A Case Study Using Scenario-Based Design Tools and Techniques in the Formative
Evaluation Stage of Instructional Design:
Prototype Evaluation and Redesign of a Web-Enhanced Course Interface

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S H E R R I   G U I L L I A M S   T U R N E R

A B S T R A C T

A Case Study Using Scenario-based Design Tools and Techniques in the
Formative Evaluation Stage of Instructional Design: Prototype Evaluation and
Redesign of a Web-Enhanced Course Interface. The main purpose of this study
was to augment the formative evaluation process of instructional design through
the incorporation of scenario-based design tools and strategies that focus on
interface design. The test population was students from undergraduate "human
development" courses at Virginia Tech, approximately 250 students. One prototype
of a course web interface was tested and revised based on data collected during the
formative evaluation process. The scenario data provided rationale for redesign
considerations.

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To these important people in my life, I dedicate my future success.

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INTRODUCTION

Since the early eighties, four areas of software design research have emerged from the literature: User-centered, scenario-based, participatory, and usability. The user-centered approach places the design focus on the end user rather than on the technological aspects of system artifacts (Norman & Draper, 1986); scenario-based design provides initial user requirements for system design, as well as the system development lifecycle (Holbrook, 1990; Carroll and Rosson, 1991); participatory design includes users throughout many aspects of the design process (Kyng, 1991, Kyng, 1995; Muller, M.J., Tudor, L.G., Wildman, D.M., White, E.A., Root, R.A., Dayton, T., Carr, R., Diekmann, B., and Dystra-Erickson, E., 1995); and, the empirical usability design utilizes an evaluation technique, which is said to be the most effective testing method. However, it is expensive because it requires working prototypes.

Without user participation, designers often only speculate about the system's interface design. Ultimately, scenario-based design includes user participation in the design process (Nielsen, 1993) and is believed to increase interface success through valuable user insight. Based on these positive advantages of scenario-based design, this study will consist of scenarios that will form the foundation for the design rationale and redesign of a system's interface.

PURPOSE

The main purpose of this study is to augment the formative evaluation process of instructional design through the incorporation of scenario-based design tools and strategies that focus on interface design (See Figure 1). This process will be another tool for instructional designers to incorporate into existing design models. By adding scenario-based design tools to existing design models, it is believed that a significantly better product will be produced.
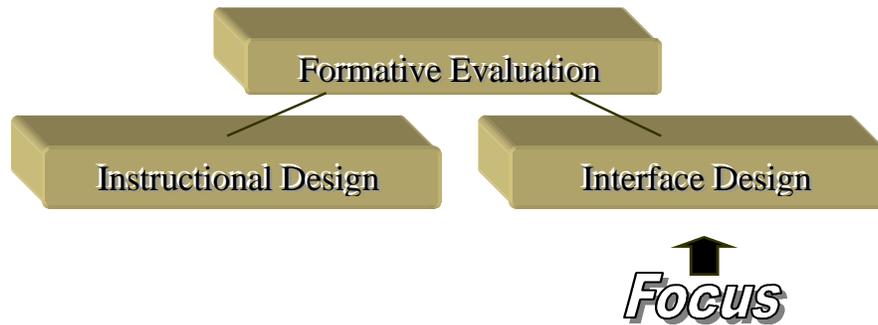
Figure 1. **Augment Formative Evaluation.**

Redesign rationale will be supported by data collected from performance tasks, from usability testing, and from end users' scenarios of use. Participants in this study will be students who are enrolled in human development courses at Virginia Tech. The Web site will be an out of class resource requirement for all students enrolled in the course. Students will need to perform the following tasks on the web site to be successful in the course: take practice quizzes, take graded quizzes, download study guides for lectures, obtain laboratory assignments, plan self-regulation strategies, make on-line journal entries, review information, participate in threaded discussions, view on-line lectures, and obtain reading assignments. These students will be held accountable for all materials and information archived at the site. Since student success in this course is based on a pass or failing grade, a user-friendly interface design is imperative.

By incorporating usability testing and scenario generation techniques into the formative evaluation process, serious interface problems that surface can be remedied prior to system implementation. The usability testing will identify the site's strengths and weaknesses in the following areas: Interface design, navigation, successful completion of tasks, common errors, and user evaluation on usability and aesthetics of the site. Student tasks should be enhanced through clear, routine navigation and easy resource retrieval. Preliminary findings of the usability

testing and the scenario evaluations will reveal strengths and weaknesses in the interface design and direct the redesign rationale considerations.

Table 1 represents examples of potential interfaces. The interface is an obstacle that can either assist or hinder user ability to perform desired actions and goals. The person needs to accomplish a goal. To accomplish this goal, the person must perform an action. The point to make here is that the interface may or may not hinder the accomplishment of the goal.

Table 1

Interface Challenges

User	Interface	Action	What
Person	Telephone	Transfer	Call
Person	VCR	Record	Movie
Person	Web Site	Obtain	Content

This study researches scenario-based design tools that ground redesign rationale. The following is an overview of the scenario analysis process performed in this study. The process of this study is modeled from the Erskine, Carter-Todd, and Burton (1997) evaluation process.

PROCESS OVERVIEW

The redesign rationale is the result of the following steps.

1. Selecting participants (See page 37 for details).

2. Elicitation of scenarios from the end users (See page 39 & 46 for details).

3. Re-tooling user-participant scenarios (See page 53 for details).

4. Developing claims analysis of the original and retooled scenarios (See page 62 for details).

5. Generating redesign rationale and justification (See page 64 for details).

6. Redesigning the web site using grounded redesign rationale.

IMPORTANCE OF NAVIGATION

World wide web technologies provide tools for the communication of information. Navigation design is imperative to the usability of any system. One important aspect of navigation is that it simplifies the site by making everything fit into as few pages of content as possible and still provide a simple scheme. Content, clarity and presentation are extremely important, when rethinking the organizational structures of the web site, since all of these hinge on navigation.

The following is a metaphor for navigation. Imagine you are going to use an elevator. How do you get on the elevator? How do you get off of the elevator? How do you know when you have left the building? How do you get back in the building? How do you know where you are? What floor are you on? Where do you want to go? Once you're there, how do you get back? These are physical examples of a navigational problem.

Clearly structured sites guide the user from page to page through the use of simple, consistent, clear navigation tools. This seems obvious, but the World Wide Web is littered with sites that contain poor navigation tools. How many sites change the look and feel of navigation throughout the site? The users are never sure whether or not they are in another site, or worse, lost within a site. The navigation bar should appear as a friendly helper to the users. It should always be the same- simple, functional, and most of all, consistent with no surprises.

Designers should only add hyperlinks when they make sense. Too often, they are over-used. In addition, the user should not have to use the back button in the browser. Instead provide navigation for the user to go back or go to another location within the site. The users should always know where they are. Thus, it is a good idea to run the risk of over explaining and make navigation painfully simple.

One other point needs to be made about the use of graphics. Web pages are a direct descendent of print media. Web pages need to facilitate the needs of the user in a logical, efficient order (Carroll & Rosson 1992). Although, the Internet is closer to print than broadcasting, there is nothing more frustrating than meaningless or overused graphics. For example, a video clip will overpower all interest so static text doesn't have a chance to compete. Therefore, graphics should be simple and use animation and video only when a point will be enhanced.

PROBLEM STATEMENT

How can the focus on interface design using scenario-based design techniques augment the formative evaluation process?

BACKGROUND RATIONALE

FORMATIVE EVALUATION

The following information defines the formative evaluation process from the perspective of instructional design and usability specialists. Formative evaluation in general is a process of testing designs prior to implementation. Preece (1993) states that formative evaluation takes place prior to implementation to influence the product that will be developed and that summative evaluation takes place after implementation with the aim of testing the proper functioning of the final system. The evaluation process in design is usually conducted to determine the effectiveness or potential effectiveness of an interface (Preece, 1993), to test the effectiveness of a system as a whole (Dick & Carey, 1996; Gagne, Briggs, & Wager, 1992; Leshin, Pollock, & Reigeluth, 1992; and, Preece, 1993), and to provide a means for suggesting improvements as a whole (Dick & Carey, 1996; Gagne, Briggs, & Wager, 1992; Leshin, Pollock, & Reigeluth, 1992; and, Preece, 1993).

From the Perspective of Usability Specialists

Usability specialists state that evaluation is concerned with gathering information about the usability or potential usability of a system in order to improve features within an interface and its supporting material or to assess a completed interface. Without usability studies, the system would reflect the intentions of its designers, but not the relationship between design and use (Preece, 1993).

In the system development cycle, evaluation is a procedure for collecting relevant data concerning the operation of the user-interface and users' attitudes toward the interface. It is common for interface designers to use scenario-based

design tools to collect their data. Preece (1993) organizes evaluation into five categories: analytic evaluation, expert evaluation, observational evaluation, survey evaluation, and experimental evaluations. The following items summarize the differences between Preece's (1993) five evaluation methods.

Analytic evaluation uses formal interface descriptions to predict user performance. Analytic evaluations do not require prototypes, therefore saving time and money. Analytic evaluation is generally used to test the interface development specifications producing quantitative data and information. This method does not require user involvement but does have all tasks specified.

Expert evaluation involves experts in assessing an interface. Expert evaluators identify large ranges of problems in a short period of time. Expert evaluation is used to test interface development specifications or the interface prototype producing qualitative data and information. Role playing without task restrictions is used. However, expert evaluators still cannot replace the role of the real users.

Observational evaluation involves observing or monitoring users' actions while they are using an interface. Video recording, direct observation, software logging and verbal protocols are some of the common observational methods employed in system development. Observational methods can produce both quantitative and qualitative data from real users. Testing is performed using simulations or working prototypes.

Survey evaluation seeks to elicit users' subjective opinions of an interface through interviews or questionnaires. Questionnaires can be designed in several formats: check list scale, multipoint scale, Likert scale, or semantic differential scale. Survey methods can produce both quantitative and qualitative data from real users. Testing is performed via simulations or working prototypes.

Experimental evaluation uses scientific experimental practice to test hypotheses about the use of an interface. Experimental methods can produce both quantitative and qualitative data by way of real users. Testing is performed using full, working prototypes.

From the Perspective of Instructional Design Specialists

Instructional design specialists state that evaluation is a procedure that provides data for revising and improving instructional materials. The focus is usually on learning. The purpose of formative evaluation is to make the materials as effective as possible for the largest number of people (Gagne, Briggs, & Wager, 1992). Formative evaluation is sometimes overlooked or not performed for a variety of reasons, usually, due to the significant amount of time and effort involved in the evaluation process (Gagne, Briggs, & Wager, 1992). It is also evident that instructional design specialists often neglect interface specifics.

Dick and Carey (1996) organize formative evaluation into three categories: one-on-one, small group, and field trial. Leshin et al. (1992) also organize formative evaluation into three categories: expert review, one-on-one, and pilot (small group). The formative evaluation steps of Leshin et al. differ from the Dick and Carey model by including expert review and omitting the field trial.

The following items summarize formative evaluation steps by combining steps from Dick and Carey, (1996), Gagne, Briggs, and Wager, (1992), Leshin, Pollock, and Reigeluth, (1992), and, Preece (1993).

Expert review (Gagne, Briggs, & Wager, 1992; Leshin, Pollock, & Reigeluth, 1992; Preece, 1993) is used to verify technological and content accuracy quickly and efficiently by using content and system experts. Expert review is implemented prior to one on one evaluation.

One-on-one evaluation targets large gross errors and provides designers with data and information for redesign considerations of specific, course materials. One-on-one evaluation is performed with one evaluator and one learner with characteristics of the target audience. Data is collected through interviews or learner "talk throughs." One to three participants representative of the target audience should be selected. Gagne et. al. (1992) state that material effectiveness might be improved by 50 percent through the use of a few one-on-one interviews.

Small group evaluation is used to evaluate the self-sufficient attributes of instructional materials. Gagne et. al. (1992) state that the small group step of the

formative evaluation process helps designers predict the overall effectiveness of the lesson by tracking how the learner uses the materials and how much they need help. Six to twenty participants representative of the target audience should be selected (Gagne, Briggs, & Wager, 1992; Dick & Carey, 1996).

Field trial is used to test the instructional materials with the entire class or group representative of the target population. The field trial is performed after revisions from the expert review, one-on-one, and small group evaluations have been implemented into the design.

Table 2 combines the formative evaluation processes of instructional designers and usability specialists as described above.

Table 2

Formative Evaluation Processes From the Perspective of Instructional Design and Usability Specialists

Category	Purpose of Evaluation	Range of Expert Participants	Range of Participants Numbers	Methods
♦ Expert review	♦ Technical accuracy ♦ Content accuracy ♦ Short period of time ♦ Test interface specifications or interface prototype ♦ Role playing	♦ 1 Expert	♦ 1 Expert	♦ Produces qualitative data and information
♦ One on one	♦ Gross errors ♦ Working prototype ♦ Simulation	♦ 3-Leshin ♦ 1-3-Gagne ♦ 3-Dick and Carey	♦ 1-3	♦ Video recording ♦ Direct observation
♦ Small group	♦ Self-sufficient attributes of instructional materials ♦ Overall effectiveness of the lesson ♦ How much help is needed from the instructor?	♦ 8-20-Leshin ♦ 6-8-Gagne ♦ 8-20-Dick and Carey	♦ 6-20	♦ Software logging ♦ Verbal protocols ♦ Surveys ♦ Questionnaires ♦ User scenarios
♦ Field trial	♦ Test entire class, group or representative population sample	♦ 0-Leshin ♦ Whole Class-Gagne ♦ Sample (30)-Dick	♦ 8-30	

Formative evaluation provides designers with data to support decisions. The revisions made during the development process make the instructional materials and the interface more efficient and effective (Dick & Carey, 1996; Preece, 1996).

As stated previously, this study will focus only on the formative evaluation of the interface. It is treating the learning and instructional design evaluation as a separate entity. The above table (2) illustrates the formative evaluation processes of the instructional design and human computer interaction fields.

NEED FOR SCENARIOS IN THE DESIGN PROCESS

If computer systems are to improve and make end users' tasks easier, system designers and instructional designers should address processes that will encompass and meet the needs of the average user. Designers should also try to account for the average users' behavior patterns and attempt to incorporate these patterns into the design of user-friendly systems. The focus of this project will be to ensure the usability of an interface, not the unwarranted success of system navigation and understanding as in older computer systems. User-centered design places the design focus on the end user rather than on the technological aspects of system artifacts (Norman & Draper, 1986). Recently, participatory design has included users throughout many aspects of the design process (Kyng, 1991, Kyng, 1995; Muller, M.J., Tudor, L.G., Wildman, D.M., White, E.A., Root, R.A., Dayton, T., Carr, R., Diekmann, B., & Dystra-Erickson, E., 1995). Though scenario-based design is a non-traditional design approach, it will aid in conceptualizing work and activity by envisioning and interpreting scenarios to enhance design and evaluation decisions (Carroll, 1995a). Thus, scenarios can provide the initial user requirements for system design (Carroll & Rosson, 1992; Holbrook, 1990) and provide designers a foundation for design rationale.

