experienced two types of presentation methods during the lecture hour. The lecturer would alternate the presentation method every other unit. The class instructor distributed the survey to the students at three weeks after the start of the semester, again at midterm and once again at the end of the semester. Approximately 82 surveys were collected each time throughout the semester.

Based on the results obtained from this study the following conclusions are drawn.

Of the eighty-two respondents, seventy-two subjects reported grade classification. More sophomores responded (35%) in comparison to freshmen (23%), juniors (23%), and seniors (7%).

A significant difference was found in the following survey statements associated with the proportion of students that prefer computer-enhanced instruction to those that prefer transparencies. “Allowed for better understanding of the material.”, “Visual quality was easier to read.”, “Room lighting was most conducive to learning.”, “Facilitated interaction between student and instructor.”, “Made better use of examples and illustrations.”, “Increased skills, knowledge and ability to think.”, “Held my attention longer.”, “Easier for me to comprehend and retain information.”, “Allowed for easier note taking.”, “Most attractive.”, “Most effective.”, “Got my attention.”, “Stressed important and relevant information.”, “Best organized.”, “Overall, I prefer (presentation method) in this class.", and "Which presentation method would you prefer in other classes?". The students highly prefer the computer-enhanced presentation over the traditional transparency presentation method. This finding is consistent with data obtained from research performed by George and Sleeth (1996). Their research concluded that technology/multimedia use in the classroom significantly motivates students by increasing student interest, involvement, enjoyment and liking for the material covered in class. Researchers have also found positive student responses to computer-aided presentations and have described multimedia presentations as a vast improvement over blackboard and overhead projectors. This data is also consistent with research by Beerman (1996) who observed that students taught with multimedia attend class more frequently and appear to be more interested than students taught without multimedia. Data analysis from this study and the available data obtained from the literature indicate positive student responses to computer aided presentations and reported multimedia presentations a large improvement over blackboard and overhead presentations.

Research conducted has consistently provided verification that the use of images can enhance instruction and support learning. Although not significant at the beginning of the semester, by the end of the semester the students felt the computer enhanced presentation method assisted them in allowing for better understanding of the material and in facilitating interaction with the instructor. It is believed that this can be achieved due to the ability of multimedia to present complex concepts in small, sequential steps as a means to improve students' ability to comprehend information. Another potential use of computer-enhanced instruction at the college level is to complement lecture courses in ways in which the computer-enhanced instruction program reviews, reinforces, or adds to materials presented in class. Data analysis of this study also found that our subjects feel that the computer-enhanced presentation was better at helping them to keep up with the material in contrast to the transparency presentation method.

At the start of the semester the students believed that the computer enhanced presentation method made better use of the examples and illustrations. As the semester progressed the students' preference shifted to the transparency presentation method for making better use of examples and illustrations. This may be due to the novelty of the computer wearing off as time progressed. In multimedia instruction, animation has been found effective and helpful to illustrate complex structural, functional, and procedural relationships among objects and events. The data analysis from this study is consistent with studies found in the literature that suggests visual explanations have a positive effect on knowledge gains and accuracy.

Student viewpoints towards the statements "held my attention longer", "easier for me to comprehend and retain information", "allowed for easier note taking", "most effective", "stressed important and relevant information", and "which presentation method would you prefer in other classes" shifted throughout the semester from preferring the transparency presentations to the computer enhanced presentations and then back to the transparency presentation method. Although the shift occurred the students still strongly are in favor of the computer-enhanced presentations for the Nutrition for Hospitality class and within other college courses. This finding is similar to undergraduate architecture students who identified multimedia as being helpful in understanding concepts and making learning more concrete (George and Sleeth 1996a).

