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The development of a computer based courseware to teach research methods

Laura McEwen
San Jose State University

THE DEVELOPMENT OF A COMPUTER BASED COURSEWARE TO TEACH RESEARCH METHODS

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Laura McEwen

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APPROVED FOR THE DEPARTMENT OF
NUTRITION AND FOOD SCIENCE

Dr. Miriam Saltmarch, Ph.D., Graduate Advisor
Department of Nutrition and Food Science

Dr. Ranfilo Belo, Ph.D., Professor
Department of Nutrition and Food Science

Dr. Kathryn Sucher, Ph.D., R.D., Professor
Department of Nutrition and Food Science

APPROVED FOR THE UNIVERSITY

M. Joe Lewandowski

ABSTRACT

THE DEVELOPMENT OF A COMPUTER
BASED COURSEWARE TO TEACH RESEARCH METHODS

by Laura McEwen

Research methodology curricula is an important part of the nutrition program at San Jose State University. A preliminary computer based instruction (CBI) courseware on research methodology was developed. The purpose of this study was (1) to evaluate the preliminary CBI courseware modules, (2) to complete development of the courseware modules based on these evaluations, and (3) to evaluate the completely developed courseware modules. Ten students evaluated the preliminary CBI courseware with several methods, including focus groups. The initial evaluation led to the final development which included multicolored text, high-resolution colored graphics, sound, and real-time video segments in approximately 10-14 hours of user interaction. Three groups of students (total n = 29) evaluated the final courseware and agreed or strongly agreed that the courseware features were presented in a logical manner and enhanced understanding.

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I wholeheartedly want to acknowledge my advisor, Dr. Miriam Saltmarch, for her dedication, energy, and support. Without her vision and confidence in me, I could not have completed the courseware or the thesis.

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PREFACE

This thesis is written in publication style. The second chapter is written in the journal format according to the style guide for research papers and will be submitted to the Journal on Excellence in College Teaching. The first and third chapters are written according to the guidelines outlined in the Publication Manual of the American Psychological Association, third edition, 1983.

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CHAPTER 1

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

Curricula at the undergraduate level in research methodology are an essential and integral part of the nutrition program at San Jose State University (SJSU). Research methodology is a knowledge requirement of the American Dietetic Association (ADA, Plan V) for undergraduate dietetic programs. Recently, many ADA Approved Plan IV/V programs have begun to strengthen their research methodology curricula to meet the more stringent requirements on the Registration Exam for dietitians. Consequently, there is increased need for dietitians to be knowledgeable consumers of research information. There is concern that it would be too costly or too difficult to increase the scope of the research methods course.

In a meta-analysis by Kulik and Kulik (1987), it was found that: 1) students generally learned more in classes when they received help from computers, 2) students learned their lessons with less instructional time and, 3) students liked their classes more when they received computer help.

Another meta-analysis by Cohen and Dacanay (1992) reported that computer enriched versions of computer based instruction (CBI), such as simulation or interactive video,

had large positive effects on the effectiveness in education of health professions. Proponents of CBI believe that the computer can simulate real life clinical scenarios in health education settings. (Cohen & Dacanay, 1992).

Computer based instruction also has the potential to provide quality education in research methodology to undergraduate students in nutrition. This CBI courseware can optimize the amount of material and can act as an adjunct to conventional instructional techniques freeing the instructor to utilize new and more critical thinking forms of instruction. In order to achieve this, it is first necessary to develop CBI courseware. Any development must include an evaluation component to ensure that the courseware adequately addresses student learning needs and preferences.

The objectives for this study were (1) to evaluate the preliminary research methodology CBI courseware modules, (2) to complete development of the CBI courseware based on evaluation of the initial courseware, and (3) to evaluate the developed research methodology CBI courseware.

Review of the Literature

Design Concerns

Pedagogical Design Concerns with CBI

Most of the learning theories associated with pedagogical CBI courseware are grounded in the cognitive learning theories with emphasis on elements to create metacognition in the learner. According to cognitive theorists, the meaningfulness of information is a primary variable affecting the strength of learning (Hannifin & Peck, 1988). Theories directly influence how a courseware is designed. Consequently, design is defined as the purposeful organization of presentation stimuli in order to influence how students process information (Hannifin & Hooper, 1989).

The elaboration theory (Reigeluth & Stein, 1983) provided insight to macro-design elements of CBI. Instruction should begin with an overview and then proceed to more complex ideas that elaborate the primary concept. The progression adds detail, counter-concepts, and finally, abstraction.

Component design theory (Merrill, 1987) proposed that there are different categories of learning. Tasks can be categorized and accomplishments associated with the task can be measured. The main principles state that cognitive structures are consistently associated with learning

outcome, the learner needs to be navigated through the program, and the learner should have time to practice.

The schema theory (Jonassen, 1988) proposed that learning is a reorganization of ideas in semantic memory. The schema, or mental associations about an idea, are restructured and interlinked in the learning process.

Hannifin and Hooper (1989) proposed another cognitive model for CBI design based on three principal foundations in the psychological, instructional, and the technological realms. Specifically, good screen design should cause learners to develop and maintain interest, to promote deep processing, to facilitate engagement between the learner and the lesson content, and to help lesson navigation (Hannifin & Hooper, 1989).

Specific Design Concerns of CBI Features

The CBI terminology describes the technology, i.e., the computer, and not the processes made possible by the medium (Higginbotham-Wheat, 1991). Computer based instruction does not have universally defined features. It can be a simple, externally paced, drill-and-practice routine that lasts a few minutes. It can also be an advanced, interactive, simulation that lasts hours. Unfortunately, the literature contains only limited studies showing the effectiveness of specific features within a CBI courseware.

The literature is also very limited in qualitative studies to identify features that students felt were effective. Although many quantitative studies survey students about their attitudes towards CBI courseware, it rarely defines the attributes that influenced students attitudes.

Text

Computer design guidelines recommended that screen text be simple and that there is ample space around the text to decrease the search time for the students and aid in the recognition of important information (Rambally & Rambally, 1987; Milheim & Lavix, 1992)

Morrison (1989) and Ross and Morrison (1989) investigated text density in print and CBI media. Text density is amount of context given in the CBI. Results confirmed that low text density in either print or CBI was as effective as high density text. In addition, students tended to prefer the low-density material when given a choice.

Pictures and Images

The theoretical framework for the effectiveness of pictures is based on the dual-coding theory advanced by Pavio (1986). This theory suggests that there are independent cognitive encoding systems, one visual and one

verbal. Information is more likely to be remembered if it is encoded in both the verbal and the visual systems. In addition, recall is more likely to occur when the content is easily abstracted to images by the learner. Consequently, any image, such as still pictures, graphs, animation, and perhaps even video, should be expected to aid in the recall of information when it serves to precisely illustrate a concept (Rieber, 1989).

Rieber (1989) established a taxonomy for classifying the uses of animated visuals in CBI instruction. This taxonomy is flexible enough to encompass most any image or graphic in CBI. The six levels are (1) cosmetic, (2) attention gaining, (3) motivation/reinforcement, (4) presentation, (5) conceptualization, and (6) interactive dynamics.

Dwyer (1978) found that pictures facilitated learning in adults when there is sufficient processing time to scan the visual material in search of essential learning cues. If insufficient time is given, students may choose to ignore the visual material and attend to the more familiar printed text. Levin and Lesgold (1978) also found that pictures should be highly related or congruent to the textual material. Unrelated pictures or pictures that are too complex may be distracting. Although the research was not

performed in computer media, the results are important for CBI designers of courseware that are externally paced or have limited time for students interaction.

Examples

According to the dual coding theory, examples of concepts are more effective if they can be imagined. In addition, there is increasing emphasis on making connections between the learner's existing knowledge structure and new information (Peterson, 1988). When college students were given a choice of examples, such as education, business, sports, or no examples, to their CBI course in education, no significant difference in achievement was found with any of the example choices (Ross, 1990). Even so, the students were very positive about selecting the type of examples. More research is needed to substantiate the effectiveness of custom examples.

Questions

There is a long teaching tradition for students to answer questions to prove understanding of the material. The quality of the answers often determine the effectiveness of the educational process. In CBI courseware, not unlike traditional learning environments, questions are also important navigational tools or learning cues for students. Interactive CBI relies heavily on questions as an integral

part of the structure of the courseware, rather just as an evaluation tool.

Shiang and McDaniel (1991) imbedded three types of questions in a CBI: (1) external higher order questions, (2) external lower order questions, and (3) self generated questions. The students were allowed to take notes during the CBI course. The quality and complexity of the student's written responses were correlated to the previous four variables. They found no significant difference between the higher order, lower order, or self generated questions on the quality of the final explanation. They did find that students who elected to take notes produced explanations that were more thoughtful, complex, and complete than students who did not take notes (Shiang & McDaniel, 1991).

Sequence Control

One of the unique features of CBI is the possibility of learner control over the pacing and sequencing of the material. As technology improves, CBI has moved from linear, designer-paced programs to interactive branched programs that are learner-paced. The assumption is that the more control over the instruction the learner has, the greater the learner's motivation. Even so, the research shows varied results on the effectiveness of various type of pacing and sequencing in CBI.

In some early CBI research, O'Day, Kulhavy, & Malczynski (1971) found that a linear format showed higher post-test gains than either a branching or auto-elucidative format in a CBI about the function and structure of the human eye.

Gray (1987) found that a CBI with a branching pattern resulted in significantly higher immediate post test scores than a linear pattern. A week after the post test, there was no significant difference between the two groups when tested a second time. Students who used the linear format had a better attitude toward the CBI. Gray (1987) concluded that too much sequence control may serve to distract the student. With each screen, two complex decisions have to be made; what decision to choose, and then where in the CBI to travel. If the program is linear, only one decision has to be made.

Small Group Learning

In general, CBI is utilized in pairs or trios of learners , and thus is uniquely different from the traditional lecture learning environment.

Mevarech, Silber, and Fine (1991) found that pairs using drill and practice math programs performed better than students who used it individually. They also found that use

of the CBI in pairs alleviated math anxiety of low ability students more than the individual CBI treatment.

Other researchers have found that lower ability students responded differently to CBI than did higher ability students. Schlechter (1992) found that for tasks designed for individual performance, lower ability students preferred small group CBI and higher ability students preferred individualized CBI. For small group learning tasks, the opposite preferences occurred (Schlecter, 1992).

Evaluation Concerns

Focus Groups

A focus group interview is a qualitative research technique used to obtain data about feelings and opinions of small groups of participants about a given problem, experience, service, or other phenomena (Basch, 1987). Generally, a moderator leads eight to ten participants who do not know each other through an interview that lasts approximately 60 minutes.

Academic institutions are using focus groups as a way to reassess programs and curricula, especially in the face of less government funding (McDermott, 1987; Elliott, Ingersoll, & Smith, 1984).

Conceptual Frame of Reference

The hallmark of focus groups is the explicit use of the group interaction to produce data and insights that would be less accessible without the interaction found in a group (Morgan, 1988). From a psychological perspective, this challenges the participants to bring more ideas into the cognitive realm. The challenge of focus group research is to identify the trends of attitudes and the interrelations so when viewed as a whole, these attributes can be seen to form a system (Crespi, 1965).

Group Interaction

Fern (1982) found that focus groups of participants who do not know one another generated significantly more ideas than focus groups made up of acquaintances. Although the quality of the ideas was not evaluated, indications are that strangers produce a higher volume of ideas in focus group interviews than acquaintances.

Likert Scale

The Likert scale was developed by Rensis Likert in 1932, as a simple scale method of attitude measurement. Attitude is defined as expressed opinion. It is understood that only the actual attitude expressed can be measured and that the subjects may be consciously hiding their true

attitude or that the social pressure of the situation have made them believe what they expressed.

This qualitative method stems from Thurston's Law of Comparative Judgment which proposed the rationale for the placement of psychological stimuli along a continuum independent of any underlying physical order. Since then, it has become a very important method of attitude measurement (Seiler & Hough, 1970).

Summary of Literature Review

Although the literature has shown CBI to be effective, the research is less clear regarding which features lead to the effectiveness of the courseware. A simplified text is generally preferred by students and is as effective as more lengthy text. Theoretically, if pictures or images aid the student's ability to imagine the content, learner outcome is improved. Researchers found that pictures facilitate learning if there is sufficient time to mentally process the image and if it is highly related to the text. Custom contexts have not shown to enhance performance, but students are very positive about the concept. In general, CBI rely very heavily on questions, although the effectiveness of questions on learner outcome is still under debate. Sequencing in CBI is changing from linear designer-controlled programs to branched user-controlled media. Even

so, the linear sequencing was shown to be effective and liked by students. Small group learning with CBI was shown to enhance the outcome of students, especially low aptitude students.

Focus groups started as a qualitative research tool in the social sciences, but are now used in many areas to evaluate media, products, and academic programs. Generally, focus groups consist of eight to ten participants who do not know one another. Research has found that focus groups of strangers produce a higher volume of ideas than acquaintances.

CHAPTER 2

JOURNAL ARTICLE

Author's Title Page

THE DEVELOPMENT OF A COMPUTER BASED DIGITAL VIDEO INTERACTIVE COMPUTER COURSEWARE TO TEACH RESEARCH METHODOLOGY

Laura McEwen, M.S., Miriam Saltmarch, Ph.D., Vicki Castelli, M.S., Kathryn Sucher, Ph.D, R.D., Lucy McProud, Ph.D., R.D., Dana Arnold, M.S., Meenakshi Hejmadi, M.S., Yvette Rivas, M.S. and Jill Ellis, Ph.D.
Department of Nutrition and Food Science
San Jose State University
One Washington Square
San Jose, California 95192

For all correspondence, please contact Dr. Miriam Saltmarch, Department of Nutrition and Food Science, San Jose State University, One Washington Square, San Jose, California, 95192, 408-924-3118.

Abstract

Research methodology curricula is an important part of the nutrition program at San Jose State University. A preliminary computer-based instruction (CBI) courseware on research methodology was developed. The purpose of this study was (1) to evaluate the preliminary CBI courseware modules, (2) to complete the development of the courseware modules based on these evaluations, and (3) to evaluate the developed courseware modules. Ten students evaluated the preliminary CBI courseware with several methods, including focus groups. The initial evaluations led to the final development which included multicolored text, high-resolution color graphics, sound, real-time video segments, and extensive multiple choice questions in approximately 10-14 hours of user interaction. Three groups of students (total n = 29) evaluated the final courseware and agreed or strongly agreed that the courseware features were presented in a logical manner and enhanced understanding.

Introduction

Research methodology curricula is an important part of the nutrition program at San Jose State University (SJSU). A preliminary computer based instruction (CBI) courseware was developed to increase the scope of the research methods course. Although the literature has shown CBI to be effective (Kulik & Kulik, 1987; Cohen, & Dacanay, 1992), the cognitive theorists are in less agreement about the pedagogical design of CBI courseware. The elaboration theory (Reigeluth & Stein, 1983) proposed that instruction should begin with an overview and proceed to more complex issues that elaborate the primary concept. Component design theory (Merrill, 1987) has aided in the micro-design of CBI in that that accomplishments associated with tasks can be measured.

The literature is limited in studies identifying the effective components of CBI. A simplified text is generally preferred by students and is as effective as more lengthy text (Milheim & Lavix, 1992; Morrison, 1989; Ross & Morrison, 1989; Rambally & Rambally, 1987). Theoretically, if pictures or images aid the student's ability to imagine the content, learner outcome is improved (Pavio, 1989). Researchers found that pictures facilitate learning if there is sufficient time to mentally process the image and if it

is highly related to the text (Hannifin & Hooper, 1989; Rieber, 1989; Dwyer, 1978; Levin & Lesgold, 1978). Custom examples have not been shown to enhance performance, but students are very positive about the concept (Peterson, 1988). In general, CBI relies very heavily on questions, although the effectiveness of questions on learner outcome is not been significantly proven (Shiang & McDaniel, 1991).

Sequencing in CBI is moving from linear designer-paced programs to branched program controlled by the learner. Even so, the linear sequencing was shown to be effective and liked by students (O'Day, Kulhavy, Anderson, & Malczynski, 1971; Gray, 1987).

Small group learning with CBI was shown to enhance the outcome of students, especially low aptitude students (Mevarech, Silber, & Fine, 1991; Schlecter, 1992).

Computer based instruction has the potential to provide quality education in research methodology to undergraduate students in nutrition. This CBI courseware can optimize the amount of material and can act as an adjunct to conventional instructional techniques freeing the instructor to utilize new and more critical thinking forms of instruction. In order to achieve this, it is first necessary to develop CBI courseware. Any development must include an evaluation

component so that the courseware adequately addresses student learning needs.

The objectives for this study were (1) to evaluate preliminary research methodology CBI courseware modules, (2) to complete development of the CBI courseware based on the evaluation of these preliminary modules, and (3) to evaluate the developed research methodology CBI courseware modules.

Materials and Methods

Materials

Hardware and Software

The CBI courseware was developed on an IBM-PC 486, 25 MHz, clone with two high capacity disc drives (1.2 gigabyte and 500 megabyte) and an Intel ActionMedia II DVI capture and delivery board. The courseware was developed with the authoring multimedia software Authology®, Version 2.0. A full list of the hardware and software used to develop the courseware is presented in Table 1.

Questionnaires

Three groups of students evaluated the CBI courseware with questionnaires that utilized the 5-point Likert scale (1 = strongly agree and 5 = strongly disagree), fill-in-the-blank questions, and ranking. The questions evaluated the appropriateness and effectiveness of the content, examples, visual images, audio/video segments, test questions, and manner of presentation. The students were also asked to write comments.

Focus Groups and Interviews

Students from each group participated in focus groups or were randomly chosen for individual interviews after completion of the courseware. Questions were prepared in

advance. The responses were tape recorded with the student's knowledge and analyzed after the session.

Methods

Evaluation of the Preliminary Courseware

Focus group.

A group of female undergraduate nutrition majors (n = 10) who had used the preliminary CBI courseware in the Spring semester, 1993, participated in qualitative and quantitative evaluations of the preliminary courseware (Rivas, 1993; Hejmadi, 1993). These results and the results from two one-hour focus groups provided the direction for the final development of the CBI courseware. The students were informed that their participation in the focus groups was voluntary and their comments would not affect their grade in the class. They were also informed the focus groups were tape recorded. Two graduate students acted as moderators and asked the focus group prepared questions about specific attributes of the CBI (Table 2).

The tape recordings were transcribed and the comments grouped according to common themes in order to achieve a full range of answers to the questions presented.

Final Development of the Modules

Structure and text.

The courseware was developed in three modules (Table 3). Each topic section in the modules had the same structure (Table 4).

The text from the preliminary courseware was edited to simple sentences or an outline. The text was divided into discrete units for each idea or concept. This separation was emphasized by placing a colored box behind every text segment.

Images.

Custom graphics, icons, and graphs were created with Harvard Graphics, Photostyler, ImagePrep, LUMENA, and a DOS based utility conversion program. Written permission was received to use all images in the courseware. Pictures were subsequently taken of students and staff at San Jose State University. All other images were from the public domain or of immediate family members who gave permission to be included in the courseware. Images were imported from other programs or directly scanned into Photostyler where they were then cropped and enhanced. These images were then exported to Imageprep to be converted and saved as Targa-16 files on the hard drive. All images were then finally converted and compressed to C16 files using a DOS based

compression utility program and incorporated into the Authology® authoring program.

Audio and video.

The Instructional Resource Center at SJSU supplied music in the public domain. All music was copied from compact disc to video cassette tape. Narration was taped live directly onto video cassette tape. Written permission was received from all individuals whose video images were used in the courseware. Video segments were taped at various locations on the SJSU Campus. The Digital Video Producer software edited, captured, compressed, and saved to disk the audio and video segments which could then be used by the Authology® program.

Final Evaluation of the Modules

Questionnaires and focus groups.

Three groups of students evaluated the developed CBI courseware with questionnaires, and two of these groups also participated in focus groups or individual interviews. The first group (n = 7) evaluated the course midway through the final development, and the other two groups (n = 17; n = 5) evaluated the courseware upon its completion.