Scenarios are usually presented in written form as narratives, which include descriptions of users, tasks to be performed, and general-to-detailed steps for carrying out the procedures (Bauersfeld, 1994). Since narration is a communication tool that many use and have used for centuries, the scenario is a design concept readily adapted for implementation. However, Carroll (1995a) points out that scenarios do not necessarily need to be in textual narrative form.

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They can be in the form of storyboards, videos, and prototypes designed to support user activity. Scenarios may also contain many different levels of descriptions from very general to very specific.

The defining property of a scenario is projecting a concrete description of an activity that engages the user when performing a specific task. This description is from the perspective of the end user. It is an explicit hypothetical situation, which may include such attributes as artifacts and claims that make use concrete. Implementing concrete descriptions in system development helps keep the future use of the envisioned system in view as the system is designed and implemented. Scenarios clearly define basic functions and system exceptions by taking "snapshots" of the system in use, or a more general description of the users and their goals. Thus, the scenarios provide a description sufficiently detailed so that design implications can be inferred and transformed into actual models. The following table (3) gives you a brief overview of some reasons for using scenario-based design tools (Erskine, Carter-Todd, & Burton).

Table 3

<u>Why Scenario-based design tools?</u>

- ◆ Without user participation, designers **speculate** about the interface design process.
- ◆ Scenarios **ground** the design process in the situated tasks of users.
- ◆ Scenarios **describe** sequences of actions taken by a user with a specific goal in mind.
- ◆ Scenarios **allow** designers to make explicit assumptions**.**

R O L E S   O F   S C E N A R I O S

Carroll (1995a) states that scenario-based design aids designers in conceptualizing the user's work and activities. Envisioning system requirements through the interpretation of scenarios compiled from the perspective of the end user of the proposed system will enhance design and evaluation decisions. Carroll

believes that scenarios can lead design teams to communicate effectively with the end-user. In addition, the scenario design represents the user's task domain with object-oriented modeling. Carroll's scenario perspective is often represented with textual narratives, storyboards, and prototypes with varying levels of detail. Carroll also notes that scenario-based design techniques should be used to augment current system designs and contends that increased end-user testing enhances usability in the human environment. Thus, scenario-based design techniques are needed to enhance the user's perspective in the development of any system.

The following describes where and how scenario-based design techniques can be implemented throughout the system development lifecycle from the System Development perspective of John M. Carroll (1995a) p. 7.

Roles of scenarios in the system development lifecycle

Carroll (1995a) feels that scenarios can be implemented in the following design stages: requirements analysis, user-designer communication, design rationale, envisionment, documentation and training, evaluation, abstraction and team building.

Requirements Analysis

People using current technology build a scenario description of the state-of-the-art and ground a scenario analysis of what subsequent technology might be appropriate. The requirements scenarios embody the needs apparent in current work practice. A typical approach is to interview users about their practices or to stage a simulated work situation. A supplemental approach is to brainstorm potential scenario descriptions of a system and attempt to guess what the end users need to perform and also to speculate how they would use the system. This approach is less responsive to users' immediate needs but may facilitate discovering user needs that are not obvious in actual situations. This process quickly educates the users. Through hypothetical scenarios, users can get an understanding of the types of information they need to provide the design team.

Recent research in Human Computer Interaction (HCI) has revealed that supporting activities in the work setting aids in the description of the system design. One way to accomplish user input is to study the work environment and ask end users for their input. A second way would be to make the end user part of the design team early in the requirements analysis stage. Kuutti (1995) states that scenarios are process description tools because scenarios represent work-process-oriented and computer-oriented descriptions of the future system. He points out that visiting the workplace and generating scenarios through observation techniques allows for explicit descriptions of the domain. A visitation to the workplace establishes valuable working relationships between the user and the design team. The scenarios describe work processes throughout system development and provide a common language for understanding system development.

User-Designer Communication

The intended users of a system can contribute scenarios illustrating design issues that are important to them, specific problems or strengths in the current technology, or the kinds of situations they think they would like to experience or avoid. The system designers and developers can also contribute scenarios to such a discussion, since the users can speak this language. Users and designers together evaluate possibilities for usability and functionality. A heuristic variant is to include user representatives.

User-interaction scenarios (narrative) are believed to be key to bridging the gap between human beings and technology (Carroll, 1995a). As Carroll (1995a) pioneered the scenario-based design research techniques, he formulated the vocabulary foundation for the design and evaluation process of interface design. Scenarios are used as a communication tool between the user and the design team by incorporating the use of open-ended, incomplete and rough scenarios (Erickson, 1995; Kyng, 1995; Johnson, Johnson & Wilson, 1995; Rosson & Carroll, 1995). The scenario seems to be a design tool for both the user and the design team by providing valuable descriptive specifications of the system to be developed.

Erickson (1995) believes that scenarios make it easier to involve people by encouraging narration, a process with which everyone is familiar. Through extracts from these stories, a framework for the project goals, system specifications, and user tasks emerge.

Muller et. al. (1995) also use scenarios as a communication tool between the user and the designer. Through low-tech scenario exercises, end-users articulate assumptions, concerns and ideas. Kuutti (1995) like Carroll (1995a) describes scenarios written within the real work environment as an abstract vocabulary that allows us to speak about activities and computer uses. In typical system design, real life work settings are sometimes ignored.

Recent research in Human Computer Interaction (HCI) has revealed that supporting work in the actual setting aids in the description of the system design. Kuutti (1995) states that there is a connection in the process of work and that scenarios are the process description tools which represent work-processes and descriptions of future systems. The scenario vocabulary describes work processes throughout system development and provides a common language for understanding system development. Carroll (1995a) utilizes the end-user input throughout various stages of the design process. Carroll describes potential users of the intended system, and also transforms the scenario's abstract information into concrete representations and working models or prototypes.

Design Rationale

Scenarios can be a unit of analysis for developing a design rationale. The rationale would explain the design with respect to particular scenarios of user interaction. Alternative narratives can be competitively analyzed to force out new issues and new scenarios. Because such a rationale focuses on particular stories, it can be a resource for guiding other lifecycle activities with respect to those scenarios. As others in the field have demonstrated, scenarios can be used as a means of generating design rationale. The user-interaction scenario representations assist in analyzing and planning how a system will impact user activities. Carroll (1995) and Robertson (1995) implement scenarios for design analysis by using a

systematic question-asking technique to identify and refine problem domains. They define techniques to articulate software designs based on scenarios of user interaction.

Envisionment

In addition to providing design rationale, scenarios can be a medium for working out what a system being designed should look like and do. The scenarios can be detailed to the point of assigning specific user interface presentations and protocols for user actions. Such scenarios can be embodied in graphical mockups such as storyboards or video-based simulations; they can themselves be early prototypes for the final system. Designers focus on the project goals through usage scenarios and system mockups. They hypothesize effects for users and their work situations from detailed overviews of scenarios including general overviews of user activities that can be used to develop a specific set of use scenarios. Design envisionment is enhanced through open-ended, incomplete, and rough scenarios that allow maximum flexibility and creativity for the team's and user's ideas (Kyng, 1995). Nielsen (1995) uses this approach with group brainstorming where micro-scenarios are generated. The envisioned system includes causal relationships between the user's activities and experiences. Thus, developing applications in the intended environment is possible via collecting scenarios of use then compiling them into prototypable system specifications (Rosson & Carroll, 1995c). Karat's (1995) design team used scenario-based design techniques to help decide what they wanted to do (envisionment) and to articulate a shared understanding of what they were working toward (specifications). The scenario played important roles in the overall specifications and details of the system.

Documentation and Training

There is an unavoidable gap between the system as an artifact presented to users and the tasks that users want to accomplish using it. This gap is bridged when documentation and training are presented within the framework of scenarios

of interaction that are meaningful to the users. Such documentation and training is easier to initially make sense of and to use later on.

Evaluation

A system must be evaluated against the specific user tasks it is intended to support. Hence it is important to have identified an appropriate set of such tasks for the evaluation. Of course, it is even more useful to know what these tasks are throughout the development process. Early system prototypes make it possible to evaluate and refine the design before excessive time and money is committed to the project. The following research shows how system prototypes were used to evaluate and refine design. Karat (1995) used videos during the evaluation process to document and obtain detailed user information on how customers perceived the speech recognition system, alternative microphone arrangements, processing delays, error rates, error corrections, and enrollment procedures. With this information Karat (1995) was able to revise the system.

Scenario-based formative evaluations occur when users are asked what they think they can and/or need to accomplish on the system screen presented. This is based on what the student needs to accomplish. Nielsen (1995) developed a method, which address concerns for many users of a system by incorporating brainstorming techniques. They generate lists of items (micro scenarios) under various categories.

Another example of the importance of scenarios in evaluation can be seen when Johnson, Johnson and Wilson (1995) used them to design a computer system for radiographers in a London hospital. During the process they incorporated observations, interviews, and reenactments of user activities to formulate user tasks. Carey and Rusli (1995) also provide a framework for evaluation when using scenario-based design techniques. Composite scenarios provide designers with summaries that serve as a guide for evaluation and project direction. These composite narratives are abstractions built on top of a set of actual usage scenarios. Carey and Rusli (1995) point out that interpretive scenarios imbed ethnographic data that is reusable by expert interpreters. This type of data is ideal

for reuse. Scenarios as well as background information can be stored in reusable case libraries that increase the cost effectiveness of the data collection process (Carey & Rusli, 1995).

Abstraction

It is possible to generalize the lessons learned in the design of a given system to design work within a class of domains. Conversely, it is important to develop and evaluate candidate generalizations across a variety of user task domains in order to understand the boundary conditions for a given generalization. Thus, it is important to develop techniques for describing similarities and categorizations among scenarios.

Team Building

Developing and sharing a set of touchstone stories is an important cohesive element in any social system. Design teams tend to do this, and some of the stories they share are the scenarios that motivate and direct their design work. Gathering, discussing, and sharing these stories as a group can be an effective means to team building.

<u>Concerns</u>

Not all designers are proponents of scenario-based design. Nardi (1995) believes that scenarios are not a substitute for: a full-blown task analysis; an ethnographic description of the complexities of the workplace; a carefully researched list of user requirements; or an exhaustive set of specifications, except perhaps in the case where designers are working so closely with prospective users that gaps in the scenarios are made up in everyday interaction. He is also concerned with methodological and empirical issues in scenario-based design's data quality, the superficiality of scenarios, and sampling. Yet he states that scenarios can be used as a cost-effective means to quickly represent technological components of system design.

Mills (1987) criticizes software development for its lack of practical research. Thus, he proposes that "middle-level abstractions" would be better grounded in social reality and better suited to application in live social contexts. He argues that scenarios are not a formal, scientific research process, yet, implies that scenarios provide an opportunity for integrative system development.

Neale and Kies (1996) agree with Muller's et al. (1995) low-tech representations (pen and paper mockups) to keep language within the user's domain. Neale and Kies (1996) designed and developed a WWW site for Virginia Tech's Human Factors Engineering Center using scenario-based design with a process similar to Nielsen's (1995) research. He categorized user classes that included information such as: user class, knowledge of content domain, knowledge of the WWW, knowledge of Scenario-Based Design, and number of users per class. For one hour, user classes generated micro-scenarios through semi-structured brainstorming techniques. Individual users generated brainstorming lists by providing information on the provided brainstorming worksheet. Based on the brainstorming lists that were generated, scenarios were constructed providing potential, in-depth detail and context for the systems design. A generalization

across the user classes was that participants with little design experience still produced effective, descriptive scenarios.

DEVELOPING A SCENARIO-BASED PROTOTYPE

By observing, listening to, and participating in user tasks, designers document and communicate necessary information to the end user through scenarios and prototypes.

The functions of the design, the development of a prototype, and the other technological processes are so interwoven and complex that they cannot easily be differentiated. This is especially true where knowledge of the technological process of functions resides in one or two generalists. However, the basic assumption of this thought is that successful management of the technological process is dependent on the administrator's ability to draw distinctions among the various functions of the process.

Important themes recur in the literature on the development of scenario-based designed prototypes. The emphasis on a scientific methodology or process can be observed in the National Science Foundation's 1965 definition, "the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems or methods, including the design and development of a prototype and process..." (Sherman & Schwen, 1977). Prototyping, or heuristic development, consists of producing a reduced function version of the proposed system in a shorter time frame and at much reduced costs compared with what would be expected from normal system development activity. This version of the system can then be used by the developers and the users to test assumptions and practicability of the design. One of the most important characteristics of the prototype is that it acts as a catalyst for communication. Thus, using the prototype method to present scenario information to all involved in the design efforts bridges gaps in development specifications and refinements.

An important aspect of prototyping early in the design process is its quick and efficient communication of the intended concepts. The term prototype encompasses many broad definitions. For example, graphical representations of user-action scenarios such as a storyboard, paper mock-ups, or, more specifically, working models of the system or application fit the prototype definition. In addition, the prototype can be interactive or non-interactive, something as simple as a pen and paper sketch, a simulation, a slide-show, or in a software environment, the prototype could have most of the properties of the end product interface.

Several successive prototypes need to be built, each using the previous prototype as a starting point and becoming progressively more sophisticated and complete, until the user is satisfied that the latest prototype is complete enough to serve as the production system. Two reasons justify successive revisions. First, designers think they know more than the intended user, yet they do not fully understand the skills and needs of the intended users. Second, and probably most important, prototyping by definition suggests revisions for improvement.

This type of development forces a high degree of user involvement with the result that the system design problems are inevitably dealt with early in the life cycle of design and development. In addition, the system is developed more quickly and the final product interface is more bug free than those developed by traditional methods (King, 1992). Using prototypes through the development life-cycle does not change the initial process. The development life-cycle does require rapid revisions and improvements after each phase of the process until an acceptable interface has been produced.

The iterative development style encouraged by the prototyping technique is ideally suited to both the top-down and bottom-up design and development models employed by most of the design techniques already mentioned. Each successive prototype can implement deeper levels of the system's hierachial structure until the whole system exists. This also means that the system development staff must be more skilled in all parts of the life cycle (King, 1992). This collaborative design

process of creating a prototype is ideal for making sure the final product is as intended through evaluation and revision and/or by creating an up-dated prototype (Erickson, 1995).

Prototypes are a Catalyst for Communication

Stories were once used to communicate myths, fables, or hunting expeditions with enough description and excitement so that the listeners could vividly visualize the day's events. Like stories, prototypes are effective tools for communicating design rationale. In the early stages of the design process, the vision prototype captures the global picture of the design project. It is a large scale, yet concrete, representation of the scenarios and intended user's actions. The prototype is a realistic depiction of how and why users would manipulate the interface being designed; however, it likely does not include finished details. Prototyping early in the design stages has its advantages. It promotes a clear direction and understanding toward the global goals and needs of the project. Though persuasion and public relations are usually enhanced by presenting a more detailed prototype to the intended audience, potentially, significant time and energy are at risk in the early stages of the design. Working prototypes emphasize the form, interactivity, and visual appearance of the interface itself, in addition to how the product interface fits the user's activities. The purpose of the working prototype is to embody the current state of the design and to serve as a medium for interaction among all stakeholders.

