Proposal Narrative

A. Project Overview

The scope of the project is to develop the course materials and laboratory setting for students studying principles in Human-Computer Interaction (HCI) to perform an ethnographic[1] design study using observation, interviews, and video tape analysis. The focus of the design study would be students in the university's computer skills course (Applied Computer Concepts). The computer skills course teaches a number of essential computer applications such as word processing, spreadsheets, web navigation, web page development, and windows operating systems. This course is taught as a combination of lecture and on-hands laboratory work. One section of the Applied Computer Concepts course would be divided into small laboratory groups. Each group would be assigned a student "tutor" from the HCI course. This student would observe the group as they perform their application tasks, answering questions, and, possibly, asking questions of the group members. Through observation and the interaction of answering and asking questions, the HCI student would develop a user's model of the tasks being performed, and critique how well the application's interface compliments this model. Post video analysis of the session will help confirm and strengthen their analysis.

The HCI students will learn and practice the methodology and skills of participatory design practice. These students will be expected to demonstrate the use of these techniques on an interface design project for the course, as well as in their subsequent cap stone project course. The computer skills students will have the benefit of learning in a small group setting with more individualized attention.

[1] Ethnography is a study technique in anthropology that involves the study of groups and people within the context of their everyday activities. The approach requires the researcher become a "participant-observer", systematically recording observations and experiences [Emerson, Fretz, and Shaw]. The technique has been borrowed for the design of software applications [Huges, O'Brien, Rodden, et al.]

B. Goals and Objectives

The overall goal of the project is to provide the material and environment in which computer science students have the opportunity to learn and practice participatory design methods, and to apply these methods to human-computer interaction design problems.

C. Project Description

Design is a creative activity of making artifacts that are usable for some specific task. Software design in particular strives for creating products that enrich the interaction between humans and computer applications. While the software programmer/engineer is concerned with developing reliable, robust, and maintainable software, the software designer is concerned with creating products that fits within the user's overall activities, enhances productivity, and produces a satisfying experience [Winograd, Kapor]. To accomplish this goal the software designer needs to be able to apply knowledge of human goals, capabilities, and limitations with knowledge of computer capabilities and limitations [Preece].

While it is important for a software product to provide the necessary functionality to perform its intended use, it is also important that it presents its functionality in a manner that is consistent with the user's understanding. For example, the DOS operating system provided all the necessary functionality for managing file and folders on a personal computer from a command line. But the graphical user interfaces and the desktop metaphor of Apple's Macintosh and Microsoft's Windows have transformed the personal computer operating system into a product that could be easily used by the most non-technical users because its presentation fit their conceptual understanding of managing files and folders.

The study of Human-Computer Interaction (HCI) has collected an array of anecdotal evidence (e.g., Norman 88, Sachs) and significant empirical evidence (e.g., Landauer) that reveals the ability for computer technology to deliver on its promises, improving our productivity and enhancing our quality of life, rests squarely on how well the application fits our conceptual understanding of how things work. While computer processing power and data storage has increased dramatically, we have yet to attain a proportional increase in the productivity of work and quality life. In part, this is because we have moved into an era where computers are being used not simply for number crunching activities, but more to augment a variety of tasks that humans are better suited for than machines. These are the types of tasks that cannot easily be codified in any kind of quantitative theory, tasks that include the ability to read, understand, negotiate, and administer [Landauer].

Left to their own devices, computer programmers take a "systems-centered point of view", concerned about "how the software works and what parts of it do what" [Landauer, p. 217-218]. The predominant users of the number crunching era were more technically literate, willing to put up with a high threshold of indignation (the highest level of behavioral compromise a user is willing to make to accomplish their goals) [Saffo]. The users of the new era are less so. They do not want to know how the inner mechanisms of the machine work; rather they want to know how the machine will work for them. This is exactly how we need to design such systems: the application should fit the users conception of the process, “the user-task model”, while the inner mechanisms, “the engineer model”, should be as transparent as possible [Gentner and Grudin]. Just as most automobile drivers (myself included) know very little of how a car actually works, and yet find the task of driving natural, similarly we want to design computer applications that are natural to use with little worry or concern about how they are being accomplished.