Review of the literature indicates that gender differences in interacting with computer-based learning materials may be an important consideration when specific design strategy is implemented. A number of studies present verification that females and males are different in perceiving visual information. Data analysis of this study found that early in the semester the females believed that the computer enhanced presentation allowed for better visual quality, better use of examples and illustrations, and an increase in skills, knowledge and ability to think. The females also felt that the computer-enhanced presentation was more attractive and was able to catch their attention more so than the males. As the semester progressed into midterm, the females still believed that the computer presentation method was more attractive than the transparency presentation. However at the end of the semester there was no difference in preference between the genders. This may be due to decreasing interest in technology supported by previous research. Review of the literature indicates that after the first few backgrounds, transitions, and clips, students may become less fascinated and more critical (Nantz and Lundgren 1998).

Further data analysis indicates that early in the semester sophomores believed the computer enhanced presentation method was better for stressing important and relevant information more so than the freshmen, juniors and seniors. This same conclusion is not true at midterm or at the end of the semester.

In the middle of the semester the sophomores felt that the computer enhanced instruction made better use of examples and illustrations more so than the freshmen, junior and senior classes. However, at the end of the semester both freshmen and sophomores felt that the computer enhanced instruction made better use of examples and illustrations more so than the juniors and seniors.

At the end of the semester both the freshmen and sophomores believed that the technology enhanced instruction was able to assist in increasing their skills, knowledge and ability to think more than the juniors and seniors. This data corresponds to previous research that has found that students usually learn more in classes in which they receive computer-based instruction and that they learn their lessons in less time with computer based instruction (Skinner 1997).

Research indicates that attention tends to lapse some 10 to 18 minutes into the lecture. Therefore, it is desirable to include some activities that reengage students. Data analysis of our study indicates that by the end of the semester the freshmen and sophomores felt that the computer-enhanced instruction was able to hold their attention longer when compared to the juniors and seniors. With this type of data one could conclude that a clear advantage of multimedia presentations is its ability to incorporate animation, text and sound directly into the lecture as a means to gain attention, motivate and captivate students.

9.0 CONCLUSION

The results of this study support the assumption that students prefer computer enhanced instruction when compared to the traditional transparency presentation method. The existing research evidence on enhancing learning with multimedia is insufficient. More research effort should be invested to explore student preference and learning with regards to other types of multimedia such as web based learning and computer-assisted instruction. Additional research regarding the influence of multimedia on different types of learning styles should also be investigated to determine how individuals with diverse learning styles benefit from multimedia instruction.

A finding of this study also suggests that females prefer technologically enhanced visual illustrations for increased visual quality and attractiveness. Many studies provide evidence that females and males are different in perceiving visual information. It is worth further investigation to determine gender differences in learning achieved when utilizing computer-enhanced instruction.

APPENDIX – A

SURVEY

Last four of SS#________________

Classification
____Freshman
____Sophomore
____Junior
____Senior

Sex _____female
_____male

You have had an opportunity to receive instruction utilizing two different presentation methods for the past few weeks. Please evaluate both presentation methods by marking your response for each question on the computer answer sheet. **By completing this questionnaire you are giving your informed consent that data collected may be used in a research study. Your name will not be identified and there are no repercussions for not participating.**

a = best accomplished by a computer
b = each were about the same
c = prefer or best accomplished by transparencies

a b c d e Allowed for better understanding of the material

1 2 3 4 5 Visual quality was easier to read

1 2 3 4 5 Room lighting was most conducive to learning

1 2 3 4 5 Facilitated interaction between student and instructor

1 2 3 4 5 Makes better use of examples and illustrations

1 2 3 4 5 Increased skills, knowledge, and ability to think

1 2 3 4 5 Held my attention longer

1 2 3 4 5 Easier for me to comprehend and retain information

1 2 3 4 5 Allowed me to take notes easier

1 2 3 4 5 Most attractive

1 2 3 4 5 Most effective

1 2 3 4 5 Allowed me to keep up easier

1 2 3 4 5 Gets my attention

1 2 3 4 5 Stresses relevant and important information

1 2 3 4 5 Best organized

1 2 3 4 5 Over all, I prefer_______in this class

1 2 3 4 5 Which presentation method would you prefer in your other classes?

Additional Comments

APPENDIX – B

LETTER FROM THE CHAIR OF THE RESEARCH COMMITTEE

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