A useful property of working prototypes is that they can be made accessible to all members of the design team with each member assigned full access rights to make changes or implementations. Periodic back-ups are a simple solution to any major catastrophe that any one person may inflict on the working prototype. Too often teams rely on a single programmer, which can limit creativity and communication efforts. An alternative to a working prototype is the creation of physical mockups, simple card stacks, foam board models, note cards, sticky notes, and the like.

One aspect of designing with the user's tasks and needs in mind is that the designers try to create tools to serve those needs. Johnson, Johnson and Wilson (1995) state that "the design and development efforts to improve the quality of work and the quality of products require designers to pay close attention to the nature of work, and to be explicit about how any technology that is designed might affect people and their work" (p. 210). It is imperative that designers understand how the software or hardware will be used and what tasks it will or will not be good for, impair, or otherwise change. Taking seriously the concerns of people who use or are affected by a computer system will require changes in the practices and methods of the system designer. Understanding users and their tasks is a central concern of the system designer. With scenarios providing explicit user and task information, the designer can better accommodate the rich perspective of the people or organizations for whom the system is being designed.

With the participant involved, ownership in the product increases and the fear of product implementation decreases. Thus, the potential for product success is enhanced. Hence, by choosing a few key representatives of each appropriate class of user, or even a single representative, the information and communication brought to the development team is a valuable insight otherwise speculated.

The first step in building a prototype is to collect information or data about the domain, people, and tasks by meeting with personnel, managers, and users. Before anything can be prototyped, a clear understanding of the user tasks, needs, and global goals must be defined. Thus, during meetings and interviews, task demonstrations, observations, and performances of activities should be thoroughly documented as goal scenarios. Likewise, limitations and agreements on the descriptions of activities should be refined and revised until a written description of all aspects of the task scenarios is agreed to collectively. Then, through the development of artifacts, both the user participant and the designer are involved equally. Consequently, an accumulated understanding of the work and tasks of users is established through communication.

The second step of prototype building involves the development of general scenarios that have a series of sub-scenarios generalizing different tasks. The designers and users put together task scenarios through tools such as text, narration, pictures, diagrams, photographs, video, audio, and recordings. During this stage, the prototype is an ideal catalyst for communication.

In summary, designers will continue enhancing the design process by adapting to the needs and practices of users, by acknowledging the social nature of design, and by developing a better understanding of how concrete artifact development supports communication.

Participation and Interactivity

By definition, the work people do on computers has always been interactive. Computers and software are tools, and their purpose is to help people interact with words, numbers, and pictures. What is different today from earlier computer applications is that computer programs are being used for interactive activities such as reading, watching and entertaining. Thus, with interactivity, the audience, not the designer, now controls the sequence, the pace, and most importantly, what to look at and what to ignore (Kristof & Satran, 1995).

Hix and Hartson (1993) define the interaction component of the interface by describing how it works, its "look and feel," and its behavior in response to what a user sees and hears. Interacting with the computer and the interface design is the means for importing user requests through programming code that communicates with the computer hardware (Hix & Hartson, 1993).

Kearsley (1988) says that the first step in successfully implementing new information technology is grassroots participation in development. For example, the Computer Science Department and the Instructional Systems Development Program at Virginia Tech are researching the impact of users as part of many facets of the design and development stages in building systems. The Virginia Tech Human-Computer Interaction (HCI) program has been focusing on human performance tasks as they develop computer systems (Hix & Hartson, 1993). In

addition, the user interprets the interface as the system itself. In this area the research studies of Hix and Hartson (1993) have incorporated the following: (1) Human-computer interaction must be addressed as an integral part of software engineering; and (2) research in this field should be balanced with practical application to bridge the gap between the behavioral world and the computer science world. Getting new concepts out into the real world, putting them into practice, and testing and refining them in the face of real needs, constraints, and limitations of a working environment (Hix & Hartson, 1993) will create vital connections between user interface development and software engineering. Likewise, it will encourage a healthy exchange between academia and the real world.

USER-CENTERED DESIGN

User-centered design, which has been around since the early 1980's, is closely related to behavioral design by developing the interface from the view of the user, rather than from the view of the system. This type of design places the user at the center of the design when developing products and systems (Rubin, 1994). Woodson (1981) describes human factors engineering as "the practice of designing products so that users can perform required use, operations, service, and supportive tasks with a minimum of stress and maximum of efficiency" (p. 152). Woodson (1981) also states that the designers make their plans fit the user as opposed to making the user fit the design. In the figure (2) below, Rubin (1994) visually represents user-centered design by locating the end user at the center of all activities.
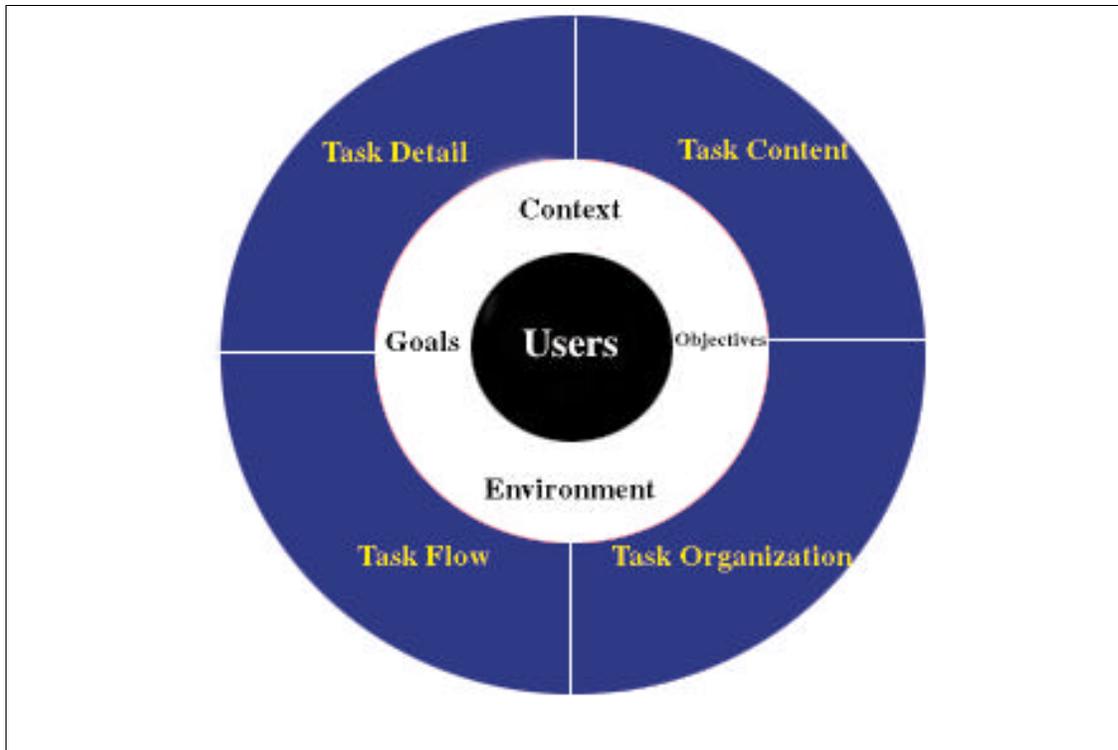
Figure 2. Ruben's User-Centered Design.

Ruben (1994) states that a scenario of user-centered design would focus or include all pre-purchase and post-purchase contacts and interactions. Thus, unlike the earlier definition of user-centered design, which is limited to the design process only, Rubin's (1994) definition expands the concept to include the lifecycle of ownership as well.

Numerous articles and books have been written on the subject of user-centered design (Gould, 1987; Norman, 1986). Gould and Lewis (1985) in Designing for Usability use three key principles to guide the design process: First, maintain an early focus on the users themselves and the tasks involved as well as continued user interaction throughout the design process. Second, collect empirical data to measure ease of learning and use throughout the design process as well as in the development and testing of prototypes with actual users. Finally, implement an iterative approach in the development of all products so that, through early

testing of conceptual models and design ideas, the end product and interface can be designed, tested, redesigned, and re-tested through each phase until all parties are satisfied.

USABILITY TESTING

Usability testing usually focuses on empirical data collection techniques. Through exploration, assessment, validation, and comparison of products, two distinct forms of testing emerge. One involves true experiments, which confirm or reject a hypothesis. The other is a less formal iterative cycle of tests performed in order to expose deficiencies (Rubin, 1994).

Task Scenarios

Rubin (1994) states that "Task scenarios are representations of actual work that the participants would conceivably perform using the product. Task scenarios are expanded versions of the original task list, adding context and the participants' rationale and motivation to perform those original tasks" (p. 179). Thus, typical patterns of use are gained from user generated task scenarios.

Field Studies

Field studies are a form of alpha and beta testing. The study would be classified as a field study when the system is placed in the intended environment. The prototype or system is placed in the work setting in order to check for minor problems. Data is collected in a very informal manner by recording narrative comments or scenarios from the user. Although this data is seriously evaluated, it will only effect minor changes to the system at this point. However, in later versions of the product, these comments will guide minor as well as major changes (Rubin, 1994).

Follow-Up Studies

Follow-up studies are usually performed after the release of the product. Follow-up studies probably give designers the most accurate data because the user, environment, and product are in place. Through observations, surveys, and interviews, usable data are collected relating strengths and weaknesses of the product (Rubin, 1994).

PARTICIPANT SELECTION

Selecting Participants

A common characteristic of user-centered design and participatory design is that they employ one or more representative users on the design team. Users are important to design success; however, the selection of user participants requires a careful approach. For example, one important aspect of selecting users is to make sure that the focus is on the end user, not the purchaser. Ideas from the purchaser (instructor and instructional designer) may be incorporated into the design, but all testing must be performed with the end users (students) since the purchaser (instructor and instructional designer) is often unaware of problems and procedures faced by the users (students) of an interface. Rubin (1994) states that good test design must include balanced mixtures of user groups. User characteristics should be represented equally. To facilitate the user selection, designers should screen participants through questionnaires and compensate them for their time and effort.

Know the User

Ideally, gathering questionnaires would be the initial step in getting to know the individual users. To know the user means to understand human behavior. More

particularly, it means to know the characteristics of the classes of users that will be using a particular interface. Designers should give early and continual attention to the user throughout the development process. They need to understand, not just identify, describe, or stereotype users of the system. Designers can further understand users by interviewing them and observing them at work both before and during interaction design. Techniques to get to know the user are the user analysis, task analysis, and information flow analysis. Collecting information regarding type of education, training, skills, and experience is also important.

User Categories

As research in the field suggests, a variety of user types should be selected when designing or evaluating a system. Included will be at least one or more end users who represent the least amount of skill. The reasoning behind using these participants is that, in theory, someone with the least amount of needed skill can truly test the product for ease of use and learning. Thus, users with more experience should be able to use the product. To determine skill level, a task analysis needs to be given to all end users. Users then need to be ranked via group and ability levels.

Number of Participants

Balanced with time and resources, designers can not have too many participants. For a true experimental design, a minimum of ten to twelve participants per condition must be utilized. However, for the purpose of conducting a less formal usability test, recent research has shown that four to five participants will expose 80 percent of the usability deficiencies of a product, and that this 80 percent will represent most of the major problems (Virzi, 1990). Rubin's (1994) quotation below summarizes several design options.

> If, however, you are attempting to expose as many usability problems as possible in
> the shortest amount of time, then test at least four to five participants. The latest
> research indicated that testing four to five participants will expose the vast majority

of usability problems. …If multiple tests will be given during the development cycle, fewer participants are needed. …[T]ry to test at least four participants per treatment in a matrix design. …[I]f all four cells do not include four participants then the study is biased toward the end users (p. 128).

Once the users have been identified, involve them. Participatory design is still somewhat an open issue; however, involving the user throughout the development and design process will increase the user's ownership in the product and decrease the fear of product implementation. By carefully choosing a few representatives of each appropriate class of users, the development team will gain valuable insight from the concrete information provided. Without user participation, the designers often only hypothesize. Ultimately, scenario-based design, which includes user participation in the design process (Nielsen, 1993), is believed to increase product success through valuable user insight. Based on these positive advantages of scenario-based design, scenarios form the foundation for the design, development, and evaluation of a system. Thus, Carroll's (1995) scenario-based development approach provides a usable guideline throughout the system's lifecycle for this study.

METHODOLOGY

METHODS

Definition of the Case

This study was developed to augment the formative evaluation process of instructional design by incorporating scenario-based tools and strategies that focused on interface design. The rationale for redesigning an existing course web site was supported by data collected through interviews from end users, the students. The data collected served as an archive for each individual's use of the course web site.

Participants in this study were students who were enrolled in Child Development and Family Studies at Virginia Tech. These students needed to use the course web site as an out-of-class resource requirement. Students needed to perform tasks on the web site in order to be successful in the course. Tasks included routine navigation and resource retrieval as assigned by the instructor. They were required to take graded quizzes on-line but also had the opportunity to take practice quizzes as well. Study guides for lectures and laboratory assignments were available to download. On-line lectures and reading assignments were available for viewing. They were also able to plan self-regulation strategies and make on-line journal entries and participate in threaded discussions. Since these students were held accountable for all materials and information archived at the site, a user-friendly interface design was imperative for student success in the course.

By incorporating scenario generation techniques into the formative evaluation process, serious interface problems that surfaced were discussed and remedied by the design team. In these scenarios students described whether or not

they were able to complete their tasks successfully. Preliminary findings from the scenarios revealed strengths and weaknesses in the interface design and directed design rationale considerations.

Research Questions

Scenario data was evaluated to provide rationale for redesign considerations, and the following questions were the driving inquiries in these considerations. These questions showed the importance of interface design and the need to focus on this aspect both during the design and evaluation stages of instructional design.

- Did users recognize the functionality of the interface?
- Were the users able to perform given tasks in a reasonable amount of time?
- Were the users able to navigate through the web site easily?

Interpretation as Method

This study looked for patterns of unanticipated as well as expected relationships and any common themes that may have emerged from the transcripts. Situational conditions were not known in advance or controlled. As Stake (1995) pointed out, it was essential for the design team to interpret the findings. Common themes and considerations were agreed on collectively by the team, which allowed them to perform four tasks. First, to keep in touch with developing events, second, to continually re-evaluate, third to redirect observations and, finally, to pursue emerging issues.

Erickson (1986) claimed that the primary characteristic of qualitative research is the centrality of interpretation and that findings are not so much findings as assertions. Stake (1996) continued in this vein, "the function of research is not necessarily to map and conquer the world but to sophisticate the beholding of it (p. 43)." In addition "thick descriptions," "experiential understanding," and "multiple realities" are expected in qualitative research (p.

43). People perceive phenomena differently, not just through un-sophistication but because meanings are determined partly by experience.

So interpretation as method is not an exact science, rather it is a personal conclusion or assertion of what was perceived. In this case, the scenarios from the students formed the foundation for the web site redesign. This process is described in detail later.