In the area of HCI research, a number of approaches have evolved to meet this challenge. These include User-Centered Design [Landauer], Human-Centered Systems [Flanagan, Huang, Jones, and Kasif], Participatory Design [Muller and Kuhn], and Contextual Design [Beyer and Holtzblatt]. Though they differ in their techniques, these approaches have a general common vision of seeing "the interplay between human activity and technological systems as inextricably linked and equally important aspects of analysis, design, and evaluation" [Flanangan, Huang, Jones, and Kasif, p. 3]. The different techniques find ways to interject the designer in the user's world and the user in the designer's world in order to develop a shared conceptual model of the task and the context in which they are being done [Muller and Kuhn].

The difference between a software designer and software engineer has been compared analogously to the difference between a building architect who designs a structure and a contractor that builds it [Winograd]. While there are HCI degree-granting programs such as Stanford's Center for HCI study, and larger companies such as IBM which have design and usability labs, it is still currently the computer science programmer doing both design and development, like an architect that both designs and constructs the building. So it is very important that we educate computer science students in the techniques of software design that embrace the human activity as an integral component of the analysis, design, and evaluation.

Early in the design process, the designer engages in analysis activities that provide an insight into the user's conceptual model or mental model of the tasks for the system that is being targeted for development [Liddle]. Mental models are cognitive artifacts that are created as we interact with our environment that we use as a dynamic representation or simulation of our world [Johnson-Laird]. These models "provide predictive and explanatory power for understanding the interaction" [Norman 83]. Norman [Norman 83] distinguishes between a *conceptual model*, which is a reasonably accurate and consistent representation of the target system, and a *mental model* which is the user's cognitive representation of the target system. If the designer can devise the conceptual model in ways that reflect a user's mental model, then the application designed from the conceptual model will be more easily understood and fit more naturally into the user's activities [Norman 88].

Passive observation of a user's activities is the least intrusive analysis method, and, therefore, is the least disruptive. Yet, this approach is limited in providing insights into the user's activities. Much of the thought process the user is going through is not verbalized. Actions or gestures may not have apparent meanings to the observer and so are left open to a biased interpretation. Some HCI methodologies have adapted ethnographic techniques from anthropology that supplement passive observation with interviewing and participation [Muller and Kuhn; Simonsen and Kensing; Rose, Shneiderman, and Plaisant; Huges, O'Brien, Rodden, et al.; Huges, King, Rodden, Anderson]. The ethnographer develops insight by putting him or herself into the situation they are trying to learn about. Data from a variety of sources, such as annotations, interviews, and video, is compiled. The ethnographer interprets this data from the context of the situation, trying to construct an understanding from the user's point of view [Simonsen and Kensing]. The variety of sources allows the researcher to validate the conclusions drawn from the mass of collected data [Rose, Shneiderman, and Plaisant].

While this approach provides a data rich environment for design, it is important that it be skillfully applied. The risk of misinterpreting observations, disrupting normal practice, and overlooking information is high [Shneiderman]. Validated ethnographic methods have established guidelines for performing the user study, analyzing the data, and reporting the results [Rose, Shneiderman, and Plaisant]. Like other notable areas of computer science, these are skills that must be experienced and practiced to fully learn their potential as well as their theoretical underpinnings [Roberge, Surviano, Clarke, Fekete, and Greening]. This is one of the main goals of this project, to provide the curriculum for an experiential learning environment for this important aspect of HCI in designing useful and usable applications.