The first group was composed of female undergraduate students who had previously taken the research methodology course with either the preliminary CBI or the traditional

classroom lecture (Arnold, 1994). They volunteered in Spring, 1993, to evaluate the courseware midway through its final development in late Fall, 1993. The students viewed the courseware in pairs or trios during three one hour sessions. After each session, they completed the objective Likert scale questionnaire. After the completion of the courseware, the students participated in a one hour focus group led by a graduate student and suggested improvements to the courseware. The students were informed that their participation was voluntary and that the group was tape recorded. The taped responses were evaluated and categorized by type of response.

The second group of female undergraduate nutrition majors were randomly chosen from 33 students enrolled in the research methodology course in the Spring of 1994 (Castelli, 1994). The students were grouped into pairs or trios and used the CBI in weekly one-hour sessions through the rest of the semester. At the end of the courseware, each student filled out the objective Likert scale questionnaire to evaluate the courseware. After the completion of the course, six students were randomly chosen for individual taped interviews conducted by a graduate student. All the students were asked to give their overall impressions of the CBI courseware, its strengths and weaknesses, suggestions for

improvement, and if they would recommend the course to others. The taped responses were evaluated.

The third group was composed of female graduate students from San Diego State University who had previously taken a research methodology course or were currently involved in research. A video tape was made of six topic sections in the CBI courseware. Each student viewed the tape individually during June of 1994, and completed the objective Likert scale questionnaire after each topic section. Due to logistical problems, no one from the SDSU group participated in a focus group or an interview at SJSU.

Results and Discussion

Focus Group Evaluation of the Preliminary Courseware

Although students indicated they wanted a highly interactive courseware (Table 3), they reacted negatively to the branches and loops used in the preliminary courseware. Even though the return to a linear design runs opposite to the current trends in CBI design, a linear program was shown to be effective (O'Day, Kulhavy & Malczynski, 1971; Gray, 1987). In addition, the authoring software did not easily support multiple loops or any file larger than 12 panels.

Students preferred simple text which was shown to be effective and well liked (Morrison, 1989; Ross & Morrison, 1989). The students stated that high quality resolution pictures should correlate directly with the text to aid in comprehension. This corresponds to the results of research (Rieber, 1989; Dwyer, 1978; Levin & Lesgold, 1978). The focus group results showed that examples, video, and pictures should have themes applicable to college aged students. This positive response toward custom examples was also seen by Peterson (1988).

Results of the Final Courseware Development

Text

The preliminary text was edited to a very simple structure. A simplified text was highly desired by the

students in preliminary evaluations (Hejmadi, 1993) and the focus group. The literature has shown that simplified text was effective and well-liked (Morrison, 1989; Ross & Morrison, 1989).

The text was divided into discrete units for each idea or concept. Each text unit had a unique color and was placed on a different colored background to emphasize separation from other text units. The color and separation aided the student's ability to recognize important information (Rambally & Rambally, 1987; Milheim & Lavix, 1992).

The text was placed on approximately 380 panels and provided for extensive interaction time, about 10-14 hours. The students in the focus groups indicated the modules were well organized, comprehensive, and clear. Although the literature is limited regarding the effect of CBI length, the CBI courseware provided extensive amounts of information that was not considered excessive by the students (Hejmadi, 1993).

Visuals

Visual images in the form of pictures, graphs, or icons were added to every panel throughout the CBI. Approximately 300 images were used in the courseware. The students felt the pictures made the modules enjoyable (Hejmadi, 1993). The results of the focus group also indicated the students were

positive about images. If images help students abstract the concepts to memory, recall is improved (Rieber, 1989).

Clear images of simple concepts with minimal abstraction were used. Captions were added to every picture for clarification. Generally, the pictures were one-quarter screen or larger in size. Students in the focus group wanted large high-quality pictures that were easily understood and also included captions. Levin & Lesgold (1978) found that pictures highly congruent to the text were also more effective in learner outcome.

Professionals or students actively engaged in research were common image themes. In addition, pictures of food and people consuming foods in their natural cultural context were other image topics. The focus group results indicated students wanted themes that were "college-aged" or represented "real-life." Ross (1990) found that students were very positive about custom examples, but no significant difference in learning with custom examples was found.

Icons, a special type of visual image, were used as location markers through each topic segment. Each topic subject had its own unique icon. For example, the topic on animal rights in research ethics, a rabbit superimposed on a international warning sign was used. When describing the advantages and disadvantages of a particular research type,

icons of a "thumb-up" or a "thumb-down" was used. The purpose of the icons was to aid student navigation through the program. The focus group response indicated the students liked headings and other location markers; icons were a natural extension. According to the component theory (Merrill, 1987), students need to be aided in navigation through CBI programs.

Sound

Sound was associated with every panel in the form of music, narration, or radio-style dialog. Over 217 sound tracks were used in the courseware. The focus group results indicated sound was best as a reiteration of the text. There is limited research on the effectiveness of sound in CBI. Consequently, borrowing Rieber's (1989) taxonomy on animated visuals provided guidance for sound features. Sound was used for (1) cosmetic purposes, such as announcing a topic subject; (2) attention gaining, such as using whistles and animal noises; (3) motivation/reinforcement, such as restating the text; (4) presentation, such as talking about features of research; and (5) conceptualization, such as creating radio-style dialog discussing research ethics. In addition, music was used to create a soothing environment.

Video

Nine video segments lasting up to three minutes each were taped at various locations throughout the SJSU campus. The purpose of the video segments was to show male and female researchers involved in a broad spectrum of positive nutrition research roles. The focus group results indicated the students were very positive about video, especially as a means to simulate real-life situations. The literature is limited on the effectiveness of video clips within a CBI courseware. Video, much like graphics, may aid in the student's ability to imagine the content and improve learner outcome (Rieber, 1989).

Evaluation of the Final Courseware

Results from the Midway Evaluation

Questionnaires.

The average score for the seven students across all modules indicated that the students agreed that the CBI courseware was effective in many ways (Arnold, 1994; Table 6). The students felt that visual images made the information more interesting which was predicted, based on earlier focus group guideline of using large bright pictures of actual students and research that correlated with the text. According to Rieber (1989), graphics can be effectively used to arouse and maintain a learner's

attention during CBI. In addition, good screen design should cause learners to maintain interest in the lesson content (Hannifin and Hooper 1989).

The students agreed that the audio\video option enhanced learning. From the written comments it was clear that the students wanted more video, even though some found the video segment of a laporoscopy workshop objectionable and difficult to understand. As with all graphic information, videos must be of high resolution and correlate directly with other information in the course (Rieber, 1989, Dwyer, 1978, Levin & Lesgold, 1978).

Suggestions for improvement taken from the written comments included increasing the print size and decreasing the amount of technical terminology. Again, students wanted easily understandable text which was known from earlier focus groups and the literature (Morrison, 1989; Ross & Morrison, 1989). These changes were subsequently included in the final courseware.

Focus groups.

The focus groups confirmed much of the results from the questionnaire (Arnold, 1994). The visual images were positive in many ways. The students felt the pictures and videos reinforced learning and provided a mental pause from reading. The icons helped the students stay organized which

was an important part of the navigation tools suggested by Merrill (1987).

Suggestions for improvement included adding the ability to move forward and backwards in the courseware. Freedom of movement was viewed positively in earlier focus groups and is the current trend in interactive CBI design. The authoring program could not accommodate bi-directional movement with the large files used in this program.

Results from the Final Evaluation

Questionnaires.

The 17 student's average score indicated they agreed that the text, examples, video segments, visual images, and test questions enhanced understanding or were presented in a logical manner (Castelli, 1994; Table 7). These responses were similar to the midway evaluation.

The student's average score indicated that they neither agreed nor disagreed that the CBI was effective for understanding the material. The high standard deviation (1.07) indicated a variety of responses within the group. The comments and interview results showed that there was enough information and examples, but there was inadequate time or opportunity to integrate and fully understand the information. Some students missed the teacher and group interaction found in the class which helped them understand

material. Others students felt that the material was learned at home after copying the information from the screen. Additionally, many students felt rushed and consequently did not use the multiple choice questions which may have provided them with greater understanding of the material. These results stress the importance that achievement be associated with tasks and that the learner has adequate time to practice (Merrill, 1987).

The students neither agreed nor disagreed that audio (voice) enhanced understanding. The decreased importance of audio was reflected in the ranking of attributes. Audio was ranked second as the attribute wanted less often (Table 8). It was also listed as one of the least important attributes (Table 9). The written comments indicated that some students were distracted when the voice track read the text that was on the screen, especially when the students were taking notes. The response to voice segments contradicts earlier focus group results that recommended the voice segments repeat the text on the screen.

In addition, the written comments indicated that many of the students found the music tracks repetitive and distracting. The earlier focus groups were neutral towards the inclusion of music. Consequently, this may have contributed to the questionnaire results on audio tracks.

Although the students average score indicated they agreed that video segments enhanced understanding, there was high standard deviation (SD = 1.13). This mixed response toward video was reflected in the attribute ranked as wanted more frequently (rank = 1) and less frequently (rank = 3). Much like the midway evaluation, some students found the video segment on laporoscopy objectionable. Customizing video, like graphics, to the text is highly recommended (Levin & Lesgold, 1978).

Text was most frequently listed as the most important attribute. Even so, it was also listed as most wanted less frequently. Although students understood the importance of text, it was one of the least desired ways to absorb information. As CBI moves toward more interactivity and incorporates more multi-media, the reliance on text may decrease. These current results stress the importance of simplified text in CBI courseware (Morrison, 1989; Ross and Morrison, 1989).

Individual interviews.

The six students chosen for individual interviews confirmed the results from the questionnaires. The overall impressions of the CBI was that it was a good concept, but there was a desire for more class interaction and more interactivity within the CBI (Table 10). The students liked

working at their own pace, but some felt there should have been more time available to use the CBI. The strengths of the CBI were clearly in the amount of information, the organization, and the examples. The weaknesses of the CBI included confusion when audio voices said the text on the screen and music that started and stopped abruptly.

The students were generally positive in recommending the CBI class. Three students stated they would recommend the CBI courseware to others and two students said they would conditionally recommended the courseware to others. One student would not recommend the CBI because of the research environment. This would not be a problem when the CBI was presented in a regular classroom.

Results of Final Evaluation from San Diego State Students Questionnaires.

In general, the results from the SDSU students evaluations were more positive than those from the SJSU students. The average score of the five students across all topic segments indicated they strongly agreed the material was presented logically, the content was at an appropriate level, and the examples enhanced understanding (Table 11). The students agreed that the audio, video, visuals, or test questions enhanced understanding or made the information more interesting.

The SDSU students ranked audio first as the attribute wanted more frequently (Table 12) and fourth as the attribute listed most important (Table 13). The SDSU students were not responsible for the CBI material and most probably did not take notes from the screen. Consequently, they found the audio voices helpful and not a distraction. Research is needed to compare different learning styles in perceived effectiveness. This is important for designers of curriculum or tutorial CBI.

Comments.

The students comments reinforced the data from the questionnaire. In general, all the students commented that the material was logical, easy to follow, and appropriate to their level of understanding. Most students said that the material was a review and some wanted a more in-depth perspective. There was a desire to have more audio. Several students consistently commented that more audio voices were needed to define, describe or explain the material. Consequently, less text would be required.

Conclusion

The purpose of the study was to evaluate the preliminary CBI courseware, to complete the development of the CBI courseware, and to evaluate the developed courseware. The evaluations of the preliminary courseware indicated the students wanted simple text, high resolution pictures, video, and examples that represented college-aged, real-life research. Although the students liked the idea of a highly interactive program, they reacted negatively to the loops and simple branching features in the preliminary courseware.

The final courseware was developed with these guidelines in a linear, student-controlled progression. Each topic section concluded with multiple choice questions that supplied feedback for each answer. The courseware consisted of approximately 380 multi-colored panels and provided for extensive interaction time, approximately 10-14 hours.

The three groups of students who evaluated the courseware agreed or strongly agreed that the courseware was presented in a logical manner and that text, visual images, examples, and test questions were interesting or enhanced understanding. Although students found the video segments interesting and wanted more of them, other students reacted negatively to the content of one video segment. In addition,

audio voices that repeated the text on the screen and music that stopped abruptly were seen as distracting to some students. Overall, the positive results from the students evaluations indicated the features of the final CBI courseware modules were considered interesting and enhanced understanding of research methodology.

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Table 1

Hardware and Software Used in the Development of the CBI

Hardware
IBM PC-486 clone with two high capacity disc drives
Intel ActionMedia II DVI capture and delivery board
Summagraphics Summasketch pad, 21-inch pad
Two 14-inch monitors: One Sceptor S-VGA and one Mitsubishi Diamond Scan RGB
External CD ROM and Media Kit stereo speakers
Panasonic-AG455 S-VHS camcorder
JVC Vid-Star HR-S8000U digital stereo S-VHS VCR
Software
Authology Multimedia V. 2.0 by CEIT of Santa Clara
LUMENA/DVI by Time Arts Inc. (Version 3.4)
Digital Video Producer (copyright 1990-1991)
Harvard Graphics by Software Publishing, Inc. and Image Mark Software labs (copyright 1991-1992)
Photostyler by U-Lead Systems, Inc. (Version 1.03, copyright 1990-1991)
ImagePrep by Computer Presentations, Inc. (Version 4.0, copyright 1990-1991

Table 2

Outline for Focus Group Evaluating Preliminary Courseware

1. Welcome and review of focus group guidelines
2. What are the highlights of a perfect CBI?
3. What are the most effective examples to use?
4. Why are video games so exciting?
5. What can we do to make this CBI better?
6. What is the role of CBI in the classroom?
7. Did you get enough information from the CBI?
8. Should you have a CBI partner?
9. What is the ideal environment to use CBI?
10. What makes a good visual image?
11. Why are the pictures from *Life Magazine* so effective?
12. Why have visual images?
13. What are bad visual images?
14. What makes good audio?
15. When is music appropriate?
16. When is humor appropriate?

Table 3

Subject Content of the Three Modules

Module I
Research Definitions
True and Quasi Experiment
Correlational Research
Descriptive Research
Epidemiology
Survey
Historical
Case Study
Methodological and Program Related
Module II
True and Quasi Experiment
Ethics and Experimental Errors
Module III
Epidemiology

Table 4

Structure of the Topic Sections

Definition of the type of research
Reasons to conduct research
Various types of research
Examples of research
How to conduct research
Advantages and disadvantages of the research

Table 5

Focus Group Results From Evaluation of Preliminary Courseware

What is the Ideal Courseware?
* Self paced and repeatable
* Used anytime and any number of times
* Unidirectional movement within the program
* High level of interactivity and feedback
* High level of student/user control
* Examples are simple, depict real life, and specific
* Images correlate directly with text and have high resolution
* Audio should be a male voice and free of accent
* Minimal humor should be used

What Changes Can We Do to Make This CBI Better?
* More Control
* More feedback
* Role playing and "what-if" scenarios

Table 6

Average Score of Final Courseware - Midway Evaluation

Question	Mean
Students (n = 7)	
1. The material was presented logically	1.6
2. The content was appropriate	1.7
3. Examples enhanced understanding	1.7
4. Audio/video option enhanced learning	2.1
5. Visuals enhanced understanding	1.8
6. The visual images made the information more interesting	1.5
7. The test questions helped me test myself	1.8
8. New terms were explained	1.9
9. The text/images/video flowed logically	1.6

Note: 1 = Strongly agree, 3 = Neither agree nor disagree, and 5 = Strongly disagree.

Table 7

Average Score of Final Courseware - Group Two Evaluation

Question	Mean Score	SD
Students (n = 17)		
1. The CBI was effective for understanding the material for this course	2.7	1.07
2. The text was presented in a logical manner	1.9	0.54
3. The examples enhanced understanding	1.7	0.82
4. The audio (voice) enhanced understanding	2.9	0.94
5. The video segments enhanced understanding	2.3	1.13
6. The visual images enhanced understanding	2.1	0.96
7. The test questions enhanced understanding	2.3	0.90
8. The text, audio, video and images flowed in a logical manner	2.1	0.56

Note: 1 = Strongly agree, 3 = Neither agree nor disagree, 5 = Strongly disagree.

Table 8

Ranking of Attributes Wanted More or Less Frequently - Group Two Evaluation

More Frequently		Less Frequently	
Rank	Attribute	Rank	Attribute
	Students (n = 7)		
1	Examples Video	1	Text
2	Images Test questions	2	Audio
3	Audio Class time Time Interactivity	3	Test questions Video

Note: Each student could identify as many attributes as were considered appropriate.

Table 9

Ranking of Attributes That Students Identified as Most or Least Important - Group Two Evaluation

Listed as 1st, 2nd or 3rd Most Important		Listed as Least Important	
Rank	Attribute	Rank	Attribute
Students (n = 17)			
1	Text	1	Music
2	Examples	2	Audio
3	Video	3	Video
4	Graphics		Test
	Visuals		Graphics
5	Test		Text
6	Audio		

Table 10

Summary of Individual Interviews - Group Two Evaluation

Strengths
* Consolidates a lot of information. Easy to follow.
* Organized. It had a lot of information.
* It was very through. Lots of examples
* Being able to go back and read everything. Self-paced.
* The video with audio and going at your own pace.
Weaknesses and Suggestions For Improvements
* There was no class interaction or interaction with an instructor or professor.
* The audio voices should not say what's on the screen. It is too hard to write and listen.
* An written outline of the CBI would be helpful.
* Maybe I would have had more out of it had I not known my partners. It was a given, so we did not discuss the material.
* Longer amount of time allotted so you were not waiting for the people in front of you to finish.
* I did not like the music starting and stopping. It was choppy.

Table 11

Average Score of Final Courseware - SDSU Evaluation

Question (N = 5)	Mean
1. The material was presented logically	1.1
2. The content was appropriate	1.2
3. Examples enhanced understanding	1.4
4. Audio/video option enhanced learning	1.8
5. Visuals enhanced understanding	1.7
6. The visual images made the information more interesting	1.6
7. The test questions helped me test myself	1.6
8. New terms were explained	1.5
9. The text/images/video flowed logically	1.3

Note: 1 = Strongly agree, 3 = Neither agree nor disagree, and 5 = Strongly disagree. This is a summation of six different topic sessions.

Table 12

Ranking of Attributes Wanted More or Less Frequently - SDSU Evaluation

More Frequently		Less Frequently	
Rank	Attribute	Rank	Attribute
Students (n = 5)			
1	Audio	1	Music
2	Video	2	Text
3	Test questions	3	Examples

Note: This is a summation of all the attributes listed on questionnaires evaluating six different topic sessions. Student could identify as many attributes as were considered appropriate.

Table 13

Ranking of Attributes That Students Identified as Most or Least Important - SDSU Evaluation

Listed as 1st, 2nd or 3rd Most Important		Listed as Least Important	
Rank	Attribute	Rank	Attribute
Students (n = 5)			
1	Text	1	Images
2	Examples	2	Graphics
3	Video	3	Video
4	Audio	4	Example
5	Images		
6	Test		
7	Graphics		

Note: This is a summation of attributes listed on questionnaires evaluating six different topic sections.

CHAPTER 3

CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to evaluate the preliminary CBI courseware, to complete the development of the CBI courseware, and to evaluate the developed courseware. The evaluations of the preliminary courseware indicated the students wanted simple text, high resolution pictures, video, and examples that represented college-aged, real-life research. Additional research is still needed to determine the effectiveness of these various features within CBI courseware on learner outcome. The literature supports numerous studies on the effectiveness of completed CBI courseware, but not the contribution of particular features to the success of the whole courseware.

Although the students liked the idea of a highly interactive program, they reacted negatively to the loops and simple branching features in the preliminary courseware. It is important that more research is conducted to create interactive features that are acceptable to the first-time students of CBI courseware and provide time to apply the information. As software improves and as more students become familiar with this medium, the negative reaction to interactive features will likely diminish.

With student evaluation results as guidelines, the final courseware was developed in a linear, student-navigated progression. Each topic section concluded with multiple choice questions that supplied feedback for each answer. The courseware consisted of approximately 380 multicolored panels and provided for extensive interaction time, approximately, 10-14 hours.

Three groups of students who evaluated the courseware agreed or strongly agreed that text, visual images, examples, and test questions were interesting or enhanced understanding. Although many students found the video segments interesting and wanted more of them, other students reacted negatively to the content of one segment. Audio voices that repeated the text on the screen and music that stopped abruptly were seen as distracting to some students. The students who used the CBI courseware as the course curriculum, although positive, were generally more critical of the CBI courseware than the students who only evaluated the program. Research is needed to compare student learning styles and identify any special learning needs.