Researcher Role

All evaluation studies are case studies of the program, person, or agency being evaluated in the case. In this sense, the case researcher is always an evaluator. Since the case study was to search for merit and shortcomings (Stake, 1995), the researcher chose specific criteria or a set of interpretations by which the program's strengths and weaknesses, successes, and failures became apparent. The qualitative evaluator usually emphasized the quality of activities and processes, portraying them in narrative description and interpretive assertions (Stake, 1995). It is also relevant to point out that the case study researcher was part of the design team, playing the roles of the formative evaluator and programmer. The following section describes the design team makeup in more detail.

Current Design Team

The design team membership was changed several times since the start of this project. However, the evaluation process would have been the same, regardless of the team membership. At the time of this evaluation, the design team consisted of several people in the following roles: project manager, instructor, instructional designer, formative evaluator, and programmer.

Project Manager and Instructional Designer

The project manager and instructional designer was a faculty member from Teaching and Learning in the College of Human Resources and Education at Virginia Tech. She has an academic background in instructional technology,

educational psychology, and elementary education as well as more than 16 years of experience in the design and development of video and computer-based learning materials.

Instructor

The instructor was a faculty member in Family and Child Development in the College of Human Resources and Education at Virginia Tech. An expert in child development, self-esteem, and play, she attempted to integrate technology into human development courses to offer different learning environments. She intended to use multimedia materials to deliver information and structure on-line situations, which actively engaged students in learning.

Formative Evaluator and Lead Programmer

The formative evaluator and lead programmer was a graduate student from Curriculum and Instruction, Instructional Systems Development in the College of Human Resources and Education at Virginia Tech. She has spent two years with the Educational Technologies group at Virginia Tech, has taught three years in higher education, and seven years in public school, K-12. She has a background in instructional design as well as web site and interface design.

Programmers

Three programmers were graduate students from Teaching and Learning, Instructional Systems Development in the College of Human Resources and Education at Virginia Tech. One programmer was a programmer analyst for the College of Human Resources and Education at Virginia Tech.

PROCESS OVERVIEW

The redesign rationale was the result of the following steps.

1. Selected participants.

2. Elicited scenarios from the end users.

3. Performed scenario analysis (See Results chapter).

Participant Selection

The test population was approximately 250 undergraduates taking human development courses at Virginia Tech during the Spring of 1998. Students were asked to help with the evaluation of the web site by describing their experiences (scenarios) and also to give suggestions for improvement.

Identified end user class

A pilot group was asked to answer a series of questions on the scenario generation instrument (SGI) (Appendix A). The scenario generation instrument became the framework for the data collection. It was separated into two instruments, one for demographics and one for the interview framework. This instrument originally encompassed both demographic information and a series of questions for students to comment on and to evaluate the pilot web site. The framework for each interview was drawn from the information gathered from the SGI, on-line demographic survey, and questions developed specifically for the interview.

In order to select the participants for this study, an on-line survey (Appendix B) was developed to collect background information from the targeted population of the course. The survey instrument was a dynamic on-line form, which was interfaced with a database designed and developed by the researcher.

The background survey, accessible from the course web site, was given to the entire class as a volunteered task. The survey (Appendix B) was designed so

that end users described themselves, which generated standard demographic information for the study. Question number five from the on-line survey was used to select participants to interview:

5. How many years have you used a computer?

This question had three categories, zero to two years of computer experience (novice), three to five years of computer experience, and five plus years of computer experience. If students had two years or less of computer experience, they qualified as a novice computer user and were eligible to participate in the study. The assumption was made that if the novice group of students could use the interface then it should be simple enough for students with more computer experience.

To contact eligible participants a list was generated using the database. The query designated anyone with two years or less computer experience. This list consisted of the participant's full name, email address and phone number. The complete list of eligible participants was emailed to the instructor. The instructor then contacted each student in the list individually and asked them to participate in the evaluation of the web site by describing their experiences (scenarios) and also to give suggestions for improvement. The students were asked to contact the researcher to schedule a time for an interview if they were interested in evaluating the web site. The researcher emailed reminders for scheduled interviews. The interview process took about two weeks to complete. Flexibility on scheduling interviews was necessary because students were busy and usually reluctant to interview. Fifteen volunteer novice participants from the target population were interviewed.

The database was a very useful tool. It featured dynamic interaction between the on-line background survey form and the database which allowed the researcher and design team to monitor survey responses immediately as well as archive the data with an organized, consistent approach. This information provided part of the supporting data for the context of individual scenarios and to select the participant group. The second part of the scenarios' context was collected from

interview questions and background information. In addition, the database made searching, selecting, and archiving participant information very easy.

Eliciting Scenarios

Participants had three months of experience with the course web site before being interviewed for the study. It can be argued that this exposure to the web site would bias the evaluation. On the contrary, the students' exposure enhanced the redesign process because they had spent large amounts of time using the course web site, confirming what they liked and disliked about the on-line components of the course.

The interface design focused on the usability of the course web site. The obvious questions were, in this case: Could the students perform the weekly assigned tasks using the course web site? Was the site's organizational structure interactive and invisible to the student? Was the course information represented in an organized, consistent manner?

Subjects were asked to describe how they performed the weekly tasks required by the instructor. At this point it was logical to ask the students not only to describe their weekly tasks but also how they would like to encounter the course web site. The usability of several artifacts from the web site was discussed in the interview: quizzes, net forums, email, on-line lectures, study guides, chapter outlines, and external resources.

Research Setting

The research activities were conducted in an office in the Old Security Building at Virginia Polytechnic Institute and State University. The office provided a quiet space for the audiotaped interviews. Colleagues in the office were informed of the research activities being conducted, which ensured no disturbances during actual interviews. The office, although very small, provided adequate space for an interview with one person. Participants selected were then asked to come to this office location for an interview at their convenience. See Figure 3 below.

Audio Recorder   Investigator

Participant   Desk

Door
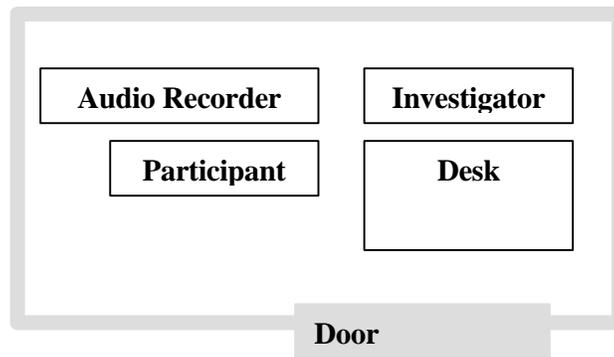
Figure 3. **Interview Setting for the Study.**

Each interview adhered to the following procedure: Each participant

1. was given a description of the study.

2. was told the purpose of the study.

3. was informed that the interview would take approximately 30 minutes.

4. read and signed the human subjects informed consent form.

5. was asked if there were any questions before the researcher turned on the audiotape.

6. was asked a series of questions (Appendix C).

7. was thanked for his/her participation and asked whether or not they want to receive a copy of the transcript.

Audiotaping

Interviews were recorded using a small Dictaphone tape recorder, which used normal size audio tapes. By audiotaping, the interaction between the investigator and the participant was captured, in addition to freeing the investigator from notetaking. Audiotaping was valuable for recording the interview verbatim. Some researchers find they can think better, reflecting, and probing, if they use a recorder (Stake, 1995).

The participants were given a verbal explanation of the study to help them understand what was being asked of them. The researcher asked two main

questions drawn from the Interview Framework Instrument (Appendix C)
Following are two example questions from the question script.

Question number six: What kinds of class related tasks do you do in the web site in a typical week?

Question number seven: Describe how you would like to encounter (use) the web site.

The Interview Framework Instrument was used to strive for question consistency during each interview (Appendix C). The entire interview process lasted more than thirty minutes. The point of mental reference during the interview was the course web site, which students used from the beginning of the semester. Course materials were added to the web site, yet the layout and design of the template was unchanged.

RESULTS

INTRODUCTION

This chapter describes how the design team went through the scenario analysis process. Once the interviews were transcribed, the formative evaluator/researcher extracted all data that had to do with the web site redesign. This information formed the basis of the action section that was then viewed by the design team. The design team was also given complete copies of the interview transcripts to refer to if they needed to understand the context of certain statements. Next, the design team looked for common themes by grouping the interview data into four categories: patterns of use, user suggestions, likes and dislikes. When compiling these themes, both the action section and the transcripts were referenced. The reason for using both the transcript and the action section was to allow the designers access to the context, which may have been lost in the action section. During two, half-day design team meetings, the patterns of use and user suggestions, which were extracted by the researcher and instructional designer, were merged to represent a global scenario of use representative of the population. The next section describes student data and how the design team used the data in greater detail. Descriptions will also be given of how the interview transcripts were used as well as how patterns of use, user suggestions, user likes, and user dislikes were compiled to support redesign considerations.

INTERVIEW FINDINGS

Once the interviews were transcribed, the evaluator/researcher archived them into the database. The transcripts were the results of audiotaped interviews with fifteen students from FCD 1004, Spring, 1998. Once the transcripts were checked for accuracy, the evaluator began organizing the data into action sections. The interviewee's comments were organized into the action sections by including only those relevant to the course web site and omitting irrelevant interviewee and investigator conversation. Action sections were made for thirteen of the fifteen transcripts. Each action section took approximately one hour to compile. On a positive side, it was noted that the action section saved the instructional designer and the evaluator/researcher valuable time when compiling specific patterns of use, user suggestions, user likes, and user dislikes. Without the action section, the team would have needed to use the complete transcript to compile these specifics. On the other hand, by reading the complete narrative from the transcript, the readers could get a good understanding of the context in which something was discussed.

The patterns of use, user suggestions, user likes, and user dislikes were compiled from the action sections and the interview transcripts. For each of the original fifteen data sets, breaking them down into these four categories took approximately one hour each. Below are comments from interviewee number eleven, which are good examples of the typical responses from the sample. The following quotation describes how students nine and eleven typically used the web site. Student eleven would "…check practice quizzes and print those out," then "…go to the homepage and check out the news," "…click on the Game Plan and click on the week, but I usually pick the wrong week because I don't know what week it is," then "click around to see what week I'm on." "I don't use the review topics." "Don't use the outline in the G part." "Used to look at on line lectures and the study guides. Don't do that anymore because it's easier to print out a whole bunch of practice quizzes and answer those questions. Download it a couple of

times. I just study from those. And then do the test and the quizzes for credit. Don't do any of the reflective questions." "…first couple of weeks I did the journal [study guide], and it did help. But got the same information from the practice quizzes. Print out practice quizzes and read them over and over once a week to memorize them and see what exam questions are like."

STAGES IN SCENARIO ANALYSIS

Specific stages of the scenario analysis process needed to be completed prior to moving on to the next phase of the analysis. Each phase needed both input and output data. The output data became the input data or starting point for the next phase of scenario analysis. The following section describes the process in more detail with examples from the case.

The Scenario Based Design process in this study consisted of four major stages (see figure 4). The first was the *scenario generation*, which was a detailed narrative from the student's point of view during the interview. The second was *re-tooling the scenario*, which was from the perspective of the design team. Third was *the claims analysis*, which was the usability or usefulness of suggested artifacts. Artifacts were key sections of the web site including quizzes, on-line lectures, study-guides and reflective questions. The fourth, and final stage, was *the design description and design rationale*, which became the redesign considerations report based on the scenario, the re-tooling of the scenario, and the claims analysis (Erskine, Carter-Todd & Burton, 1997).

1. Scenario Generation
(Detailed Narrative)

2. Retooling Scenarios
(Perspective of Design Team)

3. Claims Analysis
(Usability/Usefulness of Artifacts)

4. Design Description & Design Rationale
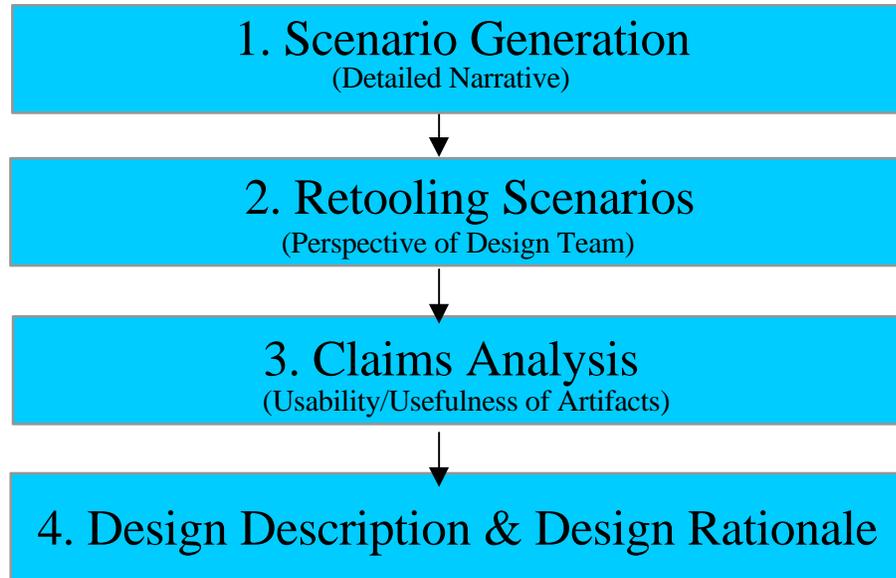
<u>Figure 4.</u> Stages in the Scenario-based Design Analysis Process.

1. Scenario Generation
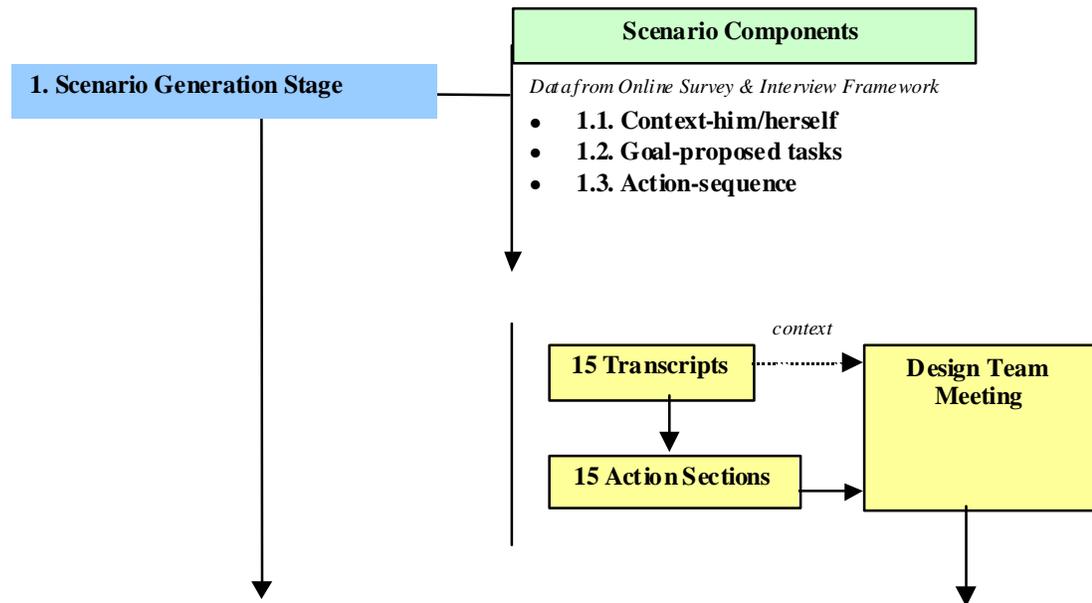
Figure 5. Scenario Generation Stage

Figure 5 is a visual representation of the steps involved in the scenario generation stage.