The "Human-Computer Interaction" course (CS 321) presents material on human aspects of design, on technological aspects of design, and design methodologies. The laboratory component is intended to study design in practice. Exercises include critiquing existing packages as well as constructing interface elements. This project proposes to develop the curriculum for the HCI students to learn and practice ethnographic analysis methods essential to creating a user's conceptual model for design. The proposed approach would combine the HCI laboratory experience with the laboratory experience of the "Applied Computer Concepts" course. “Applied Computer Concepts” (CS 108) is a course taken by non-computer science majors to teach introductory computer concepts and computer skills. The laboratory component of CS 108 teaches and practices skills of computer operating systems, word processing, spreadsheets, and the Internet. The course assumes no prior computer experience, and is taken by a wide variety of students.

The HCI students would "supervise and tutor", under the guidance of an instructor, one of the laboratory skill modules to a small group of CS 108 students. The HCI student would be available to answer questions, and have the opportunity to ask clarifying questions. Through the interaction of observing and interviewing the CS 108 students while they work, the HCI student can begin to develop an understanding of the naïve user’s conceptual model and determine how well the software design fits that model. Subsequent video review will provide important additional data that was missed during the observation session. It also aids the HCI student in recognizing activities common to the individual computer users that indicate some aspect of the conceptual model that can be generalized across the population of users they are studying. This arrangement mirrors the way many industry software developers evaluate their products.

Lecture and exercise materials in the HCI course would provide the necessary guidelines for conducting the user study. Beside lectures, the students would be provided examples of user studies that would be conducted prior to the semester, which would include annotated observation, interviews, and videotape. Both gathered data and post analysis would be presented. This would ground the more abstract lecture material into actual experiences so that the students will be prepared to conduct their own study.

It would be difficult or impossible to do this type of course if we were to rely on finding 40 or 50 volunteers from industry to participate as subjects in the HCI student's study. But the Applied Computer Concepts course, CS 108, provides a natural pool of users. The students from CS 108 also benefit. Sections of CS 108 normally have 30 students each. CS 108 students participating in this project will have the benefit of working in a small group setting. This will allow for more individualized attention, increased one-to-one interactions, and an atmosphere more conducive to asking questions.

The small groups would be arranged by adding additional "special sections" of CS 108 with strict enrollment caps of 12 students each. Each section would be divided into three groups of 4. Four sections of CS 108 would accommodate 48 students. Each group would be taught 3 skill modules: word processing, spread sheets, and the Internet. This would accommodate an HCI class size of up to 36, providing each student an opportunity to teach one module (4 sections * 3 groups * 3 modules = 36).

	Monday	Tuesday	Wednesday	Thursday
11:30am – 12:45pm	HCI Lab Section 1	HCI Lab Section 3	HCI Lab Section 1	HCI Lab Section 3
1:00pm – 2:15pm	CS 108-1	CS 108-3	CS 108-1	CS 108-3
2:30pm – 3:45pm	HCI Lab Section 2	HCI Lab Section 4	HCI Lab Section 2	HCI Lab Section 4
3:45pm – 5:00pm	CS 108-2	CS 108-4	CS 108-2	CS 108-4

Figure 1: Example Lab Schedule

An example lab schedule is shown in Figure 1. Each HCI student would be required to enroll in a lab section that mirrors the times of the CS 108 labs. The first part of the lab, labeled "HCI Lab", the HCI students would be involved in small design tasks or work on the larger design project of the course. The second part of the lab, labeled "CS 108", the HCI students would be involved in the ethnographic design exercises. During any week, 12 HCI students would be engaged in the teaching lab, the other 24 students would be involved with the other lab experiences of the class. Each module would be taught in a 4-week segment, with three hours of lab per week. For each HCI student, this would constitute a 12-hour commitment to this exercise, which is only one-third of his or her lab time for the semester. During the morning and evening hours the lab would be made available for students to work on out-of-class assignments.