Overall, the positive results from the student evaluations indicated the features of the final CBI courseware modules were considered interesting and enhanced understanding of research methodology.

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APPENDICES

Appendix A

Questionnaire, Evaluation of Preliminary courseware

Please mark the following scales with an X to rate the courseware. If you need more space, please use the back of the questionnaire or attach a separate sheet.

1. This course has increased my knowledge and understanding of research methodology (experimental research / epidemiological research). If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree

   Comments:

2. The material was presented in a logical manner. If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree

   Comments:

3. The content of this section was appropriate to my level of understanding. If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree

   Comments:

Appendix A (continued)

4. The examples provided in this section enhanced my understanding of the theory. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree

Comments:

5. The visual images were appropriate for the information provided. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree

Comments:

6. New terms were clearly explained. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree

Comments:

7. I would like to see more of _____ in this section. Circle your answer or answers.

Text Audio Images
Examples Test Questions Video
Others (specify)

Appendix A (continued)

8. I would like to see less of _____ in this section. Circle your answer or answers.

Text	Audio	Images
Examples	Test Questions	Video
Others (specify)		

9. The articles provided in the critical thinking section were simple to understand. If not, please give examples of what you did not understand.

1	2	3	4	5
Strongly agree				Strongly disagree

Comments:

10. The questions in the critical thinking section were helpful in evaluating the research design of studies. If not, please suggest ways we can improve them.

1	2	3	4	5
Strongly agree				Strongly disagree

Comments:

Appendix B

Questionnaire, Stage III, Group One

Please mark the following scales with an X to rate the courseware. You do not have to mark a specific number but can mark anywhere on the scale that you feel is appropriate

1. The material was presented in a logical manner that was easy to follow. If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree
   Comments:

2. The content of this section was appropriate to my level of understanding. If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree
   Comments:

3. The examples provided in this section enhanced my understanding of the theory. If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree
   Comments:

4. The audio/video option enhanced my learning in this section. If strongly disagree or wish to comment, please explain.

   1----------2----------3----------4----------5
   Strongly agree — Strongly disagree
   Comments:

Appendix B (continued)

5. The visual images enhanced my understanding of the information provided. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Comments:

6. The visual images made the information in this section more interesting. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Comments:

7. The test questions provided at the end helped me to adequately test myself on this section. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Comments:

8. New terms were clearly explained. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Comments:

9. The text, images and video flowed in a logical order/sequence. If strongly disagree or wish to comment, please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Comments:

Appendix B (continued)

10. To make this section ideal, I would change_____. Please give at least one example.

11. I would like to see more of _____ in this section. Circle your answer or answers.

Text	Audio	Images
Examples	Test Questions	Video
Others (specify)		

13. I would like to see less of _____ in this section. Circle your answer or answers.

Text	Audio	Images
Examples	Test Questions	Video
Others (specify)		

13. Rank the importance of the components in this section from most (#1) to least important (#7).

_____ Text
_____ Still Images
_____ Test Questions
_____ Video
_____ Examples
_____ Graphics

Appendix C

Questionnaire - Group Two

NUFS 195
SPRING 1994
EVALUATION

Name (Optional) _____

Circle the number that most closely reflects your opinion, in the following areas, based on a scale from 1-5. Please give additional comments below each question especially if you strongly agree or strongly disagree.

1	2	3	4	5
Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

1. Overall, the Computer Based Interactive (CBI) program was an effective method for understanding the material for this course.

1 2 3 4 5
Comments:

2. The text was presented in a logical manner that was easy to follow.

1 2 3 4 5
Comments:

3. The examples provided enhanced my understanding of the theory presented.

1 2 3 4 5
Comments:

4. The audio (voice) enhanced my understanding of the material.

1 2 3 4 5
Comments:

Appendix C (continued)

5. The video segments enhanced my understanding of the material.

1 2 3 4 5
Comments:

6. The visual images (photos, icons, pictures) enhanced my understanding of the material.

1 2 3 4 5
Comments:

7. The test questions enhanced my understanding of the material

1 2 3 4 5
Comments:

8. The text, audio, video and images flowed in a logical sequence.

1 2 3 4 5
Comments:

9. The physical setting enhanced my understanding (e.g. office, lighting, seating).

1 2 3 4 5
Comments:

Appendix C (continued)

10. Viewing the modules with a partner enhanced my understanding.

1 2 3 4 5

Comments:

11. I would like to have more _____. (Circle all that apply.)

Text	Images
Audio	Examples
Test questions	Video
Other _____	

12. I would like to have less _____. (Circle all that apply.)

Text	Images
Audio	Examples
Test questions	Video
Other _____	

13. Rank the importance of the following components from most important (#1) to least important (#9)

_____ Text
_____ Visual images
_____ Test questions
_____ Video
_____ Audio
_____ Music
_____ Graphics
_____ Examples
_____ Physical setting

14. Additional comments

Appendix D

Questionnaire - SDSU Students

Please mark the following scales with an X to rate the courseware. You do not have to mark a specific number but can mark anywhere on the scale that you feel is appropriate

Module Topic is _____ Evaluator Name _____

1. The material was presented in a logical manner that was easy to follow. Please explain.

   1----------2----------3----------4----------5
   Strongly Strongly
   agree disagree
   Explanation:

2. The content of this section was appropriate to my level of understanding. Please explain

   1----------2----------3----------4----------5
   Strongly Strongly
   agree disagree
   Explanation:

3. The examples provided in this section enhanced my understanding of the theory. Please explain

   1----------2----------3----------4----------5
   Strongly Strongly
   agree disagree
   Explanation:

4. The audio/video portion enhanced my learning in this section. Please explain.

   1----------2----------3----------4----------5
   Strongly Strongly
   agree disagree
   Explanation:

Appendix D (continued)

5. The visual images enhanced my understanding of the information provided. Please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Explanation:

6. The visual images made the information in this section more interesting. Please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Explanation:

7. The test questions provided at the end helped me to adequately test myself on this section. Please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Explanation:

8. New terms were clearly explained. Please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Explanation:

9. The text, images and video flowed in a logical order/sequence. Please explain.

1----------2----------3----------4----------5
Strongly agree — Strongly disagree
Explanation:

Appendix D (continued)

---

10. To make this section ideal, I would change_____. Please give at least one example.

11. I would like to see more of _____ in this section. Circle your answer or answers.

Text	Audio	Images
Examples	Test Questions	Video
Others (specify)		

13. I would like to see less of _____ in this section. Circle you answer or answers.

Text	Audio	Images
Examples	Test Questions	Video
Others (specify)		

13. Rank the importance of the components in this section from most (#1) to least important (#7).

_____ Text
_____ Still Images
_____ Test Questions
_____ Video
_____ Examples
_____ Graphics

Appendix E

Topic Files with Names

RESEARCH METHODOLOGY TOPICS WITH FILES

Please observe that these topics have files with somewhat arcane symbols. This is due to a "glitch" in the authoring software which requires very unique file letters.
Note: Files with an * after them are linked to the file immediately above them but can also be called up separately.

MODULE 1

Topics	Filenames
Introduction to Research Design & Definition of Hypothesis	**Startres** **Endres** **Hypothes*** **Birdie*(contains review questions)**
True Experimental Research	**Unotrue** **Duotrue** **Quesm1tr* (contains review questions)**
Quasi-Experimental Research	**Quaexp** **M1ququas* (contains review questions)**
Correlational Research	**Lm2corre** **Lm3rdcor** **Corrqm1* (contains review questions)**
Descriptive Research	**Descrip** **Quesdesc* (contains review questions)**
Epidemiological Research	**Epidem** **Epiquem1* (contains review questions)**
Survey Research	**Surbegin** **Surend** **Surquem1* (contains review questions)**

Appendix E (continued)

Page Two.... Research Methodology Topics & Files

MODULE 1 Continued

Topics	Files
Historical Research	**M1histo** **Histm1qu* (contains review questions)**
Case Study Research	**Lmm2case** **Casem1qu* (contains review questions)**
Methodological Research	**M1lmmeth** **Methm1qu* (contains review questions)**
Program Related Research	
Needs Assessment	**Needs** **Q1needs* (contains review questions)**
Evaluation	**Evaluati** **Q1evals* (contains review questions)**

MODULE 2

Topics	Files
True Experimental Research Design	**Lmexdes** **Lm2ndes** **Trueques* (contains review questions)**
Quasi-Experimental Research Design	**Lmquasex** **Quasique* (contains review questions)**

Appendix E (continued)

Page Three ...Research Methodology Topics & Files

MODULE 2 Continued

Topics	Files
Research Ethics	Lmreseth Ethicque* (contains review questions)
Research Errors	Lmerores Lmparter Errorque* (contains review questions)
Critical Evaluation Questions for Two Research Articles	Criteval

MODULE 3

Topics	Files
Epidemiological Research	Lmm2epi
Descriptive Epidemiology	Lmdepi(1 Descepiq* (contains review questions)
Analytical Epidemiology	Lmanaep Analydes* (contains review questions)

Appendix F

Module 1 Program Details and External Files

Application Module: STARTRES Author:

Application Module Information

Create: Thu Feb 11 14:18:43 1993

Update: Fri Jun 17 15:28:54 1994

Description:

Procedures: 14 Instructions: 19

Questions: 0 Objectives: 0

Panels: 16 Variables: 0

PROCEDURE Name	If	Then	Arguments
welcome			
		Show	welcome
icons			
		Show	icons
		Show	listen
		Show	icons
		Show	vickivid
		Show	icons
LKKPUR			
		Show	LOOKPURP
purpcause			
		Show	purpose
seeorg			
		Show	SEEORG
modorg			
		Show	modorg
common			
		Show	COMMONTRAITS
resinmeth			
		Show	resinmeth
resclass			
		Show	researchclass
basicorapp			
		Show	BORA
basic			
		Show	BASIC
applied			
		Show	applied
resdescr			
		Show	resdescr
resdef			
		Show	researchdefin
		Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

Appendix F (continued)

Application Module: STARTRES Author:

OBJECTIVE Name P% #Qs QPos OPts OPos

PANEL Name	Fm,Res	Objs
researchdefin	16,512x480	5
BASIC	16,512x480	7
researchclass	16,512x480	6
applied	16,512x480	9
resdescr	16,512x480	7
resinmeth	16,512x480	6
welcome	16,512x480	9
purpose	16,512x480	9
modorg	16,512x480	6
icons	16,512x480	10
listen	16,512x480	6
LOOKPURP	16,512x480	5
vickivid	9,512x480	2
SEEORG	16,512x480	5
COMMONTRAITS	16,512x480	5
BORA	16,512x480	11

Appendix F (continued)

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External files referenced by C:\AUTH20\APP\STARTRES.AAM

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C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
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  BORA
D:\RESMETH\IMAGES\AUDIO.C16
  icons
D:\RESMETH\IMAGES\BASESCR1.C16
  researchclass
  resdescr
  resinmeth
  welcome
D:\RESMETH\IMAGES\BASESCR2.C16
  researchdefin
  BASIC
  applied
D:\RESMETH\IMAGES\boysteam.C16
  COMMONTRAITS
D:\RESMETH\IMAGES\camera.C16
  icons
D:\RESMETH\IMAGES\FRAMNINE.CMY
  vickivid
D:\RESMETH\IMAGES\GRAPES.C16
  purpose
D:\RESMETH\IMAGES\HYPODRUG.C16
  purpose
D:\RESMETH\IMAGES\manmodel.C16
  BORA
D:\RESMETH\IMAGES\onebottl.C16
  applied
D:\RESMETH\IMAGES\PARROTS.C16
  SEEORG
D:\RESMETH\IMAGES\PLNBKG.C16
  purpose
  modorg
```

Appendix F (continued)

```
  icons
  listen
  BORA
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  LOOKPURP
D:\RESMETH\IMAGES\sleepman.C16
  listen
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  applied
D:\RESMETH\IMAGES\techbott.C16
  BASIC

AVSS
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  LOOKPURP
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  resdescr
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  resinmeth
  COMMONTRAITS
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  SEEORG
  BORA
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  vickivid

Executes
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```

Appendix F (continued)

Application Module: ENDRES Author:

Application Module Information

Create: Thu Feb 11 14:18:43 1993

Update: Sun Mar 06 19:49:25 1994

Description:

Procedures: 10 Instructions: 12

Questions: 0 Objectives: 0

Panels: 11 Variables: 0

PROCEDURE Name	If	Then	Arguments
plan			
		Show	plan
structure			
		Show	structure
strategy			
		Show	strategy
VALID			
		Show	VAL
INTERNAL			
		Show	intvalid
EXTERNAL			
		Show	externalvalid
HYPOTHESES			
		Show	hypo
	$InpID==3	Execute	HYPOTHES
CATEGORIES			
		Show	GORIES
TYPERES			
		Show	TYPESRES
TABLE			
		Show	TABCAT
		Execute	BIRDIE

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
plan	16,512x480	8
structure	16,512x480	8
strategy	16,512x480	8
intvalid	16,512x480	8
externalvalid	16,512x480	8

Appendix F (continued)

Application Module: ENDRES Author:

PANEL Name	Fm,Res	Objs
TABCAT	16,512x480	10
GORIES	16,512x480	9
TYPESRES	16,512x480	7
VAL	16,512x480	5
hypo	16,512x480	5

Appendix F (continued)

External files referenced by C:\AUTH20\APP\ENDRES.AAM

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C:\V220\vid\font\ultrab.124

Images
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  externalvalid
D:\RESMETH\IMAGES\3boys.C16
  externalvalid
D:\RESMETH\IMAGES\BASESCR1.C16
  VAL
D:\RESMETH\IMAGES\BASESCR2.C16
  plan
  structure
  strategy
  category
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  plan
D:\RESMETH\IMAGES\FOURPETR.C16
  GORIES
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  GORIES
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  GORIES
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  intvalid
D:\RESMETH\IMAGES\plnbkg.C16
  intvalid
  externalvalid
  TABCAT
  TYPESRES
  hypo
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  structure
D:\RESMETH\IMAGES\strategy.C16

Appendix F (continued)

```
  strategy
D:\RESMETH\IMAGES\surgery.C16
  intvalid

AVSS
~~~~
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  GORIES
D:\RESMETH\AUDIO\GGORIES.AVS
  TYPESRES
D:\RESMETH\AUDIO\TABBYCAT.AVS
  TABCAT
D:\RESMETH\AUDIO\TRK1LNG.AVS
  intvalid
D:\RESMETH\AUDIO\TRK1MED.AVS
  structure
  externalvalid
  VAL
D:\RESMETH\AUDIO\TRK1SHRT.AVS
  plan
  strategy

Executes
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C:\AUTH20\APP\BIRDIE.AAM

C:\AUTH20\APP\HYPOTHES.AAM
```

Appendix F (continued)

```
Application Module: UNOTRUE    Author:

Application Module Information

Create:  Wed Feb 17 13:59:40 1993

Update:  Sun Mar 13 16:13:37 1994

Description:

Procedures: 8     Instructions: 16

 Questions: 0       Objectives: 0

    Panels: 11       Variables: 0

PROCEDURE Name    If              Then    Arguments

TITLE
                                  Show    title
                  $InpID==11      Call    CONTENTS
CONTENTS
                                  Show    CONTENTS
                  $InpID==12      Call    trueexp
trueexp
                                  Show    TRUEEXP
                  $InpID==70      Call    trueexp2
trueexp2
                                  Show    trueexp2
                  $InpID==13      Call    manipulation
manipulation
                                  Show    manipulation
                  $InpID==14      Call    control
control
                                  Show    control
                  $InpID==30      Call    random
random
                                  Show    random
                  $InpID==105     Call    REASON
REASON
                                  Show    REASONS
                  $InpID==15      Exit    0

QUESTION Name     Evaluation      Try  Points  Panel

OBJECTIVE Name        P%  #Qs QPos  OPts OPos

 PANEL Name       Fm,Res    Objs

TRUEEXP           16,512x480 7
trueexp2          16,512x480 6
manipulation      16,512x480 7
```

Appendix F (continued)

Application Module: UNOTRUE Author:

PANEL Name	Fm,Res	Objs
INDEPVAR	16,512x480	4
depvar	16,512x480	2
contgroup	16,512x480	3
random	16,512x480	7
title	16,512x480	6
CONTENTS	16,512x480	7
REASONS	16,512x480	6

Appendix F (continued)

External files referenced by C:\AUTH20\APP\UNOTRUE.AAM

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Images
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  title
  CONTENTS
D:\RESMETH\IMAGES\BASESCR2.C16
  trueexp2
D:\RESMETH\IMAGES\bnecks.C16
  TRUEEXP
  title
  CONTENTS
D:\RESMETH\IMAGES\BROTHS.C16
  contgroup
D:\RESMETH\IMAGES\constraw.C16
  control
D:\RESMETH\IMAGES\pastanip.C16
  manipulation
D:\RESMETH\IMAGES\PLNBKG.C16
  INDEPVAR
  REASONS
D:\RESMETH\IMAGES\strawran.C16
  random

AVSS
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D:\RESMETH\AUDIO\SAXFUL.AVS
  CONTENTS
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  TRUEEXP
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  title
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  trueexp2
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Appendix F (continued)

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  REASONS
D:\RESMETH\AUDIO\tr2end.AVS
  control
D:\RESMETH\AUDIO\tr2med.AVS
  manipulation
D:\RESMETH\AUDIO\tr2strt.AVS
  random

Executes
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```

Appendix F (continued)

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**Application Module: DUOTRUE  Author:**

**Application Module Information**

**Create:  Wed Feb 17 13:59:40 1993**

**Update:  Mon Mar 13 15:01:15 1995**

**Description:**

**Procedures: 10  Instructions: 20**

**Questions: 0  Objectives: 0**

**Panels: 10  Variables: 0**

| PROCEDURE Name | If | Then | Arguments |
|---|---|---|---|
| TYPES | | | |
| | | Show | TYPES |
| | $InpID==18 | Call | SPECTYPE |
| SPECTYPE | | | |
| | | Show | SPECTYPE |
| | $InpID==19 | Call | HOWTO |
| HOWTO | | | |
| | | Show | HOWTO |
| | $InpID==16 | Call | CROSSOVER |
| CROSSOVER | | | |
| | | Show | crossover |
| | $InpID==20 | Call | CROSSADV |
| CROSSADV | | | |
| | | Show | crossadv |
| | $InpID==21 | Call | CROSSDISADV |
| CROSSDISADV | | | |
| | | Show | crossdisad |
| | $InpID==22 | Call | ADVDISADV |
| ADVDISADV | | | |
| | | Show | expadvdis |
| | $InpID==183 | Call | ADV |
| ADV | | | |
| | | Show | expadv |
| | $InpID==23 | Call | DISADV |
| DISADV | | | |
| | | Show | expdisadv |
| | $InpID==24 | Call | HAWTHORNE |
| HAWTHORNE | | | |
| | | Show | hawthorne |
| | $InpID==25 | Execute | QUESM1TR |

| QUESTION Name | Evaluation | Try | Points | Panel |
|---|---|---|---|---|

| OBJECTIVE Name | P% | #Qs | QPos | OPts | OPos |
|---|---|---|---|---|---|

Appendix F (continued)

---

**Application Module: DUOTRUE  Author:**

| PANEL Name | Fm,Res | Objs |
|---|---|---|
| expadvdis | 16,512x480 | 7 |
| expadv | 16,512x480 | 7 |
| expdisadv | 16,512x480 | 8 |
| hawthorne | 16,512x480 | 6 |
| crossover | 16,512x480 | 10 |
| crossadv | 16,512x480 | 6 |
| crossdisad | 16,512x480 | 6 |
| HOWTO | 16,512x480 | 6 |
| TYPES | 16,512x480 | 9 |
| SPECTYPE | 16,512x480 | 6 |

Appendix F (continued)

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External files referenced by C:\AUTH20\APP\DUOTRUE.AAM

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Images
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  crossover
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  hawthorne
D:\RESMETH\IMAGES\MOMANPOP.C16
  TYPES
D:\RESMETH\IMAGES\pharmist.C16
  expadv
D:\RESMETH\IMAGES\pizzafed.C16
  expdisadv
D:\RESMETH\IMAGES\PLNBKG.C16
  expdisadv
  crossover
  crossadv
  HOWTO
  TYPES
  SPECTYPE
D:\RESMETH\IMAGES\rathead.C16
  TYPES

AVSS
~~~~
D:\RESMETH\AUDIO\DRUMUP.AVS
  expadvdis
  SPECTYPE
D:\RESMETH\AUDIO\PIANOUP.AVS
  expadv
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Appendix F (continued)