The scenarios were student's descriptions of their experiences using the course web site. In this case, students described their tasks on the web site in a typical week. They talked about the web site in terms of what they wanted to do and what the site allowed them to do. Students described their successes and failures, as well as, their frustrations while working in the web site. They also gave recommendations for improvements by adding navigation that would allow quicker access to the class materials. Students communicated their recommendations through non-technical narratives or scenarios. These stories formed the foundation for the redesign of the web site.

To organize these responses, categories of their tasks were separated into the following components: context (survey), goal, and action (course web site

interactions). The following section defines these terms followed by an example from a participant.

The following example was a scenario generated by interviewee number eleven and the researcher categorized the responses. A full transcript (Appendix D) is available for the reader to gain the complete context of the interview interaction.

The *user context* (1.1) was the user's description of him or herself and why he/she would want to use the web site.

1.1. Example Context

"Well I'm a Freshman here at Virginia Tech. And I'm taking this class because I want to get into ECEP and this is one of the prerequisites. And I figured if I took this class maybe it would give me a better understanding of if I really want to do that or not."

After determining the context of the scenario, the next component of the scenario analysis is to examine the goal. The *goal* (1.2) described what users proposed to do with the web site in order to accomplish their weekly tasks (Erskine, Carter-Todd, & Burton, 1997).

1.2. Example Goal

In this case, the goals were external, provided by the instructor, for example, take a graded quiz. Yet students had their own sub-goals in order to meet the given goals of the instructor. The students in this department were required to take this course and the required goals and tasks were assigned by the instructor. Yet students had the opportunity to use additional resources housed on the site. In reality, the students were only required to take the real quizzes on-line. Therefore, the students did any other work on the site because they wanted to. What was not given by the instructor were the actions the students took to accomplish those goals. In fact, without scenarios, we can only guess as to the how each of these students used the web site. The students described their experiences through the scenarios.

The *action section* (1.3) described the sequence of interactions between the users and the course web site as they would have liked to encounter it.

1.3. Example Action

"Well I get on the home page first. I usually check out the news box. See if there's anything new there. In the beginning of the year there is usually a lot of stuff and I'd check it all out. But more recently she doesn't have anything new on there. You just check from the listserv. And probably, [hesitates] check the, usually check that first, and then click on Game Plan and then go, click on one of the weeks. Usually I pick the wrong week. I don't know what week it is. But I'll press 9 and it'll show me week 0 but that's not the one I want. So I'll click around to see what week it is or I'll scroll down and see where I'm at. And I don't use the review topics. I don't use that outline, the G part. And I used to look at the on-line lectures, …but… and the study guides. But I don't do that anymore because I find it's easier to print out a whole bunch of practice quizzes and answer those questions. Download it a couple of times. I just study from those. Because usually if I do that it usually helps me on my tests just fine. And I just do the tests and the quizzes that we have for credit. And that's it. I don't do any of the reflective questions. That's it pretty much."

Below is an example action section of interviewee #9 by the evaluator. This was extracted from the interview transcript by the researcher. During the extraction process the researcher analyzed the interview transcripts and eliminated data irrelevant to the current web site design. More data was collected during the interview process than was needed for the purposes of this study. Table 4 below represents an example action section extracted from the interviewee #9 transcript which was originally ten pages in length.

Table 4

Action Section From Interviewee #9 Transcript

- Well I bookmarked the Game Plan. So I just go right to that. And then I click down, click on the icon for the study, the study outline. And _____(tape skip) for rugby is the same time the course is so I'm usually not at the course. I mean at the physical class. So I use the web probably a lot more than the person who is going to class all the time. And so I fill out the study guide using the Powerpoints that are on the Internet. The lecture on line. And then I study from that. We used to have to do the reflective questions and I don't know if those really helped me a lot, she required it for the first time. But I kind of thought it was like a hassle because they were like, they were like, "I believe myself."" I can do this." " I am good at making friends." Stuff like that. I don't think that really helped me. And, but then, taking the practice quizzes helps and the quiz for credit are good just because you know the practice quizzes go pretty much long with it.
- Yes there was just because of the... [hesitation] ...I guess the layout, just because it's across. I don't know, it was kind of confusing and I didn't really catch on I had to get somebody to explain it to me. Just like how, like the schedule is and everything. And how it's called the Game Plan. I think maybe if it was like you know, to go to homework and practice questions and something like that. I mean it looks organized and it is organized but I just had trouble when I first started. Just because it was kind of like I don't know I guess I just had to work it out myself. You know work it out myself.
- [If you could redesign it what would you do to make it more usable for you?]
- I don't know. It's got all the information here but I just think it's kind of confusing how it goes across. So maybe I'd like go down. You know. Like go down like this. Because then it's also good you could see one of the two squares ahead of you. Just because, I mean, I got e-mail from her about a test but I was out of town on Sunday and I was like, good gosh I have a test tomorrow… [hesitation] …one of my friends told me. But if it was like this, you could probably see that you have a test you know. Instead of having to scroll down.
- I mean, I probably have that in my syllabus but when I check, when I click on the web and then I just looking at week two and just scroll down to week two, and I scroll down one more I would see that we would have an exam. But, I don't know, I just think if it was like more condensed and you could see week for… [hesitation] …you know like that, then I could see an exam coming up.
- You, you know, you click your answers and then you hit return. And then you get back like, and then it corrects it for you. But on the practice quizzes, it's like you click it and it then it says no this is wrong, or no the answer is really B. But I like it when that, when I take the whiz quiz is like a real quiz. Hit it and then I will get a score. And then so my

goal would be to get a 10 out of 10 at least five times just on what I'm doing. I like it because then I have a score. Not, because I mean when I do a question and they're like no it should be B, I'm not like physically seeing it marked as B you know.

♦ I don't know if I like the Game Plan. I don't know, it's cute, it looks like kids blocks and everything. And there's the plan. I don't know, I just, I don't know. My biology teacher's home, everybody has like different home pages, but like my biology teachers is just like on the side, in the column. It's like grades, practice quizzes, you know, lecture notes, all this laid out. And then it's got like her office hours and all that. I mean that's simple. I think simpler is better.

♦ [Entomology]

♦ Oh yes. I really liked it because it was easy to follow. It had like a web page and then it was like, icons like go to practice test and then you just clicked on that and you would have like all these different whiz quizzes that you could take just for practice. And then you could click on it and get some information off the web about the topic we're talking about. It was called what's hot or what's new. And then like a fake students scores on tests and how they did. It was just different like that. I mean this one is good to. I don't know.

♦ I like something I can just turn on and find my, find stuff. And like there's no reason I think for us to have the 14th of January still on here. Like I'll get on and I have to go all the way down to April. And I wish I could like bookmark it so it would like stays. But I don't know. It's kind of like it's a hassle. I mean if we could just turn it on and be right where we are. That would be great. I mean, but then some people would probably like to have I don't know, I guess with the exam it would be great. But I don't maybe if they could save it somewhere else like previous weeks or something like that.

♦ Well we're really fortunate that we have practice quizzes. And I like that but that's just the main thing. Like that it tells you right away, you know. But I mean overall they're good. I kind of wish they were like the whiz quiz, is like they score it for you and you could see you know. But

♦ [Which do you like the best?]

♦ Whiz quiz.

♦ [What were some of the problems that you encountered with the web site?]

♦ Just the crashing. That was it. Which was a big problem just because I mean, practice quizzes on the web are a really good way, I mean are really helpful for me. I mean if they're like this and not like the whiz quiz. But gosh just when I, even when I, I like to see and I like to have a question pop up and then I have to think about it. But like instead when we get the questions for the test that she gives us with the plus like 1 through 50 questions. We have to look up the answers, which can also be helpful. But then again I like to just pick because it's like on the test we're not going to be like looking up the answers we'll be like picking one of the answers. So the crashing was a big pain.

♦ I like lots of pictures. Like if your talking about Erickson. And you know have a picture of him. I mean I know they're in our book but lots of people just use the web page. I mean we read also but it's easier to use. Like lecture on line, just study your notes and stuff. So maybe if they have more photos. Just because I like to know who I'm talking about. I mean I could always read it, you know, in the book but it's like to make it

better. And maybe just like more pictures on the Powerpoint. I don't know. I just find those more interesting. Like how it was on our whiz quiz and then on our Powerpoint pages for Entomology. They had lots of graphics and pictures of bugs and stuff like that.

♦ I think if I didn't have to do anything, I probably would not follow very well. Just because since I don't' go to class this is what I have to be taught by. So I have to like, I have to have a quiz for credit just to get like some points you know. And I don't know, the, I mean, have to have a study guide so that I'll know what I'm talking about. I mean so I'll know what the tests are going to be on. So if there were no rules, I mean there aren't really rules. The only rules that are like the quizzes. It's not like you have to fill out the study guide. But you know, I have to fill out the study guide just to

♦ Uh huh. I think it's helpful. Like if this class, it wasn't a computer course and I wasn't playing a sport, like if it was in the morning, I think it would be kind of hard to make myself go because, I don't know, I really wanted to take the course but I just think it's kind of, it's not as interesting as I thought would be the instructors I think.

♦ Just simplify it. And add more pictures.

♦ And I'd say, and not the Game Plan, just like you know, to go to the week schedule, click, something that's simplified. Just because when I first logged on the first time ever I didn't know where to go.

♦ [How would you rate the quality of the navigation?]

♦ Not too good. Just because I had trouble finding my way.

♦ [How would you rate the quality of the look and the feel of the web site?]

♦ It looks good. But again, it just kind of bothers me in the way it goes across. Just because I don't follow things very well across. I mean that's me personally. I'd rather it would go down because I think I don't know, it's just the way I like things organized, going down.

♦ [organizational scheme?]

♦ It's very organized. I mean I like how everything's like for Monday it's like everything is there.

In addition to the standard components of a scenario, (context, action, and goal), user *likes* and *dislikes* (1.4) and ***user suggestions*** (1.5) were extracted to guide the redesign rationale.

1.4. Example User Likes and Dislikes

"Well I like how it has a main page where you can go to wherever you need to go. And usually I go to the Game Plan. Once I get there I like how the weeks are on the top but I wish there was some type of signal showing you what is current. I don't like how the Monday and Wednesday are separated into their own little

section, because that can get kind of confusing. And but I like the setup of how it has practice quizzes and stuff to do that helps, and then the quizzes for credit. But I don't think that the reflective questions are really helpful. I don't know if anyone I know uses them. I've clicked on them a couple of times and it just asks, I don't really remember. But we don't have to, and it's not required so I don't go there."

1.5. Example User Suggestions

" Probably have a page where it says what week do you want to go to and you click on 1 through 16 [weeks of course]. And then say you're on 12 then it'll say, once you click on 12 it'll just show you just 12 stuff. Instead of being like the whole calendar you can scroll down through 13, 14, 15, 16.

…Maybe if like, like in the new section have like reminders. I know you know that we should know stuff on our own but it's, …it'll be helpful to see that you know, now we have a lab coming up. Say "don't forget lab is due". You know when to turn it in. …Probably more attractive, more appealing. More colors and probably more decoration. It's a little plain. But I like to have a little decoration and extras for everything. So I probably, but I mean not everyone is going to like that so maybe something straightforward would be fine."

2. Re-tooling the Scenarios
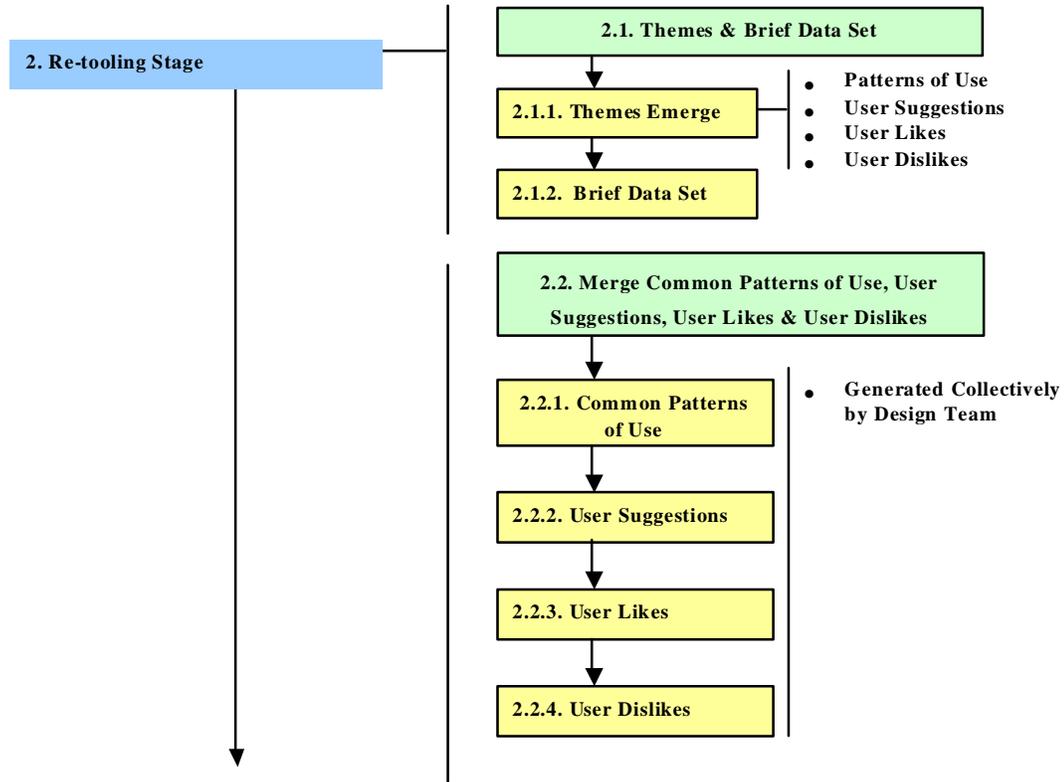
Figure 6. Re-tooling Stage

Figure 6 is a visual representation of the steps involved in the re-tooling stage of scenario based design.

It is important to point out that the preceding scenario generation is the foundation for the re-tooling process. In other words, each of the four steps in the scenario generation is contingent upon the results of the previous stage. Thus, once the scenario generation was performed, the formative evaluator/researcher extracted important design considerations from them. These considerations formed the basis of the action section then viewed by the design team.

Step 2.1. Common Themes and Brief Data Set

In Step 2.1 the instructional designer and evaluator/researcher extracted *common themes* forming the **brief data sets**. During this step, the design team extracted patterns of use, user suggestions, likes and dislikes from both the interview transcript and the action section. The reason for using both the transcript and the action section was to allow the designers access to the context, which could have been diminished or distorted in the action section. This step reduced the action section forming brief data sets of each of each interviewee. Table 5 represents the action section in its reduced (brief data set) state.