The CS 108 ethnographic study is only one component of the HCI course. The course includes material relating to other topics such as cognitive framework for design, user modeling, and prototyping (See Figure 2). During the second half of the course, students will be given a larger design problem to put to use the techniques they have learned. The HCI students will be grouped into pairs and given one of two different design problems. A group with one design problem will serve as the users for a group with the other design problem. The students will perform a design analysis with their "users", create a prototype, and perform a user testing to determine how well their design meet the users needs. This project will in part serve as a basis for the evaluation of the ethnographic lab exercises. The use of the participatory design methods in the senior capstone projects will also serve as a basis for the evaluation of the HCI curriculum.

Week	Lecture Topic	Readings
1	Introduction - What is design?	▪ Preface & Chapter 1 of Contextual Design ▪ Kapor, "A software design manifesto"* ▪ Gentner & Grudin, "Design models for computer human interfaces"
2 & 3	Principles of Contextual Design - Understanding the Customer. How to conduct an ethnography study for design.	▪ Chapters 2 - 4 of Contextual Design ▪ Liddle, "Design of the conceptual model"*
4 & 5	User modeling - interpreting ethnographic data , mental models, cognitive framework for design.	▪ Chapters 5 - 7 of Contextual Design ▪ Preece, Human Computer Interaction, Chapters 3 -7
6	Design specifications across multiple customers	▪ Chapters 8 - 10 of Contextual Design ▪ Rheinfrank & Evenson, "Design languages"*
7 & 8	Designing from customer data - innovative design	▪ Chapters 11 - 13 of Contextual Design ▪ Brown & Duguid - "Keeping it simple"* ▪ Gal, "Footholds for design"* ▪ Hammer, "Reengineering work"
9 & 10	Systems design	▪ Chapters 14 - 16 of Contextual Design ▪ Norman, "Design as practiced"* ▪ Schon & Bennett, "Reflective conversation with materials"*
11 & 12	Prototyping - envisioning design Design Evaluation	▪ Chapters 17 - 19 of Contextual Design ▪ Schrage, "Cultures of prototyping"* ▪ Preece, Human-Computer Interaction, Chapter 22, 29-34
13	Design elements - interactive devices, multiple-window strategies, displaying functionality	▪ Shneiderman, Designing the User Interface, Chapters 9, 11, & 13
14	Advanced topics in HCI - intelligent user interfaces Designing interfaces for hearing & seeing impaired	To be announced
15	Social impact of designing user interfaces	Chapter 20 of Contextual Design Shneiderman, Designing the User Interface, Afterword
Required text books: Beyer & Holtzblatt, <u>Contextual Design: Defining Customer-centered Systems</u> Winograd, <u>Bringing Design to Software</u> (* readings in this text)		

Figure 2: A sample schedule of HCI course material

The instructors who normally teach the CS 108 courses will deliver the lecture component of the course. In addition, the lab sections will be monitored jointly by these instructors and the instructor of the HCI course. This will help to insure that the CS 108 students will still receive same quality of instructions as other course sections. While the same material will be covered because it will be delivered in a different manner, the CS 108 students will be asked to sign an informed consent. Further, the difference of these sections will be advertised during the period of registration and the CS 108 students will be given an opportunity to transfer to one of the uninvolved sections. Videotaped sessions will only be used beyond the HCI course with additional consent given by the individuals portrayed. The Institutional Review Board has approved this plan for projects that involve human subjects.

Semester Sessions, 2000-2001			
Summer	Fall	Spring	Summer
Develop HCI lecture & exercise materials, set-up lab equipment, create example design study, develop CS 108 lab modules, and develop project evaluation materials.	Hire and train TA's, implement the HCI course with the new design lecture materials and lab exercises, gather data for evaluation.	Repeat the HCI course with the new design lecture materials and lab exercises, and gather data for evaluation.	Perform the analysis of the data and prepare publications and materials to disseminate results.