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  expdisadv
D:\RESMETH\AUDIO\TERDISXO.AVS
  crossdisad
D:\RESMETH\AUDIO\terxov.AVS
  crossadv
D:\RESMETH\AUDIO\TR2END.AVS
  TYPES
D:\RESMETH\AUDIO\TR2MED.AVS
  crossover
D:\RESMETH\AUDIO\TR2STRT.AVS
  hawthorne
D:\RESMETH\AUDIO\TRK62.AVS
  HOWTO

Executes
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```

Appendix F (continued)

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Application Module: QUAEXP  Author:

Application Module Information

Create: Wed Feb 17 17:01:55 1993

Update: Mon Mar 13 15:07:07 1995

Description:

Procedures: 10  Instructions: 11

Questions: 0  Objectives: 0

Panels: 10  Variables: 0

| PROCEDURE Name | If | Then | Arguments |
|---|---|---|---|
| TITLE | | Show | title |
| CONTENTS | | Show | CONTENTS |
| DEFINITION | | Show | definition |
| REASONS | | Show | reasons |
| CONTROL | | Show | control |
| RANDOM | | Show | RANDom |
| types | | Show | TYPES |
| CONDUCT | | Show | conduct |
| LIMITS | | Show | LIMITS |
| ADVANTAGES | | Show | advan |
| | $InpID==110 | Execute | M1QUQUAS |

| QUESTION Name | Evaluation | Try | Points | Panel |
|---|---|---|---|---|

| OBJECTIVE Name | P% | #Qs | QPos | OPts | OPos |
|---|---|---|---|---|---|

| PANEL Name | Fm,Res | Objs |
|---|---|---|
| advan | 16,512x480 | 9 |
| definition | 16,512x480 | 7 |
| control | 16,512x480 | 8 |
| RANDom | 16,512x480 | 7 |
| title | 16,512x480 | 6 |
| CONTENTS | 16,512x480 | 7 |

Appendix F (continued)

Application Module: QUAEXP Author:

| PANEL Name | Fm,Res | Objs |
|---|---|---|
| TYPES | 16,512x480 | 5 |
| conduct | 16,512x480 | 7 |
| LIMITS | 16,512x480 | 6 |

Appendix F (continued)

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External files referenced by C:\AUTH20\APP\QUAEXP.AAM

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D:\RESMETH\IMAGES\BASESCR1.C16
  definition
  title
  CONTENTS
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  reasons
D:\RESMETH\IMAGES\disadvan.C16
  advan
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  RANDom
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  reasons
D:\RESMETH\IMAGES\medical.C16
  control
D:\RESMETH\IMAGES\PLNBKG.C16
  advan
  control
  RANDom
  reasons
  TYPES
  conduct
  LIMITS
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  definition
  control
  title
  CONTENTS
  conduct
  LIMITS
```

Appendix F (continued)

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  advan
  reasons
  conduct
D:\RESMETH\AUDIO\m1quas.AVS
  title
D:\RESMETH\AUDIO\qua5fac.AVS
  LIMITS
D:\RESMETH\AUDIO\quacontr.AVS
  control
D:\RESMETH\AUDIO\quaconts.AVS
  CONTENTS
D:\RESMETH\AUDIO\quadef.AVS
  definition
D:\RESMETH\AUDIO\quaranda.AVS
  RANDom

Executes
~~~~~~~~
```

Appendix F (continued)

Application Module: LM2CORRE Author:

Application Module Information

Create: Tue Feb 23 10:18:25 1993

Update: Fri Jun 17 14:30:26 1994

Description:

Procedures: 12 Instructions: 24

Questions: 0 Objectives: 0

Panels: 12 Variables: 0

PROCEDURE Name	If	Then	Arguments
HELLO			
		Show	hello
	$InpID==100	Call	intcorr
intcorr			
		Show	INTCORR
	$InpID==701	Call	correlational
correlational			
		Show	CORRELATIONAL
	$InpID==501	Call	Reasons
Reasons			
		Show	reasons
	$InpID==705	Call	Retropro
Retropro			
		Show	RETROPRO
	$InpID==704	Call	MOREPRO
MOREPRO			
		Show	moreproret
	$InpID==25	Call	respec
respec			
		Show	respec
	$InpID==708	Call	prospec
prospec			
		Show	prospec
	$InpID==709	Call	exampro
exampro			
		Show	examprospect
	$InpID==29	Call	strongpro
strongpro			
		Show	strongpro
	$InpID==668	Call	2TYPESCOR
2TYPESCOR			
		Show	2typescor
	$InpID==669	Call	CROSSEC
CROSSEC			
		Show	crossec
	$InpID==711	Exit	0

Appendix F (continued)

Application Module: LM2CORRE Author:

QUESTION Name Evaluation Try Points Panel

OBJECTIVE Name P% #Qs QPos OPts OPos

PANEL Name	Fm,Res	Objs
CORRELATIONAL	16,512x480	6
INTCORR	16,512x480	6
RETROPRO	16,512x480	10
reasons	16,512x480	6
respec	16,512x480	12
prospec	16,512x480	8
examprospect	16,512x480	10
strongpro	16,512x480	6
2typescor	16,512x480	11
crossec	16,512x480	14
hello	16,512x480	6
moreproret	16,512x480	19

Appendix F (continued)

External files referenced by C:\AUTH20\APP\LM2CORRE.AAM

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  INTCORR
  hello
D:\RESMETH\IMAGES\bppro.C16
  examprospect
D:\RESMETH\IMAGES\corimag.C16
  hello
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  2typescor
  crossec
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  respec
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  2typescor
D:\RESMETH\IMAGES\mom&daug.C16
  prospec
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  respec
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  RETROPRO
  reasons
  respec
  strongpro
  2typescor
  crossec
  moreproret
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  examprospect

Appendix F (continued)

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  RETROPRO

AVSS
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  RETROPRO
D:\RESMETH\AUDIO\corrres.AVS
  hello
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  prospec
  examprospect
D:\RESMETH\AUDIO\PIANOFUL.AVS
  INTCORR
D:\RESMETH\AUDIO\SAXFUL.AVS
  respec
D:\RESMETH\AUDIO\TR2MED.AVS
  moreproret
D:\RESMETH\AUDIO\TRK62.AVS
  reasons
  crossec
D:\RESMETH\AUDIO\WATERPRF.AVS
  CORRELATIONAL

Executes
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```

Appendix F (continued)

Application Module: LM3RDCOR Author:

Application Module Information

Create: Tue Feb 23 10:18:25 1993

Update: Thu Mar 24 11:35:01 1994

Description:

Procedures: 9 Instructions: 18

Questions: 0 Objectives: 0

Panels: 9 Variables: 0

PROCEDURE Name	If	Then	Arguments
AD/DISCROSS			
		Show	ad/discross
	$InpID==670	Call	longitudinal
longitudinal			
		Show	longitud
	$InpID==713	Call	DI/ASLONG
DI/ASLONG			
		Show	di/aslong
	$InpID==624	Call	TREND
TREND			
		Show	trend
	$InpID==714	Call	COHORT
COHORT			
		Show	cohort
	$InpID==715	Call	waycon
waycon			
		Show	WAYCON
	$InpID==716	Call	HOWTO2
HOWTO2			
		Show	howto2
	$InpID==671	Call	ADVANTAGES
ADVANTAGES			
		Show	advcorr
	$InpID==718	Call	DISADVANTAGES
DISADVANTAGES			
		Show	DISADCORR
	$InpID==720	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs

Appendix F (continued)

Application Module: LM3RDCOR Author:

PANEL Name	Fm,Res	Objs
longitud	16,512x480	10
di/aslong	16,512x480	8
trend	16,512x480	16
cohort	16,512x480	10
WAYCON	16,512x480	10
howto2	16,512x480	11
advcorr	16,512x480	6
DISADCORR	16,512x480	6

Appendix F (continued)

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External files referenced by C:\AUTH20\APP\EPIDEM.AAM

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  CONTENTS
  DEFINITION
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  ADVANT
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  REASONS
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D:\RESMETH\IMAGES\megascop.C16
  EPIDEMIOLOGICAL
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  EPIDEMIOLOGICAL
  HOW TO
  ADVANT
  LASTHOUGHT
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  TITLE
D:\RESMETH\IMAGES\womnrice.C16
  epidesc

AVSS
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  DEFINITION
D:\RESMETH\AUDIO\PIANOUP.AVS
  epidesc
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Appendix F (continued)

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  TITLE
D:\RESMETH\AUDIO\TR2END.AVS
  LASTHOUGHT
D:\RESMETH\AUDIO\TRK13MED.AVS
  REASONS
D:\RESMETH\AUDIO\TRK62.AVS
  analytical
D:\RESMETH\AUDIO\TRK8.AVS
  CONTENTS
D:\RESMETH\AUDIO\trk9.AVS
  HOW TO
D:\RESMETH\AUDIO\TYPEPI.AVS
  EPIDEMIOLOGICAL

Executes
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Appendix F (continued)

Application Module: SURBEGIN Author:

Application Module Information

Create: Tue Feb 23 09:16:54 1993

Update: Sun Apr 10 14:41:07 1994

Description:

Procedures: 12 Instructions: 24

Questions: 0 Objectives: 0

Panels: 12 Variables: 0

PROCEDURE Name	If	Then	Arguments
title			
		Show	TITLE
	$InpID==3	Call	contents
contents			
		Show	CONTENTS
	$InpID==14	Call	definition
definition			
		Show	definition
	$InpID==400	Call	reasons
reasons			
		Show	REASONS
	$InpID==15	Call	type
type			
		Show	survtype
	$InpID==420	Call	correlational
correlational			
		Show	corrsurv
	$InpID==414	Call	descriptive
descriptive			
		Show	DESCSURV
	$InpID==73	Call	methods
methods			
		Show	METHSURV
	$InpID==489	Call	problem
problem			
		Show	probsurv
	$InpID==440	Call	sample
sample			
		Show	survsamp
	$InpID==399	Call	samsize
samsize			
		Show	sampsize
	$InpID==398	Call	factors
factors			
		Show	sampfact
	$InpID==327	Exit	0

Appendix F (continued)

Application Module: SURBEGIN Author:

QUESTION Name Evaluation Try Points Panel

OBJECTIVE Name P% #Qs QPos OPts OPos

PANEL Name	Fm,Res	Objs
definition	16,512x480	6
DESCSURV	16,512x480	9
survtype	16,512x480	10
corrsurv	16,512x480	9
METHSURV	16,512x480	8
probsurv	16,512x480	8
survsamp	16,512x480	7
sampsize	16,512x480	7
sampfact	16,512x480	7
TITLE	16,512x480	6
CONTENTS	16,512x480	6
REASONS	16,512x480	8

Appendix F (continued)

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  definition
  TITLE
  CONTENTS
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  probsurv
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  TITLE
D:\RESMETH\IMAGES\frychx.C16
  DESCSURV
  survtype
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  METHSURV
D:\RESMETH\IMAGES\gelpill.C16
  survtype
  corrsurv
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  REASONS
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  DESCSURV
  survtype
  corrsurv
  sampsize
  sampfact

AVSS
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  DESCSURV
D:\RESMETH\AUDIO\PIANOFUL.AVS
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Appendix F (continued)

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   definition
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   METHSURV
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   REASONS
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   corrsurv
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   probsurv
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   CONTENTS
D:\RESMETH\AUDIO\WELSUR.AVS
   TITLE

Executes
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Appendix F (continued)

Application Module: SUREND Author:

Application Module Information

Create: Tue Feb 23 09:16:54 1993

Update: Sun Apr 10 13:53:41 1994

Description:

Procedures: 12 Instructions: 12

Questions: 0 Objectives: 0

Panels: 13 Variables: 0

PROCEDURE Name	If	Then	Arguments
GETDATA		Show	GETDATA
PERSONAL		Show	persinter
TELEPHONE		Show	telesurv
MAIL		Show	MAIL
QUESTION		Show	questionnaire
CONTENT		Show	quescont
QUES		Show	quesques
TYPE		Show	questype
DATA		Show	quesdata
FINDINGS		Show	findings
ADVANTAGE		Show	advsurv
DISADVANTAGE		Show	disadvsu

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
findings	16,512x480	8
advsurv	16,512x480	7
disadvsu	16,512x480	7

Appendix F (continued)

Application Module: SUREND Author:

PANEL Name	Fm,Res	Objs
questionnaire	16,512x480	8
persinter	16,512x480	11
telesurv	16,512x480	10
quescont	16,512x480	7
quesdata	16,512x480	10
quesques	16,512x480	7
questype	16,512x480	7
MAIL	16,512x480	11
GETDATA	16,512x480	13

Appendix F (continued)

External files referenced by C:\AUTH20\APP\SUREND.AAM

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D:\RESMETH\IMAGES\beachrun.C16
  findings
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  disadvsu
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  questionnaire
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  telesurv
  GETDATA
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  persinter
  quesdata
  quesques
  questype
  MAIL

Appendix F (continued)

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   MAIL
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   quesdata
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   persinter

AVSS
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   findings
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   quesdata
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   questionnaire
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   GETDATA
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   quescont
D:\RESMETH\AUDIO\TRK3.AVS
   telesurv
D:\RESMETH\AUDIO\TRK6.AVS
   persinter
D:\RESMETH\AUDIO\TRK62.AVS
   disadvsu
D:\RESMETH\AUDIO\TRK8.AVS
   MAIL

Executes
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Appendix F (continued)

Application Module: M1LHISTO Author:

Application Module Information

Create: Thu Apr 01 10:48:17 1993

Update: Fri Jun 17 09:32:11 1994

Description:

Procedures: 9 Instructions: 20

Questions: 0 Objectives: 0

Panels: 9 Variables: 0

PROCEDURE Name	If	Then	Arguments
HISTORICAL			
		Show	HISTORICAL
	$InpID==30	Call	OUTLINE
OUTLINE			
		Show	OUTHIST
	$InpID==31	Call	DEFINITION
DEFINITION			
		Show	DEFHIST
	$InpID==32	Call	WHYDONE
WHYDONE			
		Show	WHYHIST
	$InpID==33	Call	HOWDONE
HOWDONE			
		Show	HOWHIST
	$InpID==35	Call	EVALUATION
EVALUATION			
		Show	EVALHIST
	$InpID==36	Call	WAITAMINUTE
WAITAMINUTE			
		Show	WAITAMINUTE
	$InpID==440	Call	ADVHIST
ADVHIST			
SHOW ADVHIST		Show	ADVHIST
	$InpID==400	Call	HISTVID
LOOP TO ADVHIST		Loop	2,SHOW ADVHIST
	$InpID==38	Exit	0
HISTVID			
		Show	histvid
		Call	ADVHIST

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

Appendix F (continued)

Application Module: M1LHISTO Author:

PANEL Name	Fm,Res	Objs
HISTORICAL	16,512x480	8
OUTHIST	16,512x480	6
DEFHIST	16,512x480	11
WHYHIST	16,512x480	9
HOWHIST	16,512x480	13
EVALHIST	16,512x480	13
ADVHIST	16,512x480	10
histvid	9,512x480	2
WAITAMINUTE	16,512x480	15

Appendix F (continued)

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  DEFHIST
  WHYHIST
  EVALHIST
  ADVHIST
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  WHYHIST
  HOWHIST
  EVALHIST
  ADVHIST
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Appendix F (continued)

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  DEFHIST

AVSS
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  WHYHIST
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  histvid

Executes
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Appendix F (continued)

Application Module: LMM2CASE Author:

Application Module Information

Create: Thu Apr 01 09:28:13 1993

Update: Sun Apr 10 16:10:42 1994

Description:

Procedures: 7 Instructions: 14

Questions: 0 Objectives: 0

Panels: 7 Variables: 0

PROCEDURE Name	If	Then	Arguments
CASESTUDY			
		Show	case study
	$InpID==20	Call	OUTLINE
OUTLINE			
		Show	OUTLINE
	$InpID==21	Call	DEFINITION
DEFINITION			
		Show	CASEDEF
	$InpID==23	Call	TYPES
TYPES			
		Show	CATYPE
	$InpID==22	Call	WHYCASE
WHYCASE			
		Show	whycase
	$InpID==24	Call	HOWCONDUCTED
HOWCONDUCTED			
		Show	HOWCASE
	$InpID==25	Call	ADVDISADV
ADVDISADV			
		Show	STRCASE
	$InpID==26	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
case study	16,512x480	7
OUTLINE	16,512x480	11
CASEDEF	16,512x480	8
CATYPE	16,512x480	11
whycase	16,512x480	11
HOWCASE	16,512x480	6

Appendix F (continued)

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  OUTLINE
D:\RESMETH\IMAGES\case1.C16
  case study
  OUTLINE
  CASEDEF
  CATYPE
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  CATYPE
D:\RESMETH\IMAGES\DETAIL.C16
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  STRCASE
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  HOWCASE
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  CASEDEF
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Appendix F (continued)

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D:\RESMETH\AUDIO\TRK3.AVS
  STRCASE
D:\RESMETH\AUDIO\TRK8.AVS
  HOWCASE
D:\RESMETH\AUDIO\TRK9.AVS
  CATYPE

Executes
~~~~~~~~
```

Appendix F (continued)

Application Module: M1LMMETH Author:

Application Module Information

Create: Thu Feb 18 10:27:28 1993

Update: Fri Jun 17 15:41:27 1994

Description:

Procedures: 8 Instructions: 18

Questions: 0 Objectives: 0

Panels: 8 Variables: 0

PROCEDURE Name	If	Then	Arguments
		Show	METHINTRO
	$InpID==200	Call	INTMETH
intro			
INTMETH			
		Show	INTMETH
	$InpID==329	Call	methodology
methodology			
		Show	METHODOLOGY
	$InpID==132	Call	restools
restools			
		Show	restools
	$InpID==130	Call	moretool
moretool			
		Show	moretools
	$InpID==131	Call	PIGINTRO
PIGINTRO			
SHOW PIGINTRO		Show	pigintro
	$InpID==136	Call	PIGVID
LOOP TO PIGINTRO		Loop	2,SHOW PIGINTRO
PIGVID			
		Show	PIGVID
		Show	pigintro
	$InpID==138	Call	classmeth
classmeth			
		Show	classmeth
	$InpID==333	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
METHODOLOGY	16,512x480	15

Appendix F (continued)

Application Module: MILMMETH Author:

PANEL Name	Fm,Res	Objs
moretools	16,512x480	16
pigintro	16,512x480	11
PIGVID	9,512x480	2
classmeth	16,512x480	16
INTMETH	16,512x480	10
METHINTRO	16,512x480	8

Appendix F (continued)

```
External files referenced by C:\AUTH20\APP\MILMMETH.AAM

Fonts
~~~~~
 (NOT FOUND)
C:\V220\vid\font\sans.109
C:\V220\vid\font\sans.112
C:\V220\vid\font\sans.114
C:\V220\vid\font\sans.118
C:\V220\vid\font\sans.124
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C:\V220\vid\font\ultra.112
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C:\V220\vid\font\ultra.118
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C:\V220\vid\font\ultrab.109
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C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
D:\RESMETH\IMAGES\BASESCR1.C16
  INTMETH
  METHINTRO
D:\RESMETH\IMAGES\camera.C16
  pigintro
D:\RESMETH\IMAGES\clampmed.C16
  METHODOLOGY
D:\RESMETH\IMAGES\comp.C16
  moretools
D:\RESMETH\IMAGES\costben.C16
  moretools
D:\RESMETH\IMAGES\FRAMNINE.CMY
  PIGVID
D:\RESMETH\IMAGES\idquest.C16
  moretools
D:\RESMETH\IMAGES\keyboard.C16
  restools
D:\RESMETH\IMAGES\medical.C16
  moretools
D:\RESMETH\IMAGES\OK'ED.C16
  classmeth
  classmeth
  classmeth
  classmeth
D:\RESMETH\IMAGES\plnbkg.C16
  moretools
  pigintro
  classmeth
D:\RESMETH\IMAGES\scapal.C16
  moretools
  classmeth
  INTMETH
```