Table 5

Action Section From Interviewee #9: Brief Data Set

Common Patterns of Use

♦ bookmark game plan
♦ click down for the study guide
♦ use the Powerpoint On-line
♦ lecture on-line [study from that]
♦ take the practice quizzes
♦ take the real quizzes

User Suggestions

♦ reflective questions were a hassle, I believe I can do this myself
♦ I had trouble when I first started
♦ go to homework
♦ go to practice quizzes
♦ It's got all of the information there but it is confusing how it goes across
♦ I'd like to go down
♦ make it more condensed
♦ I like something I can turn on & find my stuff
♦ I would like to be able to bookmark days
♦ have previous weeks list
♦ I wish the quizzes were like Whiz Quiz
♦ practice quizzes on the web are really helpful for me

- ♦ crashing is a big pain
- ♦ I like lots of pictures
- ♦ more pictures in PowerPoint
- ♦ simplify it & add more pictures
- ♦ [navigation] not too good, I had trouble finding my way
- ♦ it's very organized
- ♦ the site looks good
- ♦ I like things organized going down

User Likes and Dislikes

- ♦ I like my Entomology class [web design]. Its in a column with grades, practice quizzes, lecture notes, office hours [Entomology class]. It is simple
- ♦ we are fortunate to have practice quizzes
- ♦ I like lots of pictures in PowerPoint
- ♦ I don't like things organized going across
- ♦ I don't like the server crashing

2.2. Merge Compile Common Patterns of Use, User Suggestions, User Likes and User Dislikes

The next step in the retooling process merged the brief data sets across all subjects to represent a global scenario of use representative of the population. To accomplish this task, the design team met for two, half-day meetings to collectively compiled common patterns of use and user suggestions. Using the brief, action data set as a point of reference, the design team drew flow diagrams on a white board, similar to a traditional classroom chalkboard.

2.2.1. Merged Common Pattern of Use

Typically, students either read the news page on the homepage or relied on email and the listserv. Most students would navigate to the Game Plan first and most students had this page bookmarked instead of going to the homepage and then to the Game Plan. The Game Plan was a web page in the course web site, that organized course activities in a table, by week. Students could access each activity with a hyperlink, and students would then click on anchors or scroll to the week of

study they were on. Students usually printed the study guide as well as the labs if labs were available for that week. Students then opted to attend the lecture in class or do the lecture on-line to fill in their study guide. Some students would do both. When a video was listed as a resource, students chose to attend class to view the video or watch it on the university cable television. Students would then do the practice quizzes on-line. Several students took the practice quizzes many times until they felt comfortable enough with the content to take the real quiz. Finally, the students would take the real quiz on-line. Students could only take the real quiz once. The self-regulation section, the journal, and the topic outlines were among the less common patterns of use by the students.

Patterns of use were derived from the interviewee's description of how they typically used the web site in a given week. Common themes emerged such as, going to the Game Plan, printing the study guide, viewing the lecture on-line, taking the practice quizzes, and taking the real quizzes. The students interviewed worked through the previous tasks but were only required to take the real quiz on-line. In other words, they were not required to use the web site for anything except to take the on-line, real quiz. Thus, these students derived their own sub goals to study or prepare for the real quizzes and exams.

The design team collective agreed that the following figure (7) summarizes student common patterns of use of the course web site.

Design Team Meeting
June 18, 1998
10:00 a.m. – 1:00 p.m.

```
┌──────────┐                    ┌──────────────┐
│  News    │                    │ Email/Listserv│
└──────────┘                    └──────────────┘
        Read or Don't **Read**

┌────────────────────────┐  ┌────────┐  ◇      ┌────────┐
│ Game Plan or Bookmark  │  │ Anchor │  or     │ Scroll │
└────────────────────────┘  └────────┘  ◇      └────────┘

                                                        In Class

┌──────────────────┐   ┌──────────────────┐
│ Print Study Guide│   │  Actual Lecture  │
└──────────────────┘   └──────────────────┘
       ◇        ◇                      ◇           ┌──────┐
       if       or                  fill in ?      │ View │
                                                    └──────┘
   ┌──────┐   ┌──────────────┐
   │ Labs │   │  Do Lecture  │
   └──────┘   └──────────────┘
                                                        Cable TV

┌──────────────────┐   ◇
│ Do Practice Quiz │   times
└──────────────────┘

                         ⬭ The Only Requirement Goal for
                            the Entire Web Site

┌──────────────────┐
│  *Do Real Quiz   │
└──────────────────┘

┌──────────────────────────────┐
│ Take Test (In Class or Proctor)│
└──────────────────────────────┘
```
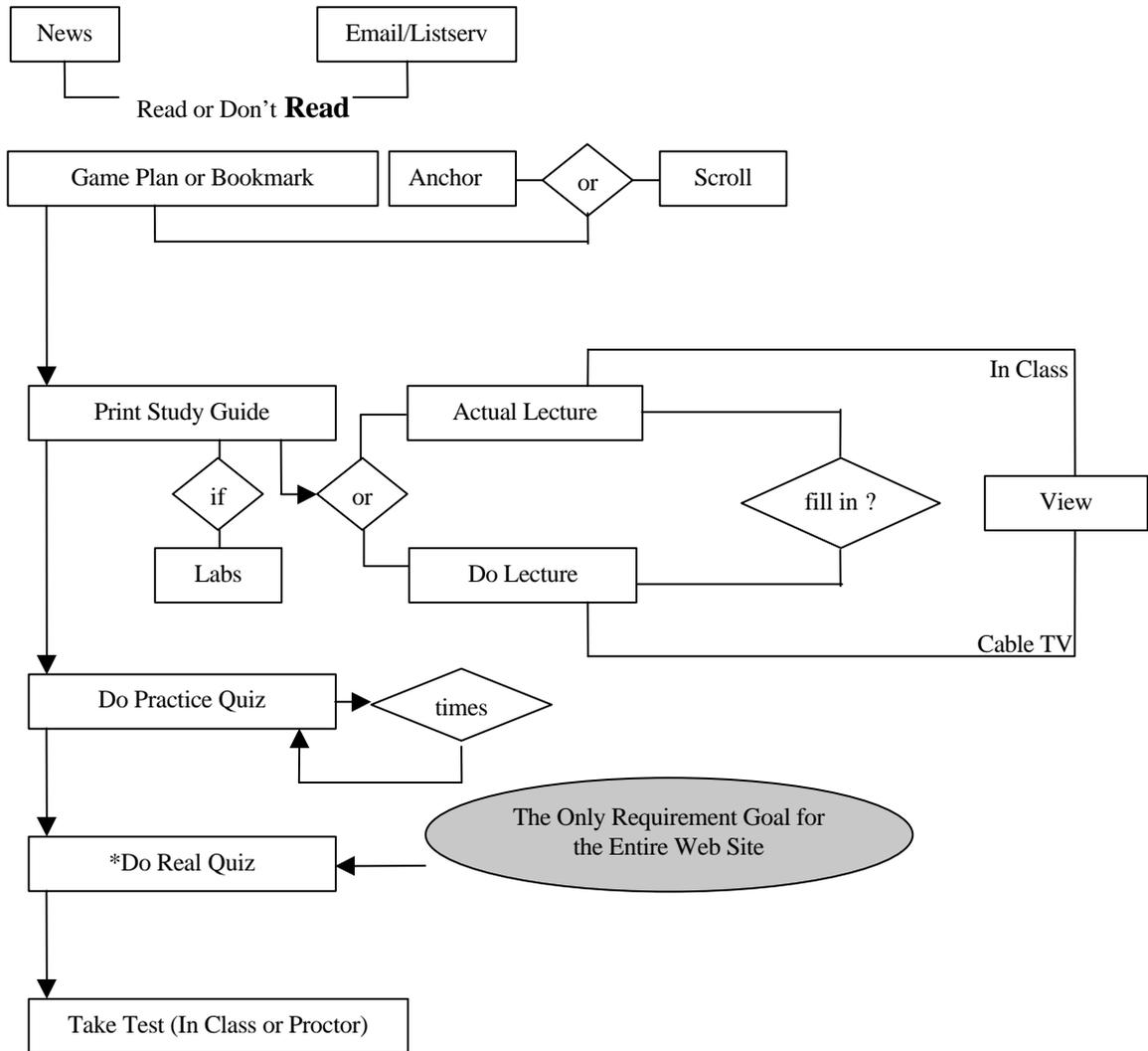
<u>**Figure 7.**</u> **Common Pattern of Use.**

The topic outlines, on-line journal and self-regulation components of the web site were not used frequently if at all by the students. The figure (8) below represents the less common use pattern of the typical student.
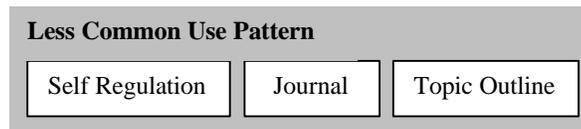
Less Common Use Pattern		
Self Regulation	Journal	Topic Outline

Figure 8. Less Common Use Pattern.

2.2.2. Merged User Suggestions

Again the design team used the brief data sets to generate common user suggestions from the sample. The suggestions emerged during the discussion. Students said: "…easier if it would highlight like this is week 2 and I could click on that. Agree with suggestions that different weeks be different colors (but I don't think it would help me know what week it was on) Would add more graphics, a little fun stuff. Would have main page where we could click on week 1 and would go to stuff you need. Put some practice quizzes and quiz for credit. Add news section. Say something in news once a week to make it consistent. Maybe a guest book where people can say stuff about what they feel or post questions and everyone can see what they are asking. Questions Rogers can answer for all to see. Like a main page that has a link to where it can show things that people have said most recently and then kind of go from there to past. Have a page where it says what week. Keep both forms of organization. Could look at calendar or just go to practice quizzes. Make more attractive, more appealing, a little decoration, but some may like it straightforward."

The table (6) below represents the design team's compiled list of user suggestions.

Table 6

<u>**Design Team's Final List of User Suggestions**</u>

♦ List of due dates and reminders
♦ Grades on-line
♦ Management History
♦ Organize by artifact but many liked the original table layout (maybe both options)
♦ Table organization by dates, weeks, and chapters
♦ Discussion forum to communicate or simulate a study hall
♦ Get all options all of the time
♦ Add video guides in the Game Plan
♦ Eliminate the redundancy in self regulation section
♦ Add scores to quizzes
♦ Backup plan for server crashes
♦ Backup plan for quiz crashes
♦ Add a quiz confirmation feature

2.2.2. Merged Common User Likes and Dislikes

The design team followed a procedure similar to that used with common patterns of use and suggestions of use to consolidate user likes and dislikes. A single list was not generated for user likes and dislikes collectively by the team, but the comments were discussed at length and used for supporting data in the next stage (claims analysis).

2.2.3. User Likes

The students generally liked the following attributes of the web site. Overwhelmingly, students liked the ability to take practice quizzes on-line. Several students used them to study as one of their personal sub goals of the web site, meaning that practice quizzes were not required from the instructor, students chose to use them. A number of students took the quizzes several times for each chapter

prior to taking the real quiz. Interviewee number twelve stated that it was "really helpful to have practice quizzes."

A second goal for most of the students interviewed was to download the study guides and print them out either prior to class or to working through the lecture on-line. The students would fill in the missing information during class or while viewing the lecture on-line. Third, students generally liked how the web site was organized. Interviewee number ten stated, "I like having it so extensive and having everything on there and the lecture is there and the study guide. …I like the quizzes. …I like the organization because it works." Interviewee number thirteen added, "I like the web site. Think it's a great idea, especially like the practice quizzes."

Another student said,"…[I] like how has main page where you can go wherever you need to. …[U]sually go to Game Plan. Once there I like how weeks are on the top but wish there was some signal showing what is current. Don't like Monday and Wednesday separated. But like setup of how it has practice quizzes and stuff to do and then quizzes for credit."

2.2.4. User Dislikes

Users of the web site primarily had two main dislikes, the technical problems (server crashes) and the reflective questions, with a few less common complaints. The less common problems were difficulties in performing tasks like finding due dates, waiting for pages and quizzes to download, confusion about week numbers, and visual limitations of screen size.

The main dislike about the site was that the server would crash. This was the most serious pitfall for the web site. The server would go down prior to a real quiz or exam because so many students were using the web site to study. Due to the limitations to FileMaker Pro, the quizzing database, this part of the site could only support twenty-five simultaneous hits. With a class size close to three hundred, this is likely to happen frequently prior to testing.

The second most common dislike about the web site was the reflective question section, primarily because they were redundant. The reflective questions

were originally designed for students to self-regulate and to provide information on terms such as extrinsic and intrinsic motivation. The students either stated that the questions were the same questions over and over or that they thought college students should be able to control their own self-regulation methods.

The following quotes show individual frustrations with less common dislikes of the web site. Interviewee number one described, "…trouble finding when tests and quizzes are due." Interviewees number four and eleven said, "Might get confused whether it is Monday or Wednesday." Interviewee number nine, "Can only see three blocks in my room. …Don't like the set up across." Interviewees number ten and eleven, "Quizzes take a long time to load." Interviewee number eleven, "Thought that Monday and Wednesday in own sections that they were two different weeks. But later she [the instructor] put M & W in one block. Takes a long time to download quizzes especially near quiz time. Don't think reflective questions are really helpful. It's not required so I don't go there. Get confused with weeks being split in Monday and Wednesday."

In summary, the common patterns of use, common user suggestions, and the common user likes and dislikes became the foundation of the claims analysis.
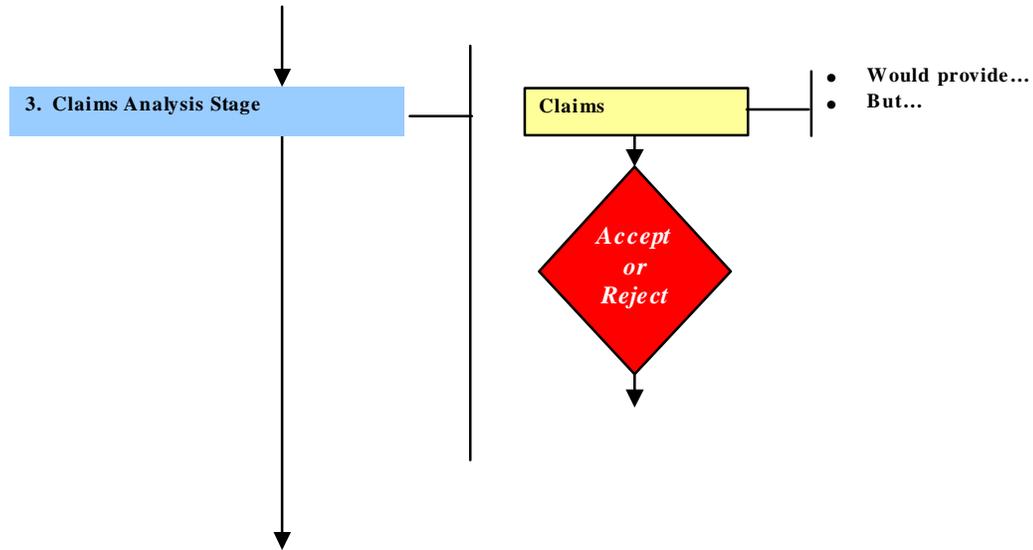
3. Claims Analysis

Figure 9. Claims Analysis Stage.