Figure 3: Time Line

Figure 3 provides a general time line for the project. Preparation for the work will begin during the summer session. The lab will be set-up and evaluated with the help of Matt Johnson from Edward Jones. Mr. Johnson is a team leader for the Computer Usability Lab at Edward Jones in St. Louis, and participates in their computer application usability studies. The School of Engineering at SIUE has agreed to provide a room to house the lab. The room will be partitioned into 4 areas. Three of these areas will house the four computers that the CS 108 users will be performing their tasks. These will be the videotaped areas. The fourth area will contain the video monitoring equipment that will allow for observation of the HCI and CS 108 students by instructors in the event that any guidance is necessary but without being a constant intrusion. This area will also house the HCI development computers that students will use to create interfaces for their course projects.

In addition to helping develop the course materials, Dr. Mary Stephen, co-investigator will also lend her expertise to deliver the material during the course. This approach will provide the HCI students with the benefits of Dr. Stephen's expertise in user ethnographic studies. This will also help to instruct current SIUE computer science faculty in the best way to teach the material. To overcome the cross institutional difficulties of funding release time, the budget includes consultation fees for Dr. Stephen's time to perform these duties.

With the successful completion of this project, it is our expectation that our approach and material would be used as a model for the delivery of these important design concepts of HCI. A tutorial video will be developed as part of the project that will be made available upon request to other educational institutions.

The tutorial would focus on:

- The adoption of our course materials or the development of similar course materials
- The incorporation of the lab experience within an HCI course and the entire computer science curricula.
- Structuring of the lab experience.
- How to conduct valid ethnographic studies.
- How to set-up a lab.

Future effort would include the development of a workshop that could be presented at the national ACM SIGCHI conference (Special Interest Group on Computer Human-Interaction) and the national ACM SIGCSE conference (Special Interest Group on Computer Science Education).

D. Experience of Capability of the Principal Investigators

Mary L. Stephen completed coursework in qualitative research and advanced qualitative research as part of her Ph.D. work at St. Louis University. She has completed two substantial qualitative research studies in recent years. One study investigated the effect on pre-service teachers' computer anxiety when they learned software programs with first grade students. The study has been published in the Journal of Technology and Teacher Education. She presented results from this study at the national conference of the Association of Teacher Educators. Her dissertation research involved the use of qualitative research methodology to study the effect of teachers' and students' perceptions of computers in a computer-supporter classroom. This research included a study of students' understanding of software. Some of the results have been presented at the International Conference of the Society for Information Technology in Education and published in the Technology and Teacher Education Annual 1998. The research has been presented at additional conferences, including the Second International Conference on Computer Support for Collaborative Learning. She recently participated in an exploratory study of factors affecting students' success in beginning computer-programming courses at Southern Illinois University at Edwardsville. In her position at Harris-Stowe State College she uses techniques, similar to those to be used in this study, in courses and workshops designed to prepare in-service and pre-service teachers to use technology effectively in their teaching.

Jerry Weinberg received his doctoral degree in Computer Science from Vanderbilt University in December of 1996, holds a Bachelors of Science degree in Computer Science from the University of South Carolina, and holds a Bachelors of Science degree in Nursing from Indiana State University. His doctoral dissertation used machine learning methods from Artificial Intelligence (AI) to extend abductive logical reasoning of medical diagnosis ("Syndromic Abstraction: A method of exploiting domain structure to focus abductive reasoning in association based representations "). This work also explored how the resulting process fit within a cognitive model of diagnosis and diagnostic knowledge. The results of this work have been reported at DX '95, an international workshop on computer diagnosis. While at Vanderbilt University, Dr. Weinberg completed course work in cognitive science and cognitive modeling. In addition to his research in AI and medical diagnosis, he has also done work in model-based reasoning, qualitative modeling, and database mining. This work has been presented at various international and national workshops and conferences. As an assistant professor at Southern Illinois University, he worked with Dr. G. Stephen to develop the curriculum for the System Design and Human-Computer Interaction Courses. Dr. Weinberg has taught these courses over the past 6 semesters. Dr. Weinberg is also currently teaching the Senior Capstone Project. These are all project courses with a significant software design component.