Appendix F (continued)

```
  METHINTRO

AVSS
~~~~
D:\RESMETH\AUDIO\14TRLONG.AVS
  moretools
D:\RESMETH\AUDIO\5TRKMED.AVS
  classmeth
D:\RESMETH\AUDIO\PIANOUP.AVS
  restools
D:\RESMETH\AUDIO\TR2END.AVS
  METHINTRO
D:\RESMETH\AUDIO\TRK1LNG.AVS
  INTMETH
D:\RESMETH\AUDIO\TRK9.AVS
  METHODOLOGY
D:\RESMETH\VIDEO\LAPERO.AVS
  PIGVID

Executes
~~~~~~~~
```

Appendix F (continued)

Application Module: NEEDS Author:

Application Module Information

Create: Tue Apr 05 10:50:38 1994

Update: Fri Apr 22 16:32:52 1994

Description:

Procedures: 7 Instructions: 7

Questions: 0 Objectives: 0

Panels: 7 Variables: 0

PROCEDURE Name	If	Then	Arguments
TITLE		Show	title
CONTENTS		Show	CONTENTS
DEFINITION		Show	DEFINITION
REASON		Show	REASONS
TYPES		Show	TYPES
HOWTO		Show	HOWTO
ADVANT		Show	ADVDISADV

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
title	16,512x480	6
CONTENTS	16,512x480	14
DEFINITION	16,512x480	9
REASONS	16,512x480	9
TYPES	16,512x480	8
HOWTO	16,512x480	7
ADVDISADV	16,512x480	12

Appendix F (continued)

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External files referenced by C:\AUTH20\APP\NEEDS.AAM

Fonts
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C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
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D:\RESMETH\IMAGES\ADVANT.C16
  ADVDISADV
D:\RESMETH\IMAGES\amish.C16
  title
D:\RESMETH\IMAGES\BASESCR1.C16
  title
  CONTENTS
D:\RESMETH\IMAGES\DISADVAN.C16
  ADVDISADV
D:\RESMETH\IMAGES\oldwom.C16
  TYPES
D:\RESMETH\IMAGES\PLNBKG.C16
  TYPES
  HOWTO
  ADVDISADV
D:\RESMETH\IMAGES\potpie.C16
  DEFINITION
D:\RESMETH\IMAGES\splits.C16
  REASONS

AVSS
~~~~
D:\RESMETH\AUDIO\14TRLONG.AVS
  DEFINITION
D:\RESMETH\AUDIO\DRUMUP.AVS
  ADVDISADV
D:\RESMETH\AUDIO\TR2END.AVS
  HOWTO
D:\RESMETH\AUDIO\TRK3.AVS
  TYPES
D:\RESMETH\AUDIO\TRK62.AVS
  REASONS
```

Appendix F (continued)

```
D:\RESMETH\AUDIO\TRK7.AVS
  CONTENTS
D:\RESMETH\AUDIO\TRK9.AVS
  title

Executes
~~~~~~~~
```

Appendix F (continued)

```
Application Module: EVALUATI   Author:
Application Module Information
Create:  Wed Apr 06 14:21:29 1994
Update:  Fri Jun 10 14:46:12 1994
Description:
Procedures: 12    Instructions: 12
 Questions: 0       Objectives: 0
    Panels: 12       Variables: 0

PROCEDURE Name    If              Then    Arguments
TITLE                             Show    title
TABLE                             Show    table
DEFINITION                        Show    tell
REASON                            Show    todo
OVERVIEW                          Show    overview
TYPES                             Show    form
FORMATIVE                         Show    rmat
SUMMATIVE                         Show    SUMMAT
BEHVIOR                           Show    BEHAVE
example                           Show    example
CONDUCT                           Show    CARRYOUT
ADVANTAGE                         Show    GOODBAD
QUESTION Name     Evaluation      Try  Points  Panel

OBJECTIVE Name         P%  #Qs QPos  OPts OPos

 PANEL Name       Fm,Res    Objs

title             16,512x480 6
table             16,512x480 17
tell              16,512x480 9
```

Appendix F (continued)

```
  STONE
D:\RESMETH\IMAGES\smoke2.C16
  exam2lim
D:\RESMETH\IMAGES\testhypo.C16
  sthree
D:\RESMETH\IMAGES\toddler.C16
  exam1limit
D:\RESMETH\IMAGES\trama.C16
  SRTWO

AVSS
~~~~
D:\RESMETH\AUDIO\1trk5sec.AVS
  STONE
  ex3limit
D:\RESMETH\AUDIO\4trkbit.AVS
  SRTWO
  LIMITATIONS
  exam2lim
D:\RESMETH\AUDIO\trk4sec7.AVS
  STRENGTHS
  sthree
  exam1limit
  ex4limit

Executes
~~~~~~~~
```

Appendix F (continued)

Application Module: EVALUATI Author:

PANEL Name	Fm,Res	Objs
form	16,512x480	13
rmat	16,512x480	9
SUMMAT	16,512x480	12
BEHAVE	16,512x480	9
CARRYOUT	16,512x480	9
GOODBAD	16,512x480	11
overview	16,512x480	13
example	16,512x480	11

Appendix F (continued)

External files referenced by C:\AUTH20\APP\EVALUATI.AAM

Fonts
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(NOT FOUND)
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C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~

D:\RESMETH\IMAGES\advant.C16
  GOODBAD
D:\RESMETH\IMAGES\basescr1.C16
  title
  table
D:\RESMETH\IMAGES\dataguy.C16
  form
  SUMMAT
D:\RESMETH\IMAGES\disadvan.C16
  GOODBAD
D:\RESMETH\IMAGES\incbaby.C16
  tell
  example
D:\RESMETH\IMAGES\newbaby.C16
  tell
D:\RESMETH\IMAGES\nutsbolt.C16
  form
D:\RESMETH\IMAGES\planchic.C16
  rmat
D:\RESMETH\IMAGES\plnbkg.C16
  todo
  form
  SUMMAT
  BEHAVE
  CARRYOUT
  GOODBAD
  overview
  example
D:\RESMETH\IMAGES\powergal.C16
  title
  table
D:\RESMETH\IMAGES\preggie.C16

Appendix F (continued)

```
  tell
D:\RESMETH\IMAGES\teensex.C16
  example

AVSS
~~~~
D:\RESMETH\AUDIO\14TRLONG.AVS
  tell
D:\RESMETH\AUDIO\1TRK5SEC.AVS
  title
D:\RESMETH\AUDIO\5TRKMED.AVS
  todo
D:\RESMETH\AUDIO\DRUMUP.AVS
  CARRYOUT
D:\RESMETH\AUDIO\PIANOFUL.AVS
  SUMMAT
D:\RESMETH\AUDIO\TRK13MED.AVS
  form
D:\RESMETH\AUDIO\TRK1MED.AVS
  table

Executes
~~~~~~~~
```

Appendix G

Module II Program Details and External Files

Application Module: LMEXDES Author:

Application Module Information

Create: Tue Mar 23 20:09:56 1993

Update: Fri Jun 17 15:45:09 1994

Description:

Procedures: 15 Instructions: 39

Questions: 0 Objectives: 0

Panels: 16 Variables: 0

PROCEDURE Name	If	Then	Arguments
TQEXPTDES			
		Show	Welcome2
		Show	TQEXPTDES
	$InpID==5	Call	EXOVER
EXOVER			
		Show	exover
	$InpID==10	Call	exintro
exintro			
		Show	exintro
	$InpID==645	Call	2EXOVER
2EXOVER			
		Show	2exover
	$InpID==700	Call	THREEOV
THREEOV			
		Show	threeov
	$InpID==643	Call	FOUREXOVER
FOUREXOVER			
		Show	fourexover
	$InpID==646	Call	INTROTRUE
INTROTRUE			
		Show	INTROTRUE
	$InpID==671	Call	EXTR
EXTR			
		Show	EXTR
	$InpID==12	Call	REDOMANIP
REDOMANIP			
SHOW REDOMANIP		Show	redomanip
	$InpID==566	Call	MANIPVID
LOOP TO REDOMANP		Loop	1,SHOW REDOMANIP
MANIPVID			
		Show	manipvid
		Show	redomanip
	$InpID==672	Call	CTRO
CTRO			
		Show	ctro
SHOW CTRO		Show	ctro

Appendix G (continued)

Application Module: LMEXDES Author:

PROCEDURE Name	If	Then	Arguments
LOOP TO CTRO		Loop	1,LOOP TO CTRO
CONTVID		Show	CONTVID
		Show	ctro
	$InpID==14	Call	cntrl
cntrl		Show	cntrl
	$InpID==15	Call	RDMIS
RDMIS		Show	RDMIS
SHOW RDMIS		Show	RDMIS
	$InpID==680	Call	VIDRANDOM
LOOP TO RDMIS		Loop	1,LOOP TO RDMIS
VIDRANDOM		Show	vidrandom
		Show	RDMIS
	$InpID==16	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
Welcome2	16,512x480	4
TQEXPTDES	16,512x480	6
exover	16,512x480	20
exintro	16,512x480	20
2exover	16,512x480	8
threeov	16,512x480	13
fourexover	16,512x480	18
INTROTRUE	16,512x480	7
EXTR	16,512x480	13
manipvid	9,512x480	2
redomanip	16,512x480	11
ctro	16,512x480	9
CONTVID	9,512x480	2
cntrl	16,512x480	12
RDMIS	16,512x480	9
vidrandom	9,512x480	2

Appendix G (continued)

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External files referenced by C:\AUTH20\APP\LMEXDES.AAM

Fonts
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C:\V220\vid\font\ultra.114
C:\V220\vid\font\ultra.118
C:\V220\vid\font\ultra.124
C:\V220\vid\font\ultrab.109
C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
D:\RESMETH\IMAGES\BASESCR1.C16
  TQEXPTDES
D:\RESMETH\IMAGES\camera.C16
  redomanip
  ctro
  RDMIS
D:\RESMETH\IMAGES\dice200.C16
  RDMIS
D:\RESMETH\IMAGES\experim.C16
  threeov
  fourexover
D:\RESMETH\IMAGES\FRAMNINE.CMY
  manipvid
  CONTVID
  vidrandom
D:\RESMETH\IMAGES\lmcontrl.C16
  EXTR
  ctro
  cntrl
D:\RESMETH\IMAGES\manip.C16
  2exover
  EXTR
  redomanip
D:\RESMETH\IMAGES\modl2.C16
  Welcome2
D:\RESMETH\IMAGES\plnbkg.C16
  exover
  exintro
  2exover
  threeov
  fourexover
  INTROTRUE
```

Appendix G (continued)

```
  EXTR
  redomanip
  ctro
  cntrl
  RDMIS
D:\RESMETH\IMAGES\quasi.C16
  threeov
D:\RESMETH\IMAGES\random2.C16
  EXTR
  RDMIS
D:\RESMETH\IMAGES\SHRIMP.C16
  cntrl
D:\RESMETH\IMAGES\true.C16
  threeov
  INTROTRUE
  EXTR
  ctro
  cntrl

AVSS
~~~~
D:\RESMETH\AUDIO\4trkbit.AVS
  2exover
  fourexover
D:\RESMETH\AUDIO\MINUTEM2.AVS
  TQEXPTDES
D:\RESMETH\AUDIO\MOD2WELL.AVS
  Welcome2
D:\RESMETH\AUDIO\trk4sec7.AVS
  exintro
  threeov
  EXTR
  cntrl
D:\RESMETH\AUDIO\TRUEEXM2.AVS
  INTROTRUE
D:\RESMETH\AUDIO\WHISTLE.AVS
  exover
D:\RESMETH\VIDEO\CONTROL.AVS
  CONTVID
D:\RESMETH\VIDEO\MANIPU.AVS
  manipvid
D:\RESMETH\VIDEO\RANDOM.AVS
  vidrandom

Executes
~~~~~~~~
```

Appendix G (continued)

Application Module: LM2NDES Author:

Application Module Information

Create: Tue Mar 23 20:09:56 1993

Update: Thu Feb 24 18:04:14 1994

Description:

Procedures: 9 Instructions: 18

Questions: 0 Objectives: 0

Panels: 9 Variables: 0

PROCEDURE Name	If	Then	Arguments
STRENGTHS			
		Show	STRENGTHS
	$InpID==17	Call	STONE
STONE			
		Show	STONE
	$InpID==612	Call	SRTWO
SRTWO			
		Show	SRTWO
	$InpID==613	Call	STHREE
STHREE			
		Show	sthree
	$InpID==623	Call	LIMITATIONS
LIMITATIONS			
		Show	LIMITATIONS
	$InpID==18	Call	EXAM1LIMIT
EXAM1LIMIT			
		Show	exam1limit
	$InpID==631	Call	EXAM2LIM
EXAM2LIM			
		Show	exam2lim
	$InpID==632	Call	EX3LIMIT
EX3LIMIT			
		Show	ex3limit
	$InpID==633	Call	EX4LIMIT
EX4LIMIT			
		Show	ex4limit
	$InpID==634	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs

Appendix G (continued)

Application Module: LM2NDES Author:

PANEL Name	Fm,Res	Objs
STONE	16,512x480	21
SRTWO	16,512x480	10
sthree	16,512x480	9
LIMITATIONS	16,512x480	6
exam1limit	16,512x480	19
exam2lim	16,512x480	18
ex3limit	16,512x480	16
ex4limit	16,512x480	20

Appendix G (continued)

External files referenced by C:\AUTH20\APP\LM2NDES.AAM

Fonts
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(NOT FOUND)
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C:\V220\vid\font\ultra.124
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C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~

D:\RESMETH\IMAGES\advant.C16
  STRENGTHS
  STONE
  SRTWO
  sthree
D:\RESMETH\IMAGES\diabetes.C16
  ex3limit
D:\RESMETH\IMAGES\disadvan.C16
  LIMITATIONS
  exam1limit
  exam2lim
  ex3limit
  ex4limit
D:\RESMETH\IMAGES\fatburger.C16
  SRTWO
D:\RESMETH\IMAGES\LMCONTRL.C16
  STONE
D:\RESMETH\IMAGES\manip.C16
  STONE
D:\RESMETH\IMAGES\moneytop.C16
  ex4limit
D:\RESMETH\IMAGES\PLNBKG.C16
  STRENGTHS
  STONE
  SRTWO
  sthree
  LIMITATIONS
  exam1limit
  exam2lim
  ex3limit
  ex4limit
D:\RESMETH\IMAGES\random2.C16

Appendix G (continued)

```
  STONE
D:\RESMETH\IMAGES\smoke2.C16
  exam2lim
D:\RESMETH\IMAGES\testhypo.C16
  sthree
D:\RESMETH\IMAGES\toddler.C16
  exam1limit
D:\RESMETH\IMAGES\trama.C16
  SRTWO

AVSS
~~~~
D:\RESMETH\AUDIO\1trk5sec.AVS
  STONE
  ex3limit
D:\RESMETH\AUDIO\4trkbit.AVS
  SRTWO
  LIMITATIONS
  exam2lim
D:\RESMETH\AUDIO\trk4sec7.AVS
  STRENGTHS
  sthree
  exam1limit
  ex4limit

Executes
~~~~~~~~
```

Appendix G (continued)

Application Module: LMQUASEX Author:

Application Module Information

Create: Tue Mar 23 20:09:56 1993

Update: Fri Jun 17 15:50:33 1994

Description:

Procedures: 12 Instructions: 26

Questions: 0 Objectives: 0

Panels: 12 Variables: 0

PROCEDURE Name	If	Then	Arguments
QEX			
		Show	QEX
	$InpID==19	Call	EXPTWO
EXPTWO			
		Show	exptwo
	$InpID==644	Call	NONEQUIV
NONEQUIV			
		Show	Nonequiv
	$InpID==20	Call	THREENEQUIV
THREENEQUIV			
		Show	threenequiv
	$InpID==665	Call	QUESTION
QUESTION			
		Show	question
	$InpID==5	Call	TIMESER
TIMESER			
		Show	TIMESER
	$InpID==21	Call	EXTIMESERIES
EXTIMESERIES			
		Show	extimeseries
	$InpID==635	Call	TIMEEXAM2
TIMEEXAM2			
show timeexam2		Show	timexam2
	$InpID==670	Call	gloriavid
loop to timeexa2		Loop	1,show timeexam2
gloriavid			
		Show	gloriavid
		Show	timexam2
	$InpID==662	Call	QSTRNTH
QSTRNTH			
		Show	qstrnth
	$InpID==22	Call	EXLIMIT
EXLIMIT			
		Show	exlimit
	$InpID==666	Call	QASILIMIT
QASILIMIT			

Appendix G (continued)

Application Module: LMQUASEX Author:

PROCEDURE Name	If	Then	Arguments
	$InpID==23	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
QEX	16,512x480	15
exptwo	16,512x480	11
Nonequiv	16,512x480	10
threenequiv	16,512x480	9
question	16,512x480	12
TIMESER	16,512x480	13
extimeseries	16,512x480	18
timexam2	16,512x480	19
gloriavid	9,512x480	2
qstrnth	16,512x480	10
exlimit	16,512x480	9
QASILIMIT	16,512x480	7

Appendix G (continued)

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External files referenced by C:\AUTH20\APP\LMQUASEX.AAM

Fonts
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C:\V220\vid\font\ultra.124
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C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
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D:\RESMETH\IMAGES\ADVANT.C16
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  timexam2
D:\RESMETH\IMAGES\CAMPUS1.C16
  qstrnth
D:\RESMETH\IMAGES\DICE200.C16
  question
D:\RESMETH\IMAGES\disadvan.C16
  exlimit
  QASILIMIT
D:\RESMETH\IMAGES\FRAMNINE.CMY
  gloriavid
D:\RESMETH\IMAGES\lmcontrl.C16
  QEX
D:\RESMETH\IMAGES\madonna.C16
  qstrnth
D:\RESMETH\IMAGES\manip.C16
  QEX
D:\RESMETH\IMAGES\marchbd.C16
  Nonequiv
D:\RESMETH\IMAGES\noneqi.C16
  exptwo
  Nonequiv
D:\RESMETH\IMAGES\PLNBKG.C16
  QEX
  exptwo
  threenequiv
  question
  TIMESER
  extimeseries
  timexam2
```

Appendix G (continued)

```
  qstrnth
  exlimit
  QASILIMIT
D:\RESMETH\IMAGES\random2.C16
  QEX
  question
D:\RESMETH\IMAGES\SUBSAND.C16
  extimeseries
D:\RESMETH\IMAGES\TIMES.C16
  TIMESER
D:\RESMETH\IMAGES\times2.C16
  exptwo
  TIMESER
D:\RESMETH\IMAGES\twoconf.C16
  QASILIMIT