Figure 9 is a visual representation of the steps involved in the claims analysis stage of scenario based design.

Claims were made after the re-tooling stage. The claims analysis process used the design team's collective data set. This data set came from the final list of common patterns of use, the final list of user suggestions, and the general context of user likes and dislikes and formed the foundation for decision-making in this stage. The claims analysis provided a systematic way to record and reflect on design artifacts (Carroll & Rosson, 1992). For example, putting a button bar on every page became a design artifact. How this change affected the entire web site as well as the organization of the other artifacts needed to be looked at carefully. Both positive and negative comments and types of interaction of the design

potential change were discussed and included reasons to consider in the redesign and what not to consider. In other words, the redesign considerations were either accepted or rejected. Another consideration was to determine what impact incorporating a new artifact would have on the other design artifacts and the navigation. For example, a redesign consideration such as placing a navigation bar on every page would verbally produce claims such as the following (See Table 7):

Table 7

Example Claims Analysis

Redesign Consideration: Place a navigation bar on every page

♦ *would provide* consistent navigation from page to page.
♦ *would provide* quick navigation to frequently used pages.
♦ *but* some of the buttons may be used infrequently.
♦ *but* a button bar would change the look and feel of the whole design.

___Accept Redesign Consideration
___Reject Redesign Consideration

The claims analysis discussion formed the foundation for the redesign of the web site.

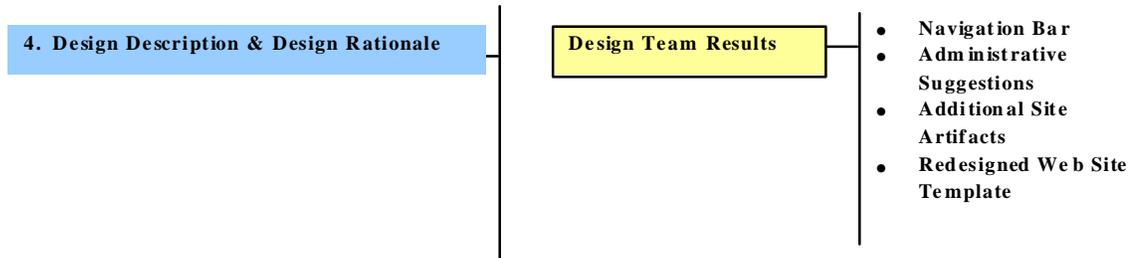## 4. Design Description and Design Rationale

Figure 10. Design Description and Design Rationale Stage.

Figure 10 is a visual representation of the steps involved in the design description and design rational stage of scenario based design.

The design team used the results from the claims analysis, which then became the redesign rationale. The design supported the concept of narrative. The team considered the scenarios given by the students and derived conclusions from what the students said.

The design team added and modified artifacts envisioned by the users and redesigned the main navigational scheme of the web site. In using structured dialogue between users and designers to increase designers' understanding of specific domains of users' work (Erskine, Carter-Todd, & Burton, 1997), it was important to remember that these scenarios were from the perspective of the end users and were meant to recommend a framework for redesign.

Results From the Team Discussion

Results from the design team agreement are as follows. Interviewees expressed many frustrations of clicking the back button to navigate or being forced to enter a page via another page. To remedy this frustration, the redesign of the web site will include a consistent navigation bar linking to the most used areas of the web site. This bar will be placed across the top of each web page. The students will be able to view the navigation bar in view at all times. A second frustration

was the necessity of scrolling through many screens within the Game Plan page. To remedy this problem, a frame set will be placed only on the Game Plan page to avoid endless scrolling. In this case frames seemed to be a possible solution to the scrolling problem for this web site. Even though frames can be very problematic, creating frames within frames and so forth, careful attention has been made to keep the web site tight while allowing the user to exit the frames of the course when leaving the site for external materials. When this happens, the users will be at the mercy of the navigation of the external sites. A common technique thus far for students using this site is to press the back button several times or reload their bookmark of the course's web site.

The frames will add a navigational feature that was not possible with the long scrolling calendar in the earlier version of the web site. Frames will also allow the navigation bar of buttons to be consistently available.

Tables 8, 9, and 10 were redesign considerations that were accepted for redesign implementation. Table 8 lists administrative suggestions for the instructor to consider. Table 9 represents the buttons to include on a navigation bar that will be on every web page in the course web site. Table 10 represents additional of web site artifacts recommended by design team and interviewees.

Table 8

<u>**Administrative Suggestions & Considerations**</u>

- Discussion (See Sections #11 This may cut down on email.)
- Guest book
- Feel
- People needs
- Content
- Server crash backup plan.
- Self-paced course. Totally independent.
- Testing centers or proctor site.
- Think through level of support and hand-holding.
- Additional Site Artifacts.
  - Video guides on-line.
  - Schedule prompts within the calendar.
  - Add links to external articles and references.
  - On-line lab submission through forms.
  - Pictures to PowerPoint.

Table 9

<u>**Navigation Bar Buttons**</u>

- ♦ About
- ♦ News
- ♦ Weekly Game Plan
- ♦ Master Schedule
- ♦ Grades
- ♦ Journal
- ♦ Planner (list of due dates)
- ♦ Discussion/Study Hall
- ♦ Help-Technical Support
- ♦ Syllabus
- ♦ Email

Table 10

<u>Additional Web Site Artifacts</u>

- ◆ In the Game Plan Table
  - ◆ Add Schedule Prompts
  - ◆ Add Video Guide
  - ◆ Add Links for Additional Articles and References
- ◆ Page Template
- ◆ Navigation Bar
- ◆ Home Page (user login)

      Figure 11 represents the early drawing of the redesigned web site that would be used to communicate with the programmers on the design team to develop. Figure 12 is the actual web site template, which includes the new navigation bar, course logo, content location and copyright. The content location or gray area is the only visual change from web page to web page. Everything else on the template will stay consistent, both visually and functionally.

      Figures 13 and 14 show the original web site page and the redesigned page after going through the scenario based design process. Figure 13 is the home page of the web site that initially included several navigation buttons that students wanted included on every page, not just the home page. Figure 14 is the GamePlan page, which was the schedule of events listing for the course. The figure (14) shows visual changes made to original GamePlan web page and how it was redesigned.

| Logo | Secondary Button Bar |
| | Primary Button Bar |
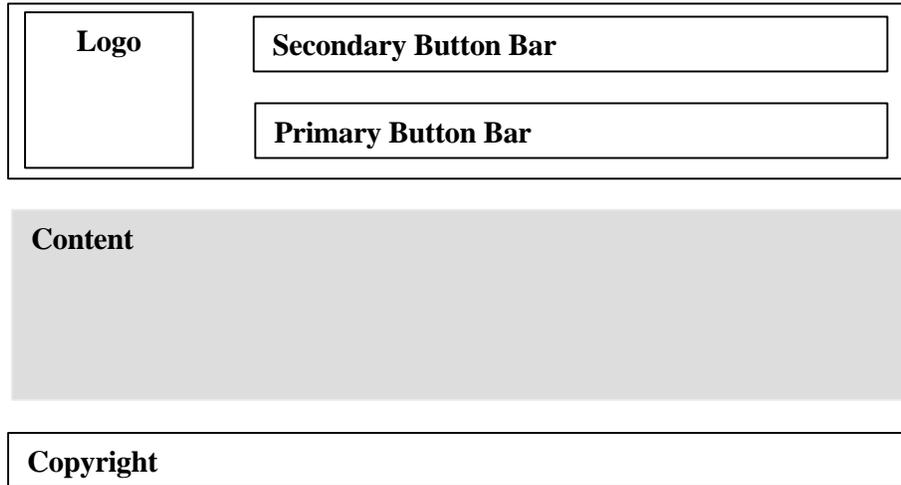
Content

Copyright

Figure 11. Redesigned Web Site Template.

Human Development I:
Childhood & Adolescence

Technical Help   Schedule   Syllabus   Grades
About the Game   Study Tools   Q&A   Email

Content Location: Use gray area as a guide.

FCD 1004, a "VaTech" CyberCore Course
Copyright © 1997-99 Virginia Polytechnic Institute and State University
ALL RIGHTS RESERVED

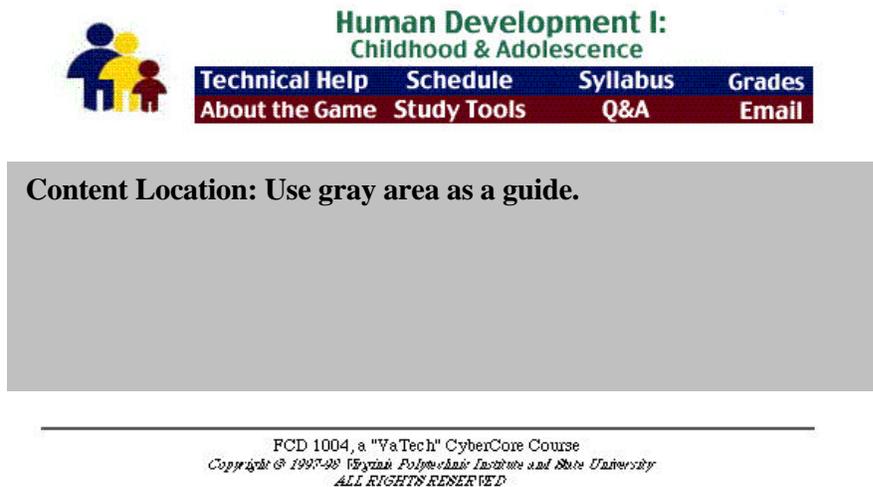**Figure 12.** Actual Web Site Template: Navigation Bar, Course Logo, Content
Location and Copyright.

Original Home Page

Redesigned Home Page

Figure 13. Home Page: Original and Redesigned.

Original GamePlan   **Redesigned GamePlan**

Figure 14. GamePlan: Original and Redesigned.

Problems That Might Be Encountered By Users

Printing the frame may be a problem. Students may need to learn how to print frames to be able to print the study guide. Frames can also be problematic when navigating to external web sites causing frames within frames. This is not a big problem if the user has a large monitor, but the screen design of this web site has focused on the fourteen to fifteen inch monitor sizes (640 X 480) to accommodate most end users. Second, frames are more difficult to program. Given that the goal of this site is to make it solely maintainable by the instructor and graduate support staff, frames could pose technical problems for common updating and maintenance.

Triangulation

To make the study stronger, two data sets were used to cross reference the validity and reliability of the data collected and analyzed through the scenario process. The first, and strongest, data set was generated by the instructional designer of the team. She processed the scenario data, duplicating the analysis process (scenario analysis and re-tooling) of the evaluator/researcher to make sure that the data generated by the evaluator/researcher was valid. The second data set was from the instruction design side (content and learning) of the formative evaluation. In addition to this case evaluation, the instructional design team evaluated the effectiveness of the instructional content of the web site. This happened through various stages of the design of this project (one-on-one and small group). In general, similar comments and suggestions emerged from both data sets even though there were different questions and evaluators involved.

DISCUSSION

As technology is increasingly incorporated into the culture of education, methods must be developed to ensure that it does not distract the student from learning the content. The instructional design must empower students as managers of information by guaranteeing that usable infrastructures are available. Much Human Computer Interaction literature focuses on interface design. Historically the research base in instructional design has not focused on interface development or usability. Although the Dick and Carey (1996) model does provide for various levels of formative evaluation as discussed in the literature review of this document, it does not separate the interface or usability aspects of a system from the instructional design components of course development. The need to evaluate the interface design is very important, especially if instructional designers are to continue developing interfaces. As in most cases, resources are scarce and sometimes designers must wear multiple hats on the design team. For example, the instructional designer may also be the interface designer or the evaluator may also be a programmer. Here at Virginia Tech, instructional designers are recognizing the importance of design team roles and are building teams with experts in both instructional design and HCI. A very good example is a current project in Veterinary Medicine. Their design teams not only include instructional designers, instructors, and programmers but they also include interface designers and usability specialists.

HCI and usability specialists have implemented several testing stages for usability. Some are more formal than others, yet the idea behind formative evaluation is to find problems with the system prior to large scale implementation. Using scenario-based design technologies as another component of formative evaluation early in the design process would be ideal for identifying strengths and weaknesses. In this study, using the scenario-based design process as a method to evaluate an existing web site has shown great promise for supporting and enriching a redesign rationale. By examining the statements generated by the students, the

design team was able to identify and remedy design flaws. In this case, the students seemed surprised, initially, that the design team wanted their opinions about the course web site. The point here is that user's opinions are rarely sought. Luckily, they were not reluctant to comment once they were informed of the confidentiality of the evaluation process.

Through scenarios, the students gave the design team valuable insight on how they actively used the web site. They described their successes and failures in great detail. The students described both positive and negative aspects of their experiences that, otherwise, the design team would have only speculated. The design team was able to organize these descriptions to support redesign considerations for the course web site using scenario-based design tools.

LOOKING AT SCENARIO-BASED DESIGN AS A PROCESS

Most instructional design models do not focus on interface design as a separate component in the instructional design process even though interface design has been studied since the early 1980's in the field of Human Computer Interaction. Instructional designers are assuming the responsibility of interface design without much, if any, expertise in the field. In most cases, interface design is ignored in instructional design processes. This is not to say that designers should not design interfaces, but they do need to focus on interface design as a legitimate component of any design project. In this case, the course web site was evaluated using scenario-based design tools that focused on the interface design and usability after a semester of use. Decision making processes surfaced through this cycle and the student scenarios played an important role in either accepting or rejecting redesign considerations. Scenarios and claims tend to document the design consideration process.

The design team added and modified artifacts envisioned by the end users and redesigned the main navigational scheme of the web site. In using dialogue

between users and designers to increase designers' understanding of specific domains of users work (Erskine et al, 1997), it is important to remember that these scenarios were from the perspective of the end users and were meant only to recommend a framework for redesign.

FORMATIVE EVALUATION COSTS MEASURED IN TIME

A great deal of time was spent on the design, development, evaluation and redesign of this course web site before and after it was implemented. The process was not difficult but was very time consuming. However, the more time spent on the front end of a project, the more problems can be thought through and solved prior to implementation. The table (10) below summarizes the amount of time spent on each task during the formative evaluation process.