E. Evaluation

The project will be evaluated for its effectiveness for both the HCI students (CS 321) and the Applied Computer Concept course (CS 108). For the students in the Applied Computer Concepts course, a quantitative study will examine the effects of the small group experience afforded by the learning environment. This experience creates an environment that increases exposure to a tutor, allows for more individualization of guidance, and produces an environment that reduces apprehension to asking questions. The study will use a combination of Likert-style surveys and comparisons of exam scores. Some of the hypotheses that will be tested are:

1. Applied Computer Concepts students participating will have an overall greater course satisfaction than students in larger course sections.

2. Applied Computer Concepts students participating will by the end of the course have reduced computer anxiety and greater confidence in their computer skills.

3. Applied Computer Concepts students participating will perform higher on standardized computer skill exams.

The project evaluation with regards to the HCI students will answer two general questions:

1. How well does the course material and lab experiences translate to an understanding of design principles and practices.

2. How well does the HCI students' understanding of design principles and practices translate to their actual design practices.

Qualitative techniques will be used to assess these aspects of the project. The standard criteria for judging the integrity of a quantitative research study are inconsistent with the qualitative paradigm (Lincoln & Guba, 1985; Guba, 1981). Lincoln and Guba demonstrate that internal validity, external validity, reliability, and objectivity all fail when applied to naturalistic inquiries. Instead, they suggest that the following four constructs are more consistent with the qualitative paradigm and should be used to determine the "trustworthiness" of a qualitative study: credibility, transferability, dependability, and confirmability. Lincoln and Guba identify strategies for dealing with the each of the criteria they list. This study will use the following strategies suggested by Lincoln and Guba in order to establish the trustworthiness of the research: (a) triangulation, (b) participant checks, and (c) audit trail.

Triangulation: "Triangulation is the act of bringing more than one source of data to bear on a single point" (Marshall & Rossman, 1989, p. 146). This involves cross-checking interpretations and verifying data obtained from multiple, independent approaches and sources (Stake, 1988). The data sources for the assessment of this project will be journals kept by the HCI students, videotapes of the sessions, and interviews with selected HCI and Applied Computer Concept students at the end of each semester. Dr. Stephen will cross-check the data and interpretations by pitting data obtained from one source against that obtained from another source to confirm information and explore inconsistencies (Guba, 1981). She will look for themes that emerge in multiple contexts.

Participant checks: Dr. Stephen will seek the participant's insights and comments on the potential significance and role of themes and preliminary interpretations that emerge as she gathers the data. She will do this through conversational interviews. At the conclusion of the formal data analysis, she will discuss with selected participants her analysis of the data gathered.

Audit trail: Schofield (1989) warns that any researcher should question the truthfulness of a study "if other researchers reading their field notes feel the evidence does not support the way in which they have depicted the situation" (p. 93). Throughout the study, Dr. Stephen will create an audit trail to enable other researchers to examine how she collected data, analyzed data, and formed interpretations. She will keep a journal in which she will document these processes. All original data, including videotapes, audiotapes, transcripts of interviews, field notes and questionnaires will be kept in an organized and retrievable form.

This part of the study will focus on three particular periods of performance. First, the student's performance of the actual lab exercise will be evaluated. Second, student's performance on a course design project will be evaluated. The HCI students will be grouped into pairs and given one of two different design problems. A group with one design problem will serve as the users for a group with the other design problem. The students will perform a design analysis with their "users", create a prototype, and perform a user testing to determine how well their design meet the users needs. Finally, the Computer Science curriculum requires each student participate in a senior capstone project. The capstone project is a two-course sequence where students are put into a small group of 4 to 6 and are given an large software development project. The projects are solicited from the university and surrounding communities (examples of projects can be found at www.cs.siue.edu/SeniorProjects). These projects have "real" users. The students participating in this project will be followed for an extended study that will evaluate how this earlier course affected their practices.