AVSS
~~~~
D:\RESMETH\AUDIO\12tok.AVS
  question
  extimeseries
  QASILIMIT
D:\RESMETH\AUDIO\14trlong.AVS
  Nonequiv
  TIMESER
  exlimit
D:\RESMETH\AUDIO\FIELDDRN.AVS
  qstrnth
D:\RESMETH\AUDIO\POPQUIZ.AVS
  threenequiv
D:\RESMETH\AUDIO\QUASIM2.AVS
  QEX
D:\RESMETH\AUDIO\TRK4SEC7.AVS
  exptwo
D:\RESMETH\VIDEO\QUASI.AVS
  gloriavid

Executes
~~~~~~~~
```

Appendix G (continued)

Application Module: LMERORES Author:

Application Module Information

Create: Mon Apr 05 09:37:51 1993

Update: Sat Aug 06 13:17:15 1994

Description:

Procedures: 13 Instructions: 26

Questions: 0 Objectives: 0

Panels: 13 Variables: 0

PROCEDURE Name	If	Then	Arguments
ERROULI			
		Show	ERROULI
	$InpID==34	Call	SLING
SLING			
		Show	sling
	$InpID==35	Call	2SLING
2SLING			
		Show	2sling
	$InpID==647	Call	REPRSENT
REPRSENT			
		Show	REPRSNTVE
	$InpID==36	Call	SASIZE
SASIZE			
		Show	sasize
	$InpID==37	Call	SMPTABL
SMPTABL			
		Show	SMPLTABL
	$InpID==38	Call	OPTSIZE
OPTSIZE			
		Show	optsize
	$InpID==39	Call	2optsize
2optsize			
		Show	2optsize
	$InpID==648	Call	NONCOVERAGE
NONCOVERAGE			
		Show	NONCOVERAGE
	$InpID==40	Call	2noncover
2noncover			
		Show	2NONCOVER
	$InpID==649	Call	NONRESPONSE
NONRESPONSE			
		Show	nonresponse
	$InpID==41	Call	2nonrespn
2nonrespn			
		Show	2NONRESPN
	$InpID==626	Call	threnonrespn

Appendix G (continued)

Application Module: LMERORES Author:

PROCEDURE Name	If	Then	Arguments
		Show	threnonrespn
	$InpID==653	Exit	0

QUESTION Name	Evaluation	Try	Points	Panel

OBJECTIVE Name	P%	#Qs	QPos	OPts	OPos

PANEL Name	Fm,Res	Objs
ERROULI	16,512x480	8
sling	16,512x480	8
2sling	16,512x480	10
REPRSNTVE	16,512x480	10
sasize	16,512x480	7
SMPLTABL	16,512x480	6
optsize	16,512x480	8
2optsize	16,512x480	10
NONCOVERAGE	16,512x480	8
2NONCOVER	16,512x480	10
nonresponse	16,512x480	7
2NONRESPN	16,512x480	8
threnonrespn	16,512x480	11

Appendix G (continued)

```
External files referenced by C:\AUTH20\APP\LM2NDES.AAM

Fonts
~~~~~
 (NOT FOUND)
C:\V220\vid\font\sans.109
C:\V220\vid\font\sans.112
C:\V220\vid\font\sans.114
C:\V220\vid\font\sans.118
C:\V220\vid\font\sans.124
C:\V220\vid\font\ultra.109
C:\V220\vid\font\ultra.112
C:\V220\vid\font\ultra.114
C:\V220\vid\font\ultra.118
C:\V220\vid\font\ultra.124
C:\V220\vid\font\ultrab.109
C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
D:\RESMETH\IMAGES\advant.C16
  STRENGTHS
  STONE
  SRTWO
  sthree
D:\RESMETH\IMAGES\diabetes.C16
  ex3limit
D:\RESMETH\IMAGES\disadvan.C16
  LIMITATIONS
  exam1limit
  exam2lim
  ex3limit
  ex4limit
D:\RESMETH\IMAGES\fatburger.C16
  SRTWO
D:\RESMETH\IMAGES\LMCONTRL.C16
  STONE
D:\RESMETH\IMAGES\manip.C16
  STONE
D:\RESMETH\IMAGES\moneytop.C16
  ex4limit
D:\RESMETH\IMAGES\PLNBKG.C16
  STRENGTHS
  STONE
  SRTWO
  sthree
  LIMITATIONS
  exam1limit
  exam2lim
  ex3limit
  ex4limit
D:\RESMETH\IMAGES\random2.C16
```

Appendix G (continued)

```
  STONE
D:\RESMETH\IMAGES\smoke2.C16
  exam2lim
D:\RESMETH\IMAGES\testhypo.C16
  sthree
D:\RESMETH\IMAGES\toddler.C16
  exam1limit
D:\RESMETH\IMAGES\trama.C16
  SRTWO

AVSS
~~~~
D:\RESMETH\AUDIO\1trk5sec.AVS
  STONE
  ex3limit
D:\RESMETH\AUDIO\4trkbit.AVS
  SRTWO
  LIMITATIONS
  exam2lim
D:\RESMETH\AUDIO\trk4sec7.AVS
  STRENGTHS
  sthree
  exam1limit
  ex4limit

Executes
~~~~~~~~
```

Appendix G (continued)

```
External files referenced by C:\AUTH20\APP\LMERORES.AAM

Fonts
~~~~~
 (NOT FOUND)
C:\V220\vid\font\sans.109
C:\V220\vid\font\sans.112
C:\V220\vid\font\sans.114
C:\V220\vid\font\sans.118
C:\V220\vid\font\sans.124
C:\V220\vid\font\ultra.109
C:\V220\vid\font\ultra.112
C:\V220\vid\font\ultra.114
C:\V220\vid\font\ultra.118
C:\V220\vid\font\ultra.124
C:\V220\vid\font\ultrab.109
C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
D:\RESMETH\IMAGES\lgsample.C16
  sasize
D:\RESMETH\IMAGES\NONCOVER.C16
  NONCOVERAGE
  2NONCOVER
D:\RESMETH\IMAGES\NONRESPN.C16
  nonresponse
  2NONRESPN
D:\RESMETH\IMAGES\oops.C16
  ERROULI
D:\RESMETH\IMAGES\optsize.C16
  optsize
D:\RESMETH\IMAGES\PLNBKG.C16
  ERROULI
  sling
  2sling
  REPRSNTVE
  sasize
  SMPLTABL
  optsize
  2optsize
  NONCOVERAGE
  2NONCOVER
  nonresponse
  2NONRESPN
  threnonrespn
D:\RESMETH\IMAGES\samperr.C16
  sling
  REPRSNTVE
D:\RESMETH\IMAGES\STUDUS.C16
  2sling
D:\RESMETH\IMAGES\STUSTUD.C16
```

Appendix G (continued)

```
  2sling
D:\RESMETH\IMAGES\table1.C16
  SMPLTABL
D:\RESMETH\IMAGES\weighin.C16
  threnonrespn

AVSS
~~~~
D:\RESMETH\AUDIO\14TGOOD.AVS
  2optsize
D:\RESMETH\AUDIO\14TRLONG.AVS
  SMPLTABL
D:\RESMETH\AUDIO\5TRKEXC.AVS
  threnonrespn
D:\RESMETH\AUDIO\5TRKMED.AVS
  2NONRESPN
D:\RESMETH\AUDIO\ERCOVER.AVS
  NONCOVERAGE
D:\RESMETH\AUDIO\ERESPON.AVS
  nonresponse
D:\RESMETH\AUDIO\ERLARSAM.AVS
  sasize
D:\RESMETH\AUDIO\ERREP.AVS
  optsize
D:\RESMETH\AUDIO\ERSAM.AVS
  2sling
D:\RESMETH\AUDIO\ERSTART.AVS
  ERROULI
D:\RESMETH\AUDIO\TR14MED.AVS
  2NONCOVER
D:\RESMETH\AUDIO\TRK1MED.AVS
  sling
D:\RESMETH\AUDIO\TRK4SEC7.AVS
  REPRSNTVE

Executes
~~~~~~~~
```

Appendix G (continued)

Application Module: LMPARTER Author:

Application Module Information

Create: Mon Apr 05 09:37:51 1993

Update: Sat Aug 06 13:34:59 1994

Description:

Procedures: 12 Instructions: 24

Questions: 0 Objectives: 0

Panels: 12 Variables: 0

PROCEDURE Name	If	Then	Arguments
FLTYMEAS			
		Show	fltymsment
	$InpID==42	Call	unomeasure
unomeasure			
		Show	unomeasure
	$InpID==654	Call	duomeasure
duomeasure			
		Show	duomeas
	$InpID==655	Call	tresmeas
tresmeas			
		Show	tresmeas
	$InpID==656	Call	quatromes
quatromes			
		Show	quatromes
	$InpID==657	Call	introtype
introtype			
		Show	INTROTYP
	$InpID==650	Call	moretype
moretype			
		Show	moretype
	$InpID==651	Call	TYPESERROR
TYPESERROR			
		Show	TYPSERR
	$InpID==43	Call	pone
pone			
		Show	pone
	$InpID==44	Call	two
two			
		Show	two
	$InpID==45	Call	three
three			
		Show	three
	$InpID==46	Call	four
four			
		Show	four
	$InpID==47	Exit	0

Appendix G (continued)

Application Module: LMPARTER Author:

QUESTION Name Evaluation Try Points Panel

OBJECTIVE Name P% #Qs QPos OPts OPos

PANEL Name	Fm,Res	Objs
fltymsment	16,512x480	7
unomeasure	16,512x480	11
duomeas	16,512x480	14
tresmeas	16,512x480	11
quatromes	16,512x480	11
INTROTYP	16,512x480	9
moretype	16,512x480	8
TYPSERR	16,512x480	14
pone	16,512x480	12
two	16,512x480	9
three	16,512x480	10
four	16,512x480	10

Appendix G (continued)

External files referenced by C:\AUTH20\APP\LMPARTER.AAM

Fonts
~~~~~

(NOT FOUND)
C:\V220\vid\font\sans.109
C:\V220\vid\font\sans.112
C:\V220\vid\font\sans.114
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C:\V220\vid\font\sans.124
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C:\V220\vid\font\ultra.118
C:\V220\vid\font\ultra.124
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C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~

D:\RESMETH\IMAGES\200lbs.C16
  unomeasure
D:\RESMETH\IMAGES\badtool.C16
  duomeas
D:\RESMETH\IMAGES\goodtool.C16
  duomeas
D:\RESMETH\IMAGES\helperga.C16
  tresmeas
D:\RESMETH\IMAGES\measur2.C16
  fltymsment
  unomeasure
  duomeas
  tresmeas
  quatromes
D:\RESMETH\IMAGES\PLNBKG.C16
  fltymsment
  unomeasure
  duomeas
  tresmeas
  quatromes
  INTROTYP
  moretype
  TYPSERR
  pone
  two
  three
  four
D:\RESMETH\IMAGES\robin.C16
  quatromes
D:\RESMETH\IMAGES\type1.C16
  INTROTYP
  TYPSERR

Appendix G (continued)

```
D:\RESMETH\IMAGES\type2.C16
  INTROTYP
  TYPSERR

AVSS
~~~~
D:\RESMETH\AUDIO\5TRKEXC.AVS
  moretype
D:\RESMETH\AUDIO\5TRKMED.AVS
  pone
D:\RESMETH\AUDIO\DRUMUP.AVS
  three
D:\RESMETH\AUDIO\FME3.AVS
  tresmeas
D:\RESMETH\AUDIO\FMEFOUR.AVS
  quatromes
D:\RESMETH\AUDIO\FMEINTRO.AVS
  fltymsment
D:\RESMETH\AUDIO\FMEONE.AVS
  unomeasure
D:\RESMETH\AUDIO\FMETWO.AVS
  duomeas
D:\RESMETH\AUDIO\FMETYPES.AVS
  INTROTYP
D:\RESMETH\AUDIO\PIANOUP.AVS
  two
D:\RESMETH\AUDIO\TRK62.AVS
  four

Executes
~~~~~~~~
```

Appendix H

Module III Program Details and External Files

```
Application Module: LMM3EPI    Author:

Application Module Information

Create:  Tue Apr 20 09:19:31 1993

Update:  Sat Aug 06 13:44:06 1994

Description:

Procedures: 4     Instructions: 9

 Questions: 0       Objectives: 0

    Panels: 5        Variables: 0

PROCEDURE Name     If                Then    Arguments

OVERVIEW
                                     Show    Helloepi
                                     Show    OVERVIEW
                   $InpID==60        Call    VIEW
VIEW
                                     Show    VIEW
                   $InpID==66        Call    FRAMING
FRAMING
                                     Show    FRAMING
                   $InpID==68        Call    CLASSEPI
CLASSEPI
                                     Show    CLASSEPI
                   $InpID==69        Exit    0

QUESTION Name    Evaluation          Try  Points  Panel

OBJECTIVE Name         P%  #Qs QPos  OPts OPos

 PANEL Name       Fm,Res     Objs

Helloepi          16,512x480 4
OVERVIEW          16,512x480 15
VIEW              16,512x480 8
FRAMING           16,512x480 10
CLASSEPI          16,512x480 10
```

Appendix H (continued)

```
External files referenced by C:\AUTH20\APP\LMM3EPI.AAM

Fonts
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 (NOT FOUND)
C:\V220\vid\font\sans.109
C:\V220\vid\font\sans.112
C:\V220\vid\font\sans.114
C:\V220\vid\font\sans.118
C:\V220\vid\font\sans.124
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C:\V220\vid\font\ultra.118
C:\V220\vid\font\ultra.124
C:\V220\vid\font\ultrab.109
C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
D:\RESMETH\IMAGES\1sister.C16
  FRAMING
D:\RESMETH\IMAGES\2sisters.C16
  FRAMING
D:\RESMETH\IMAGES\ANEPIDEM.C16
  CLASSEPI
D:\RESMETH\IMAGES\country.C16
  OVERVIEW
D:\RESMETH\IMAGES\DESEPID.C16
  CLASSEPI
D:\RESMETH\IMAGES\DOCHEART.C16
  VIEW
D:\RESMETH\IMAGES\inwhom.C16
  OVERVIEW
D:\RESMETH\IMAGES\mod13.C16
  Helloepi
D:\RESMETH\IMAGES\PLNBKG.C16
  OVERVIEW
  VIEW
  FRAMING
  CLASSEPI
D:\RESMETH\IMAGES\where.C16
  OVERVIEW

AVSS
~~~~
D:\RESMETH\AUDIO\EP3D&A.AVS
  CLASSEPI
D:\RESMETH\AUDIO\EP3DEF.AVS
  OVERVIEW
D:\RESMETH\AUDIO\EP3INTRO.AVS
  Helloepi
```

Appendix H (continued)

```
D:\RESMETH\AUDIO\PIANOUP.AVS
  FRAMING
D:\RESMETH\AUDIO\TRK62.AVS
  VIEW

Executes
~~~~~~~~
```

Appendix H (continued)

Application Module: LMDEPI(1 Author:

Application Module Information

Create: Tue Apr 20 12:20:40 1993

Update: Sat Aug 06 13:58:11 1994

Description:

Procedures: 15 Instructions: 30

Questions: 0 Objectives: 0

Panels: 15 Variables: 0

PROCEDURE Name	If	Then	Arguments
DSCRIP			
	$InpID==70	Show Call	dscrip PREVINC
PREVINC			
	$InpID==71	Show Call	PREVINC PRERATE
PRERATE			
	$InpID==72	Show Call	PRERATE INRATE
INRATE			
	$InpID==75	Show Call	INRATE aninsid
aninsid			
	$InpID==667	Show Call	aninsid TYPEDEPI
TYPEDEPI			
	$InpID==76	Show Call	TYPEDEPI ECOLOGICAL
ECOLOGICAL			
	$InpID==77	Show Call	ECOLOGICAL DADVECO
DADVECO			
	$InpID==78	Show Call	DADVECO ECOEXAMP
ECOEXAMP			
	$InpID==79	Show Call	ECEXAMP CASEREP
CASEREP			
	$InpID==80	Show Call	CASEREP ADCASE
ADCASE			
	$InpID==81	Show Call	ADCASE EXAMCASE
EXAMCASE			
	$InpID==82	Show Call	EXAMCASE CROSSSEC

Appendix H (continued)

Application Module: LMDEPI(1 Author:

PROCEDURE Name	If	Then	Arguments
ADCROSS	$InpID==84	Show Call	CROSSSEC ADCROSS
EXAMCROSS	$InpID==85	Show Call	ADCROSS EXAMCROSS
	$InpID==86	Show Exit	EXCROSS 0

QUESTION Name Evaluation Try Points Panel

OBJECTIVE Name P% #Qs QPos OPts OPos

PANEL Name	Fm,Res	Objs
dscrip	16,512x480	9
PREVINC	16,512x480	11
PRERATE	16,512x480	12
INRATE	16,512x480	11
aninsid	16,512x480	10
TYPEDEPI	16,512x480	12
ECOLOGICAL	16,512x480	15
DADVECO	16,512x480	9
ECEXAMP	16,512x480	10
CASEREP	16,512x480	11
ADCASE	16,512x480	10
EXAMCASE	16,512x480	9
CROSSSEC	16,512x480	8
ADCROSS	16,512x480	9
EXCROSS	16,512x480	9

Appendix H (continued)

```
External files referenced by C:\AUTH20\APP\LMDEPI(1.AAM

Fonts
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 (NOT FOUND)
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C:\V220\vid\font\sans.118
C:\V220\vid\font\sans.124
C:\V220\vid\font\ultra.109
C:\V220\vid\font\ultra.112
C:\V220\vid\font\ultra.114
C:\V220\vid\font\ultra.118
C:\V220\vid\font\ultra.124
C:\V220\vid\font\ultrab.109
C:\V220\vid\font\ultrab.112
C:\V220\vid\font\ultrab.114
C:\V220\vid\font\ultrab.118
C:\V220\vid\font\ultrab.124

Images
~~~~~~
D:\RESMETH\IMAGES\ADVANT.C16
  DADVECO
  ADCASE
  ADCROSS
D:\RESMETH\IMAGES\biobaby.C16
  EXAMCASE
D:\RESMETH\IMAGES\calendar.C16
  ECOLOGICAL
D:\RESMETH\IMAGES\CAMPUS3.C16
  EXCROSS
D:\RESMETH\IMAGES\case1.C16
  TYPEDEPI
  CASEREP
D:\RESMETH\IMAGES\case2.C16
  CASEREP
D:\RESMETH\IMAGES\country.C16
  ECOLOGICAL
D:\RESMETH\IMAGES\CROSSSEC.C16
  TYPEDEPI
  CROSSSEC
D:\RESMETH\IMAGES\DESEPID.C16
  dscrip
  PREVINC
  PRERATE
  INRATE
  aninsid
D:\RESMETH\IMAGES\disadvan.C16
  DADVECO
  ADCASE
  ADCROSS
D:\RESMETH\IMAGES\ECOLOGY.C16
  TYPEDEPI
```

Appendix H (continued)

```
   STONE
D:\RESMETH\IMAGES\smoke2.C16
   exam2lim
D:\RESMETH\IMAGES\testhypo.C16
   sthree
D:\RESMETH\IMAGES\toddler.C16
   exam1limit
D:\RESMETH\IMAGES\trama.C16
   SRTWO

AVSS
~~~~
D:\RESMETH\AUDIO\1trk5sec.AVS
   STONE
   ex3limit
D:\RESMETH\AUDIO\4trkbit.AVS
   SRTWO
   LIMITATIONS
   exam2lim
D:\RESMETH\AUDIO\trk4sec7.AVS
   STRENGTHS
   sthree
   exam1limit
   ex4limit

Executes
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```

Appendix H (continued)

```
  ECOLOGICAL
D:\RESMETH\IMAGES\econstat.C16
  ECOLOGICAL
D:\RESMETH\IMAGES\icincid.C16
  PREVINC
  INRATE
  aninsid
D:\RESMETH\IMAGES\icprev.C16
  PREVINC
D:\RESMETH\IMAGES\insid.C16
  aninsid
D:\RESMETH\IMAGES\observe.C16
  dscrip
D:\RESMETH\IMAGES\over65.C16
  ECEXAMP
D:\RESMETH\IMAGES\PLNBKG.C16
  dscrip
  PREVINC
  PRERATE
  INRATE
  aninsid
  TYPEDEPI
  ECOLOGICAL
  DADVECO
  ECEXAMP
  CASEREP
  ADCASE
  EXAMCASE
  CROSSSEC
  ADCROSS
  EXCROSS
D:\RESMETH\IMAGES\preval.C16
  PRERATE

AVSS
~~~~
D:\RESMETH\AUDIO\14TGOOD.AVS
  INRATE
  ADCROSS
D:\RESMETH\AUDIO\DEPCASE.AVS
  EXAMCASE
D:\RESMETH\AUDIO\DEPCROSS.AVS
  EXCROSS
D:\RESMETH\AUDIO\DEPECO.AVS
  ECEXAMP
D:\RESMETH\AUDIO\DEPINCL.AVS
  TYPEDEPI
D:\RESMETH\AUDIO\DEPINTRO.AVS
  dscrip
D:\RESMETH\AUDIO\DRUMUP.AVS
  CROSSSEC
D:\RESMETH\AUDIO\PIANOFUL.AVS
  CASEREP
D:\RESMETH\AUDIO\PIANOUP.AVS
  DADVECO
```