F. Dissemination of Results

The results of the evaluation would be of interest to the computer science education community, the community of researchers in HCI, and to education psychologists. During the project a World Wide Web site will be used to promote the project and provide a clearing house of course material and results. The Web site will include the course syllabus, course materials, results of students assignments and exercises, digital capture of lab sessions along with user models developed by the students, and an archive of student's course projects. Details of the lab set-up and curriculum design will also be accessible as a guide for other institutions that are interested in doing a similar program. In addition, a tutorial videotape will be developed that tours the lab, shows it in use, and discusses how the lab experience fits into entire HCI curriculum. The copies of the videotape will be made available free of charge to educational institutions. Research notes announcing the Web site and videotape will be sent to SIGCSE and SIGCHI Bulletins (the major publications for these organizations). Comments from these communities will also be solicited via an email account, which will be accessible from the Web site. The Computer Science Department maintains it's own Web Server, so it will be easy to keep the Web site up-to-date. The initial site will be developed by one of the supported Teaching Assistants.

The development, implementation, and results of the HCI curriculum will be of interest to computer science educators. The results of the study of the learning environment will be of interest to educators of computer science educators, educators of higher learning, and educational psychologists. Publications will be prepared for journals and conferences in these areas such as SIGCSE, SIGCHI, and the Journal of Cognitive Psychology.

As discussed in the Project Description, additional funding would be sought to implement the program on a wider forum. This effort would include the development of a workshop that could be presented at the national SIGCHI conference and the national SIGCSE.

G. Equipment Request

The list of equipment request is shown in Figure 4. The proposed plan calls for a room to be divided up into four smaller lab areas (see Figure 5 for furniture budget). Three of the areas will be set-up with 4 computers each for the user observation studies. The videotape cameras will be situated to capture the four user's actions. Having three separate areas will allow for 3 sessions to be run simultaneously. This will allow for efficient monitoring of sessions by instructors and graduate TA's, and will allow the project to explore the potential for scaling-up to larger HCI classes. An earlier plan called for two areas of 6 computers. But it would be difficult for HCI students to observe 6 users in addition to answering the potential questions from the 2 additional users.

Videotaping is an important component for the analysis technique. To piece together a user's conceptual model, the designer must recognize common sets of activities that indicate a general thought process of the user in respect to the task and computer application's functionality for completing the task. Direct observation and interaction is one component for gathering information, but it is impossible to be able to make a complete set of detailed notes without missing much of the activity occurring. A systematic videotape analysis of the sessions is the best approach to recognizing these generalities, which are part of developing a conceptual model. The cameras chosen are part of Panasonic's industrial line of video equipment. They are built with sturdier parts and casing to handle the extra wear-and-tear of heavy use. They also allow taping with ambient light. This is important because additional bright lights would introduce a distraction in the user's environment. An earlier plan considered having one of these cameras be digital to allow transfer of video to the computer. This would serve two purposes. The first is to be able to include clips of sessions in tutorial material that would be developed for the World Wide Web and presentation material for conference presentations. The second use of digital video capture is for HCI students developing interfaces that may include video clips. The digital camera technology is still quite expensive and only having one of three of the cameras seemed to be limiting. Therefore, a good alternative is to have video capture equipment that would allow for the digitization and editing of videotape.

The project plan includes monitoring equipment to be connected to the video cameras. The monitoring equipment will allow instructors to view each session effectively without introducing any undue disturbance into the user's environment. The instructor can interject advice or guidance for the HCI student during the session if it is warranted. The fourth sub-area of the lab will house the videotaping monitors. In addition, this area will also house two additional computers that will be set-up for interface and application development. HCI students will be required to apply the techniques they have learned in the design study to a course design project. These development machines will be equipped to allow the students to explore as wide a range of interface design as possible. This may include the use of graphics, audio, and video as elements of the interface and interaction design. Video capture equipment, as mentioned above, would allow the digitization of video, scanning equipment would allow students to capture graphics or forms, and audio equipment (microphones, sound cards, and speakers) will allow students to capture audio clips. These additional two machines will have more storage and working memory to support the applications to render and edit graphics relatively efficiently.

Equipment Item	Cost
Computer Equipment	
12 lab computers: 450 MHz processor, 128MB ram, audio card with speakers, Ethernet card, 17" color monitors	$2400 each
2 development computers: 450 MHz processor, 256MB ram, audio card with speakers, Ethernet card, 17" color monitors, IOMEGA Zip Drive, microphone	$2800 each
Flatbed Scanner: HP ScanJet 5100Cse	$300
Adaptec VideOH!, video capture and editing system	$285
Video Equipment	
3 camcorders: Panasonic AG-188U	$699 each
3 option batteries for camcorders: Panasonic TP-2012D	$49 each
3 video tape monitors: JVC AV20920 20" color video monitors	$275 each
3 interface cables: Hosa VRA-304	$10 each
3 tripods: Bogen 3165	$149 each

3 external camcorder microphones: Crown Sound Grabber	$59 each
3 Equipment carts: Advance AV2-42E	$115 each
Installation of video equipment: The AVID Group, Inc.	$1,200
Supply of video tapes, $300 (to paid for by CS Dept.)	$300

Figure 4: Equipment Requests

H. Equipment on Hand for the Project

The University's Audio-Visual Services has several videotape players and monitors available which will be used for HCI students to view and analyze their design study session. There are 25 players available. Some of these will be reserved for the course. The number and amount of time necessary will be determined as the need dictates. In addition to observation and videotaping, the design study may call for user interviews. Audio-Visual Services has 15 cassette recorders available for students to check out to support this. The University also has professional videotape editing equipment available to faculty only. This equipment can be used to develop tutorial material for the course and materials for workshops and conferences presentations.

I. Implementation and Equipment Maintenance

The School of Engineering has agreed to designate a room for the lab, and to purchase the necessary furniture to support the equipment (See Figure 4). The University has received funds to construct a new building to house all of the departments of the School of Engineering. The Building is scheduled to be ready for occupancy in the summer semester of 2000. At that time, funds designated for the permanent installation of equipment will be used to set-up the lab. The Computer Science Department shares a computer support person who will oversee the installation and maintenance of all computer equipment. In addition, the Department has put-in a request to the State of Illinois for a full time computer support person to oversee all Department labs and the Computer Science sub-network. Both the School of Engineering and the University have supported this request.

In addition to the 1:1 cost sharing of the computer and video equipment, the School of Engineering has also agreed to cost share release time during the academic year for Dr. Weinberg. The request for release time is for one unit load for fall and spring semesters. The School of Engineering will fund one-half of that. The School has also agreed to continue funding the Teaching Assistant support normally allotted for the CS 108 course. This is important both for the initial implementation of the curriculum and its continuation beyond the lifetime of the project funding.

Funds are available from a combination of sources to support the continuation of the curriculum after the initial funding of the project. The Computer Science Department receives an annual equipment budget, part of that is set aside for software upgrades, hardware upgrades, and hardware replacement. In addition, students registering for computer lab courses are charged a nominal semester fee. This money is expressly earmarked for the maintenance and upgrade of student labs. The combination of these sources of funding allows the Department to keep software up-to-date, and to replace computers so that no machine is older than 3 or 4 years.

Furniture Item (To be purchased by the School of Engineering)	**Cost**
14 computer desks: 30 X 48 computer desk with wire management	$315 each
14 chairs	$88 each
8 room partitions: 60 X 66 room dividers	$420 each
4 Partition wall starters	$35 each
Installation	$600

Figure 5: Furniture Budget