Appendix H (continued)

```
D:\RESMETH\AUDIO\SAXFUL.AVS
  ADCASE
D:\RESMETH\AUDIO\TRK3.AVS
  PREVINC
D:\RESMETH\AUDIO\TRK6.AVS
  aninsid
D:\RESMETH\AUDIO\TRK62.AVS
  ECOLOGICAL
D:\RESMETH\AUDIO\TRK8.AVS
  PRERATE

Executes
~~~~~~~~
```

Appendix H (continued)

Application Module: LMANAEP Author:

Application Module Information

Create: Tue Apr 20 15:29:12 1993

Update: Sat Aug 06 14:10:03 1994

Description:

Procedures: 13 Instructions: 26

Questions: 0 Objectives: 0

Panels: 13 Variables: 0

PROCEDURE Name	If	Then	Arguments
ANAEPI			
	$InpID==90	Show Call	ANAEPI OBOREXP
OBOREXP			
	$InpID==658	Show Call	OBOREXP OBSERVA
OBSERVA			
	$InpID==659	Show Call	OBSERVA ANQUES
ANQUES			
	$InpID==660	Show Call	ANQUES CONTCASE
CONTCASE			
	$InpID==95	Show Call	CONTCASE CONEXAMP
CONEXAMP			
	$InpID==96	Show Call	CONEXAMP COHORT
COHORT			
	$InpID==97	Show Call	COHORT COEXAMP
COEXAMP			
	$InpID==99	Show Call	COEXAMP PROCOHORT
PROCOHORT			
	$InpID==100	Show Call	PROCOHORT EXPEPIDEM
EXPEPIDEM			
	$InpID==661	Show Call	expepidem CLINICAL
CLINICAL			
	$InpID==101	Show Call	CLINICAL EXCLIN
EXCLIN			
	$InpID==333	Show Call	EXCLIN CLIADV

Appendix H (continued)

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CONEXAMP	16,512x480	9
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Appendix H (continued)

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Appendix H (continued)

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Appendix I

V. Castelli - Master's Project

July 11, 1995

I give Laura McEwen permission to include my Master's project "Evaluation of the Effectiveness of Computer Based Instructional (CBI) Courseware for Teaching Research Methodology to Undergraduate Students" as an appendix to her Master's thesis.

Victoria G. Castelli

Appendix I (continued)

EVALUATION OF THE EFFECTIVENESS OF
COMPUTER BASED INSTRUCTIONAL (CBI) COURSEWARE
FOR TEACHING RESEARCH METHODOLOGY
TO UNDERGRADUATE STUDENTS

A Research Project
Presented to
The Faculty of the Department of Nutrition and Food Science
San Jose State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

By
Victoria G. Castelli
April 10, 1995

Approved

Miriam Saltmarch, Ph.D.

Kathryn Sucher, Sc.D., R.D.

Appendix I (continued)

EVALUATION OF THE EFFECTIVENESS OF
COMPUTER BASED INSTRUCTIONAL (CBI) COURSEWARE
FOR TEACHING RESEARCH METHODOLOGY
TO UNDERGRADUATE STUDENTS

Victoria G. Castelli
April 10, 1995

Running Head: CBI EVALUATION

Appendix I (continued)

Preface

The journal article titled "Evaluation of the Effectiveness of Computer Based Instructional Courseware (CBI) to Teach Research Methodology to Undergraduate Students" comprises Appendix D of this document. It was written according to the information for authors of the Journal of Educational Multimedia and Hypermedia.

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Table of Contents

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Tables

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Acknowledgments

I would like to thank several people who helped make the completion of this project possible. I thank Dr. Miriam Saltmarch for her advice, enthusiasm and guidance. Her commitment and dedication to this project made its completion possible. I thank Dr. Kathryn Sucher for her advice on this project and for her support throughout my experience in the nutrition department. I am grateful to Stephen Aquino for his help with the statistical analysis and for his patient explanations.

I thank my mother Grace Castelli for her unconditional love, her eternal optimism, and her quiet strength. She was my first nutrition teacher.

Finally, I thank Dr. Joni Finney for her friendship, encouragement and absolute confidence in me. Her efforts on my behalf have been extraordinary.

Appendix I (continued)

Evaluation of the Effectiveness of Computer Based Instructional (CBI) Courseware for Teaching Research Methodology to Undergraduate Students

Abstract

The potential effectiveness of computer-based instruction (CBI) as a pedagogical tool has been suggested by numerous studies. Its benefits include logical well-sequenced instruction, a self-paced individualized approach, and the ability to provide immediate feedback to the student. This versatile technology is ideal for teaching the complicated concepts of research methodology. CBI courseware was developed at San Jose State University (SJSU) to teach an undergraduate, semester-long course in research methodology. The purpose of this study was to evaluate the effectiveness of that courseware. Subjects were undergraduate students in a one credit course for nutrition and food science majors at SJSU enrolled during the spring 1994 semester. Students were assigned to a treatment or control group based on ranked random selection according to grade point average. The control group (n=14) received the course material through the traditional lecture and discussion format with the usual classroom teacher. The treatment group (n=17) received the same material via the CBI courseware. Analysis of pretest and posttest scores indicated a statistically significant positive difference in achievement in the treatment group over the control group at the p=0.02 confidence level.

Appendix I (continued)

Introduction

Nutrition research appropriately applied has profound and far-reaching implications. It may improve patient outcomes in the hospital setting, enhance the quality of life of those managing a long term condition such as diabetes or hypertension, enrich the health of the general public and promote interest and support for the continued study in the field of nutrition. The volume of nutrition information currently available is astounding.

Research supports and directs the clinical practice of nutrition (Monsen & Cheney, 1988). It is the backbone of the dietetics profession. The public is eager for nutrition information, but is for the most part unprepared to apply it to making healthy food choices for their own diets. Increasingly, registered dietitians (R.D.) are asked to interpret nutrition research and to define its implications for the health of their clients. As a result, the American Dietetic Association (ADA) has placed stronger emphasis on the study of research methodology and the development of critical thinking skills in the curriculum for dietetic students, and stresses these issues among its professional competencies for R.D.'s.

Concerned that their students be prepared to successfully write the examination for registered dietitians and that they be competent to interpret the complexities of nutrition research in their professional practices, the faculty of the Department of Nutrition and Food Science at San Jose State University (SJSU) began to develop a one credit, undergraduate course in research methodology. Computer-based instruction (CBI) was chosen as the instructional medium for the course because of the potential it had shown in teaching other subjects. Many of CBI's features make it ideal for teaching the complex concepts and definitions of research methodology. Those features include a logical, well-

sequenced program of instruction, the ability for repetition and review and a format that allows students to proceed through the material at their own pace.

In 1991, the (USDA) awarded a grant to the Department of Nutrition and Food Science at San Jose State University (SJSU) to develop Computer-Based Instructional (CBI) courseware materials for the purpose of teaching NUFS 195 Research Methodology a one credit undergraduate course. The program utilizes Intel's Digital Video Interactive (DVI) technology which enables the programmer to incorporate still images, text, graphics, sound and moving video in a compressed format. If determined to be effective in aiding students in meeting the course's goals and objectives, the courseware package will be transferred to compact disc and distributed to other interested dietetic programs around the country for a nominal charge.

The purpose of this study was to determine the effectiveness of CBI courseware to the teaching of an undergraduate course in research methodology as compared to the traditional lecture and discussion format.

Review of Related Literature

Computer-based instruction (CBI) is a technological method for delivering instructional material to students. CBI is defined as the interaction of computer systems and individuals to help individuals learn new material or improve their knowledge of previously studied material (Azarmsa, 1991). With CBI, a student need never miss instruction due to an absence since the instructional material is retained in the computer's data base and can be delivered at any time. The computer delivers instruction free of instructor bias, and does not wander off the topic thus eliminating the mediocre human contribution to teaching (Wade & Thiele, 1973). CBI offers variety, flexibility, immediate

Appendix I (continued)

feedback, eternal patience and accurate record keeping. When used to its fullest capacity, CBI can actively engage students because of its individualized approach to learning.

CBI can be employed in several ways: the electronic blackboard, drill and practice, simulation, instructional dialogue, and record keeping (Arons, 1984). Its simplest format is as an electronic textbook or blackboard through which lecture notes are converted to computer screen, and the computer writes and erases the lessons like the instructor would do on the blackboard. Drill and practice programs enable students to practice the skills they have learned in the classroom such as math problems and new vocabulary words. The three dimensional graphics and moving video available through the computer can be used to simulate physical phenomenon such as molecular structure and dissections.

A more complex use of CBI is as an instructional dialogue which utilizes a function know as branching in which the computer engages the learner in a conversation by asking questions. A correct response allows the student to progress to the next level of difficulty or complexity. An incorrect response sends the learner back to a previous section of the text for review or into a remedial sequence and then more questions. There are many applications for this feature. For example, it could be used to present symptoms and signs to medical students requiring them to give an accurate diagnosis (Arons, 1984).

CBI can be used to administer and grade exams, accurately record grades and produce a printout of results for the instructor. Finally, CBI can be used as a complete self-study course incorporating all the other features into a comprehensive program of study.

After an exhaustive analysis of the literature regarding the use of CBI in the classroom, Kulik and Kulik (1987) concluded that students generally: learned more in classes when they received help from the computer; learned with less instructional time; liked their classes more; and developed more positive attitudes towards computers. CBI appears to be as effective or more effective than traditional lecture methods for teaching

various subjects as evidenced by higher posttest scores among CBI students (Boysen and Francis, 1982; Drake, 1988; Vogler, O'Quinn and Paterson, 1991).

Researchers attribute higher posttest scores to several of CBI's features. The branching ability of CBI enables students to progress through the material at their own pace, or weave their own path through the lessons (Cohen, 1983; Emerson, 1988; Ries & Granell, 1985; Schroeder & Kent, 1982; Wade & Thiele, 1973). Schroeder and Kent (1982) reported that CBI students in a renal diet therapy class not only learned more with the CBI than those in the lecture group, but the students felt they were more efficient in their learning because they could skip over material they already knew and concentrate on mastering new information. In a study using CBI to teach the principles of a vegetarian diet to nutrition students, Ries and Granell (1985) reported that students found CBI to be an efficient way to learn the material since it saved time and improved their grades.

CBI allows students to periodically test their knowledge through self-test questions and practical exercises that may not count for a grade (Boysen & Francis, 1982). This feature allows students who respond incorrectly to a question or problem to go back to a previous portion of the lesson for additional work while student who answer correctly can advance to the next section. CBI thus spares students the embarrassment of answering a teacher's question incorrectly in front of the class by allowing them to make mistakes privately (Rockman, 1993).

The graphics, color, moving video and audio features available through the computer can illustrate functions and phenomena more realistically than the one dimensional illustrations on a blackboard or in a textbook (Arons, 1984; Boysen & Francis, 1982).

The consultation with a programmer required for the development of CBI courseware generally leads to a logical, well-sequenced and highly structured program of study with clear and explicit objectives (Kulik and Kulik, 1987). The process of converting lecture material to computer software demands that the instructor rethink the

Appendix I (continued)

fundamentals of the course (WICHE, 1994). This point is strengthened by the fact that when two instructors are used, one for the CBI group and a different one for the lecture group, the CBI group scores higher than when the same teacher is used for both groups (Clark, 1985). The CBI instructor had to go through the planing process with the programmer to develop the CBI courseware and therefore was forced to reorganize her course material so that it could be presented in the logical fashion required by the computer which inevitably leads to a more logical presentation of material overall and higher posttest scores.

CBI seems to confer benefits over and above the effective delivery of instructional material. Drake (1988) found that students not only learned more nutrition information with CBI, but they also retained more of that knowledge up to five months after taking the course. Vogler, O'Quinn and Paterson (1991) found that students in a sociology course not only scored higher on posttests, but their "critical thinking skills developed from rigid to flexible" and they were more comfortable asking the instructor questions. In a biomechanics course, Boysen and Francis (1982) found not only higher posttest scores, but that the computer presented more practical exercises and graded them for the students freeing the teacher from grading duties.

Even in studies where CBI did not produce statistically significant results on posttests, the computer learning experience seemed to impart some benefit to students. Students developed positive attitudes towards computers and technology in general as a result of working with CBI (Vogler, O'Quinn and Paterson, 1991). In a renal diet therapy class, Schroeder and Kent (1982) found no significant difference in posttest scores, but CBI group students expressed a more positive attitude towards CBI that the control group students expressed towards the traditional lecture method of instruction. Ries and Granell (1985) found that there was no significant difference in posttest scores using CBI to teach a course in vegetarianism, but CBI students had positive responses to learning by

computer and CBI spared the instructor from time spent evaluating student practice efforts.

CBI may have the potential to change students' attitudes about a subject. Using CBI to teach the difficult concept of nutrient density, Edmunds, Wyse and DeBloois (1987) found no significant difference in posttest scores, but students had positive feelings towards the material presented and the technology used to teach it. Using CBI to teach statistics produced positive but not statistically significant posttest results for Collis, Oberg and Shera (1989). However, students expressed an improved attitude toward statistics and toward CBI. Furthermore, the instructors felt positive about their own and the students experiences with the computer modules.

Several factors may have contributed to the positive outcomes found in many of the studies besides the use of the computer. Students in CBI classes may have spent more time with material than students in lecture classes. The greater time spent on a subject may have been the reason for the higher posttest scores not the CBI (Hagler & Knowlton, 1987). CBI programs may be presenting more material than lecture teachers which would give CBI group students an advantage on posttests (Gillingham & Guthrie, 1987). In situations where two different instructors were used, the better teacher may have been assigned to the CBI group which led to the higher posttest scores not the computer (Clark, 1985). The novelty effect of a new teaching method of any kind may have inspired students to work harder in CBI classes than students in the traditional lecture classes.

Cohen (1983) points out that as class size increases, CBI can be used to aid teachers by decreasing the amount of time they must spend in labor intensive tasks such as grading exams and record keeping. CBI will allow teachers to spend more time tutoring students with individual needs. In terms of instructor productivity, it has been asserted that technology frees instructors from routine teaching assignments and allows them to spend more time in critical thinking sessions with students (WICHE, 1994).

Appendix I (continued)

CBI may have the potential to improve student-teacher interactions. The instructor of CBI classes had more time to answer questions than the instructor in the traditional classroom (Boysen & Francis, 1988; Vogler, O'Quinn & Paterson, 1991). In a recent study involving several colleges and universities, researchers found overwhelming support for CBI and other instructional technologies as teaching methods (WICHE, 1994). Students characterized the quality of their interactions with faculty and other students as equal to or better than those that they had experienced in other classes. Faculty praised instructional technology such as computer based instruction because it put the student at the center of the learning experience and it kept conversations focused on content and not on peripheral matters (WICHE 1994).

The use of CBI and other instructional technology (IT) in colleges and universities seemed to reach a culmination point the late 1980's with a institutions that had initiated programs getting their programs operational, but most institutions still lagging far behind. Possible reasons for the limited use of technology in higher education include: lack of reward system for faculty to develop instructional innovation; lack of programming skills or lack of access to programmers; risk aversion among faculty to trying new instructional methods; resource constraints recently imposed on higher education (Geoghegan, 1994).

CBI has been used to teach several subjects. This literature review has not produced any study using CBI to teach research methodology. The study conducted at SJSU is the first to use CBI to teach this subject.

Methods

Subject Selection

Subjects were undergraduate students, 32 females and 1 male, (n=33) enrolled in NUFS 195 Research Methodology a one credit course for Nutrition and Food Science majors at San Jose State University during the spring 1994 semester. Nine seniors were

Appendix I (continued)

granted permission by the department chairperson to simultaneously enroll in NUFS 195 and another department course that met at the same time in order to meet graduation requirements. These nine double-enrolled students were placed in the experimental group. All other students for the experimental group were selected using stratified random sampling and grouped according to their grade point averages. The four grade point average (GPA) groups were: those with GPA 3.5 or greater (n=6), those with GPA greater than 3.0 but less than 3.5 (n=12), those with GPA greater than 2.5 but less than 3.0 (n=9), and those with GPA less than 2.5 (n=6) (Table 1). The nine double enrolled students in the experimental group were placed in one of these four GPA groups also. Students selected for the experimental group who did not wish to participate were given the opportunity to stay in the lecture group. Only one student selected this option and was substituted with a student with a similar GPA from the control group.

After four introductory class sessions, the control group participated in the usual lecture and discussion for the course provided by the usual instructor while the experimental group received the remainder of the course material from the CBI teaching modules. A graduate student or faculty member was always present during the CBI sessions to answer questions or provide technical assistance.

Module Development

Intel's digital video interactive technology (DVI) was used to develop the courseware for this class. This technology allows for the integration of moving video, still images, audio, text and graphics into a compressed format. Authology was the authoring program used. CBI modules were developed directly from the lecture notes of the classroom instructor and the textbook for the course. The control group and experimental group students received the same course material.

Testing Methods

Appendix I (continued)

The pretest was administered to all students on the first day that the class met prior to the breakout of the experimental group and before any instruction began. The posttest was administered on the last day the class met and was also given to all students. Both tests were identical and contained fifty multiple choice questions. The test was developed from the lecture notes and textbook material (Rivas, 1993). The pre/posttest was independent of the final exam and was not used to determine students' grades for the course.

The pre/posttests were reviewed for validity with the aid of a discrimination index using choice analysis. The discrimination index measured the degree of differentiation in responses between students comprising the upper and lower twenty-seventh percentiles of all test takers. A discrimination index of -0.5 to +0.5 was considered desirable. Questions with discrimination scores outside of this range were considered invalid (Rivas, 1993). Although the pre/posttest was administered with eighty questions, after choice analysis was performed, thirty questions were eliminated leaving fifty questions for statistical analysis.

An independent student t-test was performed using the Statistical Package for the Social Science (SPSS/PC, Chicago, IL.) software on the overall mean pre/posttest scores of the control and experimental groups. An analysis of GPA subgroups was not conducted due to the small sample size in each subgroup.

Experimental group students provided their feedback regarding the CBI courseware through a written survey and selected interviews (Appendix C).

Results

Scores were collected from the control and treatment groups and reviewed prior to conducting any statistical tests. It was observed that in the treatment group two cases showed extreme variability in their scores; the posttest scores were much lower than the pretest scores. Recognizing the potential effect this could possibly have on the

requirements of the statistical test, it was decided to eliminate these two particular cases from inclusion in the data prior to analysis using the student t test. Explanation of these two aberrant scores would only be speculative. Lack of seriousness in taking the posttest since it did not contribute to the final course grade may have contributed to this result.

An independent student t-test (n=31) produced a t value of 2.46 at the p=0.02 confidence level. Mean posttest scores were higher in the experimental group than the control group across all four GPA subgroups. The most dramatic result was in the group with GPA's less than 2.5 (Table 5). Here the experimental group had mean posttest scores 12.2 points above the control group mean.

Discussion

Students in the experimental group scored higher on the posttest than students in the control group indicating that CBI had a more positive effect on the learning of the experimental group than the lecture method had on the learning of the control group. These findings are consistent with that of previous research (Kulik & Kulik, 1987). This trend is more pronounced perhaps because the instructor for the lecture and CBI groups was different. Previous research indicates that when two instructors are used posttest results are more divergent (Clark, 1985 and Kulik & Kulik, 1987).

The close grouping of posttest scores among students in the experimental group indicates that the CBI courseware had a universally positive effect on the learning of all students. Additionally, the posttest scores of the students in the experimental group were higher than those in the control group within each GPA subgroup indicating that CBI was effective for students of all academic ability levels.

While it might be expected that those students in the top GPA group would be successful regardless of instructional method used, the results of the lowest GPA group were unexpected. CBI's positive effects on learning are most powerfully illustrated in the lowest GPA group. These students scored within one point of those in the top GPA

Appendix I (continued)

group. Without the CBI courseware, these students would have scored comparable to their counterparts in the control group. The CBI courseware enabled them to compete equally with more successful students eliminating the learning barriers which, under traditional academic teaching methods, negatively impacts their performance resulting in lower GPA's and lower self-esteem (Rockman, 1993).

The Hawthorne effect cannot be overlooked as a possible influence on the higher scores among the computer group on the posttest. The experimental group may have worked harder to produce the results that they thought the researchers were expecting to see. Similarly, the novelty of exposing students to a new learning tool may have produced sufficient enthusiasm among the computer group students to encourage them to work harder and score higher on the posttest. However, Emerson (1988) controlled for the novelty effect in teaching a biology course to undergraduates, and the CBI group students still scored significantly higher on posttests.

Close controls were in place in the CBI group to ensure attendance at all sessions. With the exception of one student, all CBI group students attended all CBI sessions and viewed all the modules. Class attendance in the lecture group was not as strictly enforced or monitored. The CBI group may have had more instructional time with the computer than the lecture group had with the classroom teacher. Furthermore, individual study time was not accounted for. The amount of time students spend with new material may contribute to mastery of the material and ultimately to learning (Clark, 1985). This factor may have contributed to the higher posttest scores in the CBI group.

Students' Comments

Students in the computer group provided comments regarding their experience in the form of a written survey that utilized a five point Likert-type scale (Appendix C). Additionally, six students were randomly selected and interviewed. Overall, experimental group students enjoyed the learning experience with CBI. They thought the text in the

computer modules was thorough and concise. They liked the videotape segments and visuals including the pictures, graphics and icons. Several students expressed a desire for improvements of the interactivity features such as more branching, the addition of more video segments, enhancements of color and graphics, more self-test questions and greater access to the computer lab.

Comments concerning the audio aspects were less positive. For example, some students enjoyed the background music while others were distracted by it. A few students expressed a desire for time for interaction with other students or an instructor to discuss material that was covered in the computer modules.

Students' recommendations for improvement indicated their support for CBI and their positive feelings towards it as an instructional tool. Students wanted more video segments, more interactivity, more self-test questions. The individual interviews conducted with selected students elicited similar comments and served to reinforce and clarify the responses given on the written surveys rather than to reveal new information. No comments were solicited from the control group students.

Limitations of the Study

Clearly the CBI courseware had a positive and significant effect on posttest scores and, therefore, on the learning of the students in this study. However, due to the small sample size, the results of this study should be interpreted with caution. They do, however, support previous research in suggesting that CBI is a feasible alternative to the lecture and discussion format.

The survey given to CBI group students was not given to the lecture group students. This information could have been used to compare the attitudes and feelings of students towards their respective learning situations.

Recommendations for Further Research

Additional trials, perhaps with larger samples, are needed to verify the posttest trends seen in this experiment. More importantly, future research is needed to more specifically identify the characteristics of CBI that led to the trend seen in this study and previous studies with regard to the characteristics and instructional components that are responsible for these results (Keane, Norman and Vickers, 1991 and Gillingham & Guthrie, 1987). Identifying the specific features of CBI that promote improvements in learning would allow these features to be identified so that they could be replicated in future CBI courseware. Furthermore, it would settle the debate over the value of CBI as a pedagogical method.

The issue of retention should also be addressed in future trials. Students could be assessed at various intervals following the conclusion of the course to determine CBI's effect on long term retention of material.

Conclusion

The purpose of this study was to evaluate the effectiveness of CBI courseware in teaching research methodology to undergraduate students. Analysis of posttest scores indicate that CBI is an effective tool for this purpose. Furthermore, students expressed a positive attitude toward CBI. They appreciated its completeness and conciseness in covering the course material, and enjoyed its multimedia format. Following the completion of minor improvements in the program based on student's recommendations, copies of this CBI courseware should be made available to other dietetic programs around the country and should be utilized to teach this course for its next offering.

Appendix I (continued)

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Appendix I (continued)

Appendix B: Student Survey

NUFS 195

Spring 1994

NAME (Optional):

Circle the number that most closely reflects your opinion, based on a scale from 1-5, on the following areas. Please give additional comments below each question especially if you strongly agree or strongly disagree.

1	2	3	4	5
Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

1. The text was presented in a logical manner that was easy to follow.

1 2 3 4 5

Comments:

2. The examples provided enhanced my understanding of the theory presented.

1 2 3 4 5

Comments:

3. The audio (voice) enhanced my learning of the material.

1 2 3 4 5

Appendix I (continued)

Comments:

4. The video segments enhanced my learning of the material.

1 2 3 4 5

Comments:

5. The visual images (photos, icons, pictures) enhanced my learning of the material.

1 2 3 4 5

Comments:

6. The test questions enhanced my learning of the material.

1 2 3 4 5

Comments

7. The text, audio, video and images flowed in a logical sequence.

1 2 3 4 5

Comments:

Appendix I (continued)

8. The physical setting enhanced my learning (e.g. office, lighting, seating)

1 2 3 4 5

Comments:

9. Viewing the modules with a partner enhanced my learning.

1 2 3 4 5

Comments:

10. I would like to have more_____.(Circle all that apply.)

Text	Images
Audio	Examples
Test questions	Video
Other	

11. I would like to have less_____.(Circle all that apply.)

Text	Images
Audio	Examples
Test questions	Video
Other	

Appendix I (continued)

12. Rank the importance of the following components from most important (#1) to least important (#9)

_____ Text
_____ Visual images
_____ Test questions
_____ Video
_____ Audio
_____ Music
_____ Graphics
_____ Examples
_____ Physical setting

13. Overall, the Computer Based Interactive (CBI) program was an effective method for learning the material for this course.

1 2 3 4 5

Comments:

14. Additional comments:

Appendix I (continued)

Appendix C: Students Comments

Responses to Students' Survey

Survey Question	Frequency of Student Responses					
	1	2	3	4	5	Total
1. Overall, the CBI program was an effective method for understanding the material for this course	1	8	2	4	1	16
2. The text was presented in a logical manner that was easy to follow	3	11	2	0	0	16
3. The examples provided enhanced my understanding of the theory presented.	7	7	1	1	0	16
4. The audio (voice) enhanced my learning of the material.	1	3	8	3	1	16
5. The video segments enhanced my learning of the material.	5	4	5	1	1	16
6. The visual images (photos, icons, pictures) enhanced my learning of the material.	5	4	6	1		16
7. The test questions enhanced my learning of the material..	4	5	6	1	0	16
8. The text, audio, video and images flowed in a logical sequence	3	11	2	0	0	16
9. The physical setting enhanced my learning (e.g. office, lighting, seating)	1	1	3	2	9	16
10. Viewing the modules with a partner enhanced my learning.	3	4	6	2	1	16

NOTE (1): A response of 1 indicted strongly agree and 5 indicated strongly disagree

Appendix I (continued)

Additional Students' Comments

1. Environment
Too much noise, hard to concentrate
Not the greatest environment
Space too small, noisy, high traffic area, poor lighting
Uncomfortable, too many distractions, people coming in and out, phone calls

2. Group interaction
Missed out on group interaction on critique of research articles; don't feel like I know how to critique research

3. Music
Music should continue to next screen or section; I thought something was wrong when the music stopped
Music ended abruptly which was annoying
Soft music was nice, however, it frequently ended abruptly

4. Audio
Audio distracted from reading the material on the screen
Audio with video was better than just audio
Audio should match the print on the screen
The audio voice was annoying

5. Text
Very thorough, to the point, concise, there was an example for everything
I strongly agree that the computer was effective for learning this material, however it helps if there is a discussion so we can review the material thoroughly
Subject headings and overview made it easy to follow the text
Icons were helpful in illustrating the point

6. Video
Video explained some concepts better than the notes
Pictures and video very helpful

7. Would like to see more
Video--10 (10 students mentioned this item)
Images--4
Examples--9
Test Questions--5
Audio--2

Appendix I (continued)

Other--ability to interact with other students/teacher--2

8. Would like to see less
Test Questions--3
Audio--6
Text--7
Video--2

9. Examples
Examples helped to clarify the text
Especially the examples on research errors

10. Questions
There should be more questions to allow time to stop and think about what I have written in my notes
Helpful when we did go through them, but due to time constraints we did not always do the test questions
Very beneficial; they encouraged me to pay attention

11. Recommendations for improvements
a. A module on how to critique a research article
b. Written outline of the material (a general outline not necessarily word for word)
c. When the audio voice comes on, there should be a graphic or picture rather than text so that we can pay attention to what is being said and not try to read the screen at the same time
d. More interactive, like a game where you can touch the screen or move the mouse around
e. Need more time for each session so you can do the questions
f. Continuous soft music playing in the background
g. A midterm would have forced me to study the material during the semester instead of waiting until the final
h. More video and audio segments
i. More quiet environment with fewer distractions
j. Can this be put on videotape so we can check it out and view at home?

Appendix I (continued)

Appendix D. Journal Article

Evaluation of the Effectiveness of Computer Based Instructional (CBI) Courseware for Teaching Research Methodology to Undergraduate Students

Victoria G. Castelli, Miriam Saltmarch, and Kathryn Sucher

San Jose State University

Department of Nutrition and Food Science

Appendix I(continued)

Evaluation of the Effectiveness of Computer Based Instructional (CBI) Courseware for Teaching Research Methodology to Undergraduate Students

Abstract

The potential effectiveness of computer-based instruction (CBI) as a pedagogical tool has been suggested by numerous studies. Its benefits include logical well-sequenced instruction, a self-paced individualized approach, and the ability to provide immediate feedback to the student. This powerful technology is ideal for teaching the complicated concepts of research methodology. CBI courseware was developed at San Jose State University (SJSU) to teach a one credit, semester-long, undergraduate course in research methodology. The purpose of this study was to evaluate the effectiveness of that courseware. Subjects were nutrition and food science majors at SJSU enrolled during the spring 1994 semester. Students were assigned to a treatment or control group based on ranked random selection according to grade point average. The control group (n=14) received the course material through the traditional lecture and discussion format with the usual classroom teacher. The treatment group (n=17) received the same material via the CBI courseware. Analysis of pretest and posttest scores indicated a significant positive difference in achievement in the treatment group over the control group.

Introduction

Appendix I (continued)

It is now widely accepted that computer-based instruction (CBI) is as good as or perhaps better than traditional lecture methods for teaching many subjects (Keane, Norman and Vickers, 1991). CBI is highly visual. It can employ moving video, still images, graphics, icons and color to help stimulate interest and attention (Steinberg, 1983). Among its benefits students liked classes more with CBI, learned with less instructional time, and developed positive attitudes about computers (Kulik & Kulik, 1987). It has been claimed that students can use their time more efficiently with CBI because it allows them to concentrate on new information and disregard material they already have mastered (Schroeder & Kent, 1982). The more control students are given over moving through the computer courseware the more they learn as evidenced by higher test scores (Cohen, 1983 and Emerson, 1988). With CBI, students can review material as often as needed and perform self-tests to access their own progress. Furthermore, CBI is nonjudgmental allowing students to make mistakes in privacy and free from embarrassment (Rachal, 1993).

The time and collaboration with programmers required for the development of CBI obligates curriculum to be reviewed and revised ensuring that the lessons are more thoughtful than their traditional lecture counterparts. CBI instruction is by necessity logical, well-developed and well-sequenced instruction (Kulik & Kulik, 1987).

The study of research methodology can be daunting for many students. Its intricate definitions and esoteric concepts can cause consternation for even the best students. CBI's logical sequencing, self-pacing and patient repetition make it an ideal medium for teaching the complexities of research methodology. Nutrition research is dynamic and voluminous. Mastery of the concepts of research methodology is essential for the study of nutrition. To date, no programs exists to teach research methodology using CBI technology. A semester-long, one credit undergraduate course was developed using CBI technology to teach research methodology to nutrition majors at San Jose State

University. This study evaluates the effectiveness of CBI courseware as compared to the traditional lecture and discussion format for teaching research methodology.

Methods

Subject Selection

Subjects were undergraduate students, 32 females and 1 male, (n=33) enrolled in NUFS 195 Research Methodology a one credit course for Nutrition and Food Science majors at San Jose State University during the spring 1994 semester. Nine seniors were granted permission by the department chairperson to simultaneously enroll in NUFS 195 and another department course that met at the same time in order to meet graduation requirements. These nine double-enrolled students were automatically placed in the experimental group. All other students for the experimental group were selected using stratified random sampling and grouped according to their grade point averages. The four grade point average (GPA) groups were: those with GPA 3.5 or greater (n=6), those with GPA greater than 3.0 but less than 3.5 (n=12), those with GPA greater than 2.5 but less than 3.0 (n=9), and those with GPA less than 2.5 (n=6) (Table 1). Students selected for the experimental group who did not wish to participate were given the opportunity to stay in the lecture, control group. Only one student selected this option and was substituted with a student with a similar GPA from the control group.

After four introductory class sessions, the control group participated in the usual lecture and discussion for the course provided by the usual instructor while the experimental group received the remainder of the course material from the CBI teaching modules. A graduate student or faculty member was always present during the CBI sessions to answer questions or provide technical assistance.

Module Development

Appendix I (continued)

Intel's digital video interactive technology (DVI) was used to develop the courseware for this class. This technology allows for the integration of moving video, still images, audio, text and graphics into a compressed format. Authology was the authoring program used. CBI modules were developed directly from the lecture notes from the classroom instructor and textbook for the course. The control group and experimental group students received the same course material.

Testing Methods

The pretest was administered to all students on the first day that the class met prior to the breakout of the experimental group and before any instruction began. The posttest was administered on the last day the class met and was also given to all students. Both tests were identical and contained fifty multiple choice questions. The test was developed from the lecture notes and textbook material (Rivas, 1993). The pre/posttest was independent of the final exam and was not used to determine students' grades for the course.

The pre/posttests were reviewed for validity with the aid of a discrimination index using choice analysis. The discrimination index measures the degree of differentiation in responses between students comprising the upper and lower twenty-seventh percentiles of all test takers. A discrimination index of -0.5 to +0.5 was considered desirable. Questions with discrimination scores outside of this range were considered invalid (Rivas, 1993). Although the pre/posttest was administered with eighty questions, after choice analysis was performed, thirty questions were eliminated leaving fifty questions for statistical analysis.

An independent student t-test was performed using the Statistical Package for the Social Science (SPSS/PC, Chicago, IL.) software on the overall mean pre/posttest scores of the control and experimental groups. An analysis of GPA subgroups was not conducted due to the small sample size in each subgroup.

Appendix I (continued)

Experimental group students provided their feedback regarding the CBI courseware through a written survey and selected interviews (Appendix A). Their comments and recommendations will be used to make improvements in the courseware prior to its fielding.

Results

Scores were collected from the control and treatment groups and reviewed prior to conducting any statistical tests. It was observed that in the treatment group two cases showed extreme variability in their scores; the posttest scores were much lower than the pretest scores. Recognizing the potential effect this could possibly have on the requirements of the statistical test, it was decided to eliminate these two particular cases from inclusion in the data prior to analysis using the student t test. Explanation of these two aberrant scores would only be speculative, but might include personal problems, overall academic difficulties, or lack of seriousness in taking the posttest since it did not contribute to the final course grade.

An independent student t-test (n=31) produced a t value of 2.46 at the p=0.02 confidence level. Mean posttest scores were higher in the experimental group than the control group across all four GPA subgroups. The most dramatic result was in the group with GPA's less than 2.5 (Table 5). Here the experimental group had mean posttest scores 12.2 points above the control group mean.

Discussion

Students in the experimental group scored higher on the posttest than students in the control group. These findings are consistent with that of previous research. This trend is more pronounced perhaps because the instructor for the lecture and CBI groups

was different. Previous research indicates that when two instructors are used posttest results are more dramatic (Clark, 1985 and Kulik & Kulik, 1987).

The close grouping of posttest scores among students in the experimental group indicates that the CBI courseware had a universally positive effect on the learning of all students. Additionally, the posttest scores of the students in the experimental group are higher than those in the control group within each GPA subgroup.

While it might be expected that those students in the top GPA group would be successful regardless of instructional method used, the results of the lowest GPA group were unexpected. CBI's positive effects on learning are most powerfully illustrated in the lowest GPA group. These students scored within one point of those in the top GPA group. Without the CBI courseware, these students would have scored comparable to their counterparts in the control group. The CBI courseware enabled them to compete equally with more successful students eliminating the learning barriers which under traditional academic teaching methods negatively effect performance resulting in lower GPA's and lower self-esteem (Rockman, 1993).

Limitations of the Study

Clearly the CBI courseware produced a positive trend in posttest scores and, therefore, a positive effect on the learning of the students in this study. However, due to the small sample size, the results of this study should be interpreted with caution. They do however support previous research in suggesting that CBI is a feasible alternative to the lecture and discussion format.

The Hawthorne effect cannot be overlooked as a possible influence on the higher scores among the computer group on the posttest. The novelty of exposing students to a new learning tool may have produced sufficient enthusiasm among the computer group students to encourage them to work harder and score higher on the posttest. Close controls were in place in the CBI group to ensure attendance at all sessions. With the

exception of one student, all CBI group students attended all CBI sessions and viewed all the modules. Class attendance in the lecture group was not as strictly controlled nor monitored. Furthermore individual study time was not accounted for . These factors may have contributed to the higher posttest scores in the CBI group. The amount of time students spend with new material may contribute to mastery of the material and ultimately to learning.

Recommendations for Further Research

Additional trials are needed to verify the posttest trends seen in this experiment. More importantly, future research is needed to more specifically identify the characteristics of CBI that led to the trend seen in this study and previous studies with regard to the characteristics and instructional components that are responsible for these results (Keane, Norman and Vickers, 1991 and Gillingham & Guthrie, 1987). Identifying the specific features of CBI that promote improvements in learning would allow these features to be replicated in future CBI courseware and other instructional media. Furthermore, it would settle the debate over the value of CBI as a pedagogical method.

Students' Comments

Students in the computer group were asked to provide their comments regarding their experience in the form of a written survey that utilized a five point Likert-type scale Additionally, six students were randomly selected and interviewed. In general, students thought the text in the computer modules was thorough and concise. They liked the videotape segments and visuals including the pictures, graphics and icons. Comments concerning the audio aspects were less positive. For example some students enjoyed the background music while others were distracted by it. A few students expressed a desire for time for interaction with other students or an instructor to discuss material that was covered in the computer modules.

Appendix I (continued)

Students' recommendations for improvement reflect their support for CBI and their positive feelings towards it as an instructional tool. Students wanted more video segments, more interactivity, more self-test questions. Individual interviews conducted with selected students elicited similar comments and served to reinforce and clarify the responses given on the written surveys rather than to reveal new information.

Conclusion

The purpose of this study was to evaluate the effectiveness of CBI courseware in teaching research methodology to undergraduate students. Analysis of posttest scores indicate that CBI is an effective tool for this purpose. Furthermore, students expressed a positive attitude toward CBI. They appreciated its completeness and conciseness in covering the course material, and enjoyed its multimedia format. Following the completion of minor improvements in the program based on student's recommendations, copies of this CBI courseware should be made available to other dietetic programs around the country and should be utilized to teach this course for its next offering.

Appendix I (continued)

Tables

Table 1: Ranked Subject Selection By GPA

Group	GPA (1)	n=33 (2)	n=31
1	>3.5	6	6
2	>3.0 but <3.5	12	12
3	>2.5 but <3.0	9	8
4	<2.5	6	5

NOTE: (1) GPA is grade point average based on a 4.0 scale. (2) n is the number of cases

Table 2: Pretest/Posttest Results (n=31)

	Control Group		Experimental Group	
	Mean	SD (2)	Mean	SD
Pretest	18.0	4.1	16.9	4.8
Posttest	24.2	5.6	27.5	4.9
Difference Score (1)	6.2	3.7	10.6	5.7

NOTE (1) Difference score means for the control group and the experimental group are significant at p=0.02. (2) SD is standard deviation.

Appendix I (continued)

Table 3: Pretest Score Results by GPA (n=31)

		Control Group		Experimental Group	
Group	GPA (1)	Mean	SD (2)	Mean	SD
1	>3.5	19.7	2.5	18.0	7.8
2	3.0-3.5	18.5	4.0	18.0	3.2
3	2.5-2.0	20.0	1.0	14.6	6.1
4	<2.5	11.0	1.4	17.7	2.1

NOTE: (1) GPA is grade point average based on a 4.0 scale. (2) SD is standard deviation

Table 4: Posttest Score Results by GPA Group (n=31)

	Control Group			Experimental Group		
GPA (1)	Mean	SD (2)	n (3)	Mean	SD	n
>3.5	28.7	2.3	3	28.7	5.5	3
3.0-3.5	24.3	5.3	6	27.8	5.5	6
2.5-3.0	24.7	3.5	3	26.4	6.4	5
<2.5	16.5	7.8	2	27.7	2.1	3

NOTE: (1) GPA is grade point average based on a 4.0 scale. (2) SD is standard deviation.
(3) n is number of cases