Table 11

Formative Evaluation Costs Measurement in Time

Number of Team Members	Time on Task	Design Process Task
2	5 hours	Organization and Planning
1	30 minutes	Interview Rehearsal
1	2 weeks	Schedule Interviews
1	1 week	Build & Test Database
1	30 minutes	Post Demographic Survey
1	2 weeks	Monitor Database
1	30 minutes	Send Participant Requests to Instructor
1	1 hour	Instructor Forwards Request to Students
1	30 minutes	Send Reminders to Students
1	30 minutes	Follow-up Thank You to Participants
2	45 hours	Audio-tape (15) Transcripts
2	1 hour	Meet with Instructional Designer
1	2 hours	Enter Transcripts into Database
1	15 hours	Reduce Transcripts into Action Section
2	2 hours	Meet with Instructional Designer
2	15 hours	Reduce Action/Transcript to Patterns of Use and User Suggestions
	3 hours	Meet with Instructional Designer to Compile Common Patterns of Use
3	3 hours	Meet with Instructional Designer and Graduate Student to Compile User Suggestions
3	2 hours	Meet with Design Team to Build Redesign Rationale
5	2 hours	Meet with Design Team to Design Graphics and Code the Prototype
5	2 hours	Meet with Design Team and Instructor to Demo Redesign Prototype Finalize Design Decisions and Discuss Future Plans

With the diverse backgrounds of the design team and limitations of the technology, agreements on some of the artifacts of the redesign seemed to be laborious. Team members learned from the other team members, sometimes with

large learning curves. For example, common crashing of the quiz server was caused by too many simultaneous hits. However, the optional quiz system that would support large numbers of hits did not meet the instructional objectives of the instructional design. This system limitation posed serious problems for both the students and the instructor, given that the students were required to take the real quiz on-line.

In this case, the technology limited the instructional goals as it was decided to change quizzing systems to accommodate the system limitations. It was decided to keep the FileMaker Pro quizzing system for students to practice and take the real quizzes using WhizQuiz.

For approximately six months the quizzing system was a concern. This continual crashing problem to the students and faculty member was the determining reason to change the quizzing system even though, with class numbers less than fifty, the original quizzing design worked without crashing the server.

NAVIGATION

Overall the navigation of the original web site was acceptable to the students. Several students mentioned during the interview that they liked the way the web site was and that it was easy to use, but a major frustration for them was the consistent crashing while working on the quizzes. Even though students were generally happy with the web site, they made several suggestions for improvement. The design team was able to incorporate the users' suggestions into the redesign rationale.

Overall, the scenario collection process and point of view of the end user provided the design team with an insight that otherwise could only have been speculated. The end users informed the design team of common problems and irritations imposed on them by the web site design, as well as described the components that were acceptable for them to use.

Future users of the scenario-based design process, who happen to play the role of evaluator, should look at the situation of the design team carefully. Early in the design process of this particular case, the evaluator became a programmer, then an evaluator, then back to a programmer. There is really nothing wrong with serving multiple roles on a design team if the evaluator can be objective. Looking back on the process, the evaluator's programming background may have pointed the design team in a biased direction. Even though the student interviews supported the redesign rationale, the various technological experiences of the design team members may have directed discussion.

CONCLUSION

The interface of a course web site is the window through which a user communicates with the system and retrieves content and pertinent information. A well-designed user interface makes it easy and natural for users to perform a specific task. The user's performance then becomes a series of tasks that they, then, transform naturally into subtasks and map to the system's functions. Thus, "A poorly designed system requires its users to decompose tasks in unnatural ways and …mapping is then prone to errors" (Preece, 1995, p. 14).

This study supports the contention that "The primary goal of the designer is to facilitate the extension of the users' on-going workplace inquiry to include the application of digital technology" (Erskine, Carter-Todd & Burton, 1997, p. 173). Educational technology encompasses the maintenance and development of computer hardware, software, and the systematic foundation for developing instruction. Increasingly instructional designers are processing and transferring information using computers or electronic delivery systems without expertise in HCI. The World Wide Web is a logical tool for instructional designers to use as an inexpensive delivery and communication system. Many groups communicate through the Internet: programmers, producers, editors, content specialists, users, and designers, especially instructional designers. For example, instructional designers are developing web sites for course materials, interactive CD-ROM packages, drill and practice computer programs, course notebooks, delivery systems, and on-line courses. An important aspect of the designer's role is to produce web sites that do not confuse or frustrate users. Successful web sites represent the wealth of information and provide a user-friendly interface through simplistic navigation and organization. Good design means content, pertinent information, and navigation. Thus, one of our main jobs as instructional designers is to clearly communicate information and instructional concepts to an end user.

How does the focus on interface design techniques augment the formative evaluation process in order to promote good web based design including effective navigation? What is the value of the scenario-based design process? Formative evaluation is typically a process of testing prior to implementation in both instructional design and interface design. This study concentrated on the design of the user interface, apart from other instructional design issues. The scenario-based design process opened channels of communication between end users and the design team about the web site interface (Carroll, 1995, Erskine, Carter-Todd & Burton, 1997; Johnson, Johnson & Wilson, 1995.) Not only did the end users give descriptions of their experiences but they were also forthright in giving recommendations to improve the web site. Without the end user's perspective, the design team could only guess about the way the system would be used. By communicating with end users, usability issues can be solved prior to implementation of the system (Erskine, Carter-Todd & Burton, 1997; Johnson, Johnson & Wilson, 1995). It is important to know the audience as well as their work habits. The usability testing in this study identified the target web site's strengths and weaknesses in the following areas: Interface design, navigation, common errors, usability and aesthetics of the web site (Rubin, 1994).

To expand the research in scenario-based design, work needs to be conducted in: enhancing cost reduction, incorporating the process into different components of instructional design models, exploring team decision-making and synergism (Engleberg & Wynn, 1997), and allowing student ownership in the building or transformation of a system.

In conclusion, although formative evaluation has been part of instructional design models for decades, this case augmented the standard models by generating valuable information and rationalizing redesign considerations of the system interface through scenario-based tools and techniques. Designers will continue enhancing the design process by adapting to the needs and practices of users, by acknowledging the social nature of design, and by developing a better understanding of how concrete artifact development supports communication and

making decisions (Erskine, Carter-Todd & Burton, 1997 and Johnson, Johnson & Wilson, 1995).

This process of decision making is directly related to specific organizational contexts. Design decisions ought not to be made in isolation. They may be related in different ways and may require certain consistency to be maintained. As shown using scenario-based design tools, a sequence of design decisions can be viewed as a decision tree that links tasks to sub-tasks and finally to specific end solutions. Managing dependencies among design decisions is important for collaborative design, since decisions change frequently and impact other design plans. As computer-mediated instructional materials continue to grow in importance, instructional designers and developers need to expand their design processes to accommodate the special characteristics of new delivery mechanisms. Thus, further research and development must transpire to ensure that tools enhance design processes.

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APPENDIX A

SCENARIO GENERATION INSTRUMENT (SGI)

Full Name (please print) _____

Student ID_____ **Email Address** _____

[Directions]

The following questions pertain to the course web site interface. Write your comments for the following questions in the spaces provided. If additional space is needed, please use the back of the document pages and *write the corresponding question number beside each your comments.* **Your comments will be used to redesign the existing web site for future courses. Thus, please be as detailed as possible with your comments. If you have questions or need assistance, please raise your hand.** *Thank you for your assistance in this project and ALL of your comments will be kept strictly confidential.*

[User Context]

1.   Describe yourself (for example: academic level, education level, age, sex, major, and etc.)

2.   How many years have your used a computer?

3.   How many hours per week do you use a computer?

4.   How many hours per week do your use the Internet?

5.   In your own words describe your general attitude toward computers?

[Goals]

6.   Why do you need or want to use this web site?

7.   How would you like to use this web site?

8.   What would you like to see added to this web site?

9.   What changes should be made to this web site?

10.   How do you think computers should be used?

[Action]

11.   Describe how you would make your answers to the questions in the above [Goal] section *work* in a course web site. For example, how would you design the web site interface: How would you make your navigation and links work: How would you organize the site: How would you visualize the site: How would you make this web site better for future students?

12.   What do you like about the interface of this web site?

13.   What do you dislike about the interface of this web site?

14.   How would you make this web site interface better? (please give details)

[Other]

Please circle your answer to the following questions.

15.   How would you rate the quality of this interface?

a) Inadequate

b) Adequate-no serious problems

c) Very Good

d) Excellent

16. How would you rate the quality of the navigation?

a) Inadequate

b) Adequate-no serious problems

c) Very Good

d) Excellent

17. How would you rate the quality of the visual perception?

a) Inadequate

b) Adequate-no serious problems

c) Very Good

d) Excellent

18. How would you rate the quality of the visual theme?

a) Inadequate

b) Adequate-no serious problems

c) Very Good

d) Excellent

19. How would you rate the organizational scheme of this web site?

a) Much below average

b) Somewhat below average

c) About average

d) Somewhat above average

e) Much above average

f) I have not taken a course prior to this course that used web resources.

Other comments: If you have additional comments that you would like to add, please write them in the space below.

APPENDIX B

INSTRUMENT: ON-LINE DEMOGRAPHIC DATA

APPENDIX C

INSTRUMENT: INTERVIEW FRAMEWORK

1. Introduction
2. Description of the study
3. Purpose of the interview
4. Confidentiality
5. Consent Form
6. Audio-tape

Interview Questions
1. Background Information
2. Describe yourself.
3. How many years have you used a computer?
4. How many hours per week do you use the Internet?
5. Describe your general attitude toward computers.
6. What kinds of class related tasks do you do in the web site in a typical week? Be as specific as possible and assume that I know nothing about the web site.
7. Describe how you would like to encounter (use) the web site.
8. Reflect their scenarios back to them
9. Ask them how they would like the web site to be.
10. Ask them why they would like the web site to be as described.
11. What were some of the problems you encountered with the web site? Give examples.
12. How would you propose to fix these problems?
13. Summarize what you have said today. Pull out your key likes and dislikes about the web site then describe how you would like to encounter them in the web site.
    Imagine that you are redesigning this web site. There are no rules. Pull your ideas from your experiences and needs as a student in this course.
14. What would you like to be added to the web site that would meet your needs as a student in this course?
15. Describe how you would like to encounter the "added" features.
16. How would you like to use this web site?
17. Why do you need or want to use this web site?
18. What changes should be made to this web site?
19. How do you think computers should be used?
20. How would you design this web site?
21. How would you make this web site look?
22. How would you rate the quality of the interface?
23. How would you rate the quality of the navigation?

24. How would you rate the quality of the look and feel?
25. How would you rate the quality of the organizational scheme?
26. Do you have other comments?
    Thank you for your participation with this evaluation. I'll send you a transcript of our discussion.

INTERVIEW TRANSCRIPT #9

Interview #9

S: To begin with could you kind of describe yourself and why you took this class?

#9:   Well my twin sister Rebecca took the course last semester but she had a different teacher. And hers wasn't on the web. But she said, I mean it just looks interesting so, and I play sports. My best friend is my twin sister. And I like to take classes, you know that, she took Personal Health but she didn't like that but she liked Human Development. And then I took Entomology which is also web. I really liked that one.

S: (can't understand)

#9:   Uh huh. Mr. Mack. So she's taking that next semester. And so is my boy friend. Because I liked it so much. And I'm 18 years old, I'm a girl. I love Virginia Tech and I make pretty good grades.

S: Ok. Did you realize this course was going to be a computer course? Web based?

#9:   No I didn't. No I was, my sister when she had it last semester with the teacher who doesn't teach it anymore, she really liked it because it was like I guess, I like to take notes. That's the way that I like to get my information down, and she like took a lot of notes and that's good. Watch really interesting videos and like the tests were really hard she said. And now with like the cyber tests and the practice tests. I really like that because you can, you know, you can study those and she gives us all the tests questions but plus 150 more so it's not like you just have the test. You know you have to memorize additional information. But I don't know. I really like it.

S: Do you find you're learning the stuff?

#9:   Uh huh. Yea, I am.

S: Even after you memorize it for the test, can you still remember?

#9:   Uh huh. Yea. Just like, it's also like that with the Entomology course. I don't know why. I guess I don't forget the question or I just remember it.

S: How many hours a week do you use the internet?

#9:   For anything?

S: For anything globally.

#9:   A week. I probably say about maybe 7 or 8. Just because I like you know, maybe an hour to study or you know write e-mails to my parents and stuff like that. Not like a lot, lots of people like just sit at their computers all the time. I don't do that.

S: You play sports.

#9:   Yea.

S: Have a social life. Could you kind of describe your attitude toward computers?

#9:   Well my family has always had a computer since we were like really little. Like none of my friends had them but we had them because it was kind of like what my dad did. So I like them. In mean once like I guest used to using Microsoft Word and once I get used to how my computer is you know it's easy. But when I like go and use a new one I kind of have problems. Just because I'm used to mine.

S: Ok. Now here's a good one. This will probably be a long explanation. Describe what kinds of class related tasks you do on the web site in a typical week?

#9:   Class related tasks?

S: Yes, be very specific and kind of describe each step that you take, even how you used the web site. Like you start where you start on the home page or game plan, click, that kind of stuff.

#9:   Well I bookmarked the Game Plan. So I just go right to that. And then I click down, click on the icon for the study, the study outline. And _____ for rugby is the same time the course is so I'm usually not at the course. I mean at the physical class. So I use the web probably a lot more than the person who is going to class all the time. And so I feel out the study guide using the Powerpoints that are on the internet. The lecture on line. And then I study from that. We used to have to do the reflective questions and I don't know if those really helped me a lot, she required it for the first time. But I kind of thought it was like a hassle because they were like, they were like, I believe myself I can do this. I am good at making friends. Stuff like that. I don't think that really helped me. And, but then, taking the practice quizzes helps and the quiz for credit are good just because you know the practice quizzes go pretty much long with it.

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S: Ok. If you can think back, like when you first saw the web site. Were you confused at all? Did you find everything you needed? As you described it very, it doesn't seem like you have any problem getting the stuff you want and need. But early on was there a problem understanding what was up?

#9:   Yes there was just because of the I guess the layout, just because it's across. I don't know, it was kind of confusing and I didn't really catch on I had to get somebody to explain it to me. Just like how, like the schedule is and everything. And how it's called the Game Plan. I think maybe if it was like you know, to go to homework and practice questions and something like that. I mean it looks organized and it is organized but I just had trouble when I first started. Just because it was kind of like I don't know I guess I just had to work it out myself. You know work it out myself.

S: If you could redesign it what would you do to make it more usable for you?

#9:   I don't know. It's got all the information here but I just think it's kind of confusing how it goes across. So maybe I'd like go down. You know. Like go down like this. Because then it's also good you could see one of the two squares ahead of you. Just because, I mean, I got e-mail from her about a test but I was out of town on Sunday and I was like, good gosh I have a test tomorrow one of my friends told me. But if it was like this, you could probably see that you have a test you know. Instead of having to scroll down.

S: So on your screen in your room

#9:   This is all I see.

S: You can only see

#9:   Three blocks.

S: Are you seeing entire week. I mean three entire sets like is it going all the way over like G A M E, can you see the whole thing?

#9:   No. This is all I can see is three days.

S: Ok.

#9:   And then, so that time, I mean I e-mails from her that we had a test and I think about well we just had a test. And then sure enough we had a test. I got a B on it. I had three tests on Monday though so. Finding out about that at eight o'clock didn't help.

S: A little stressful.

#9:   Yea, very stressful.

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S: I know what you mean, I'm still in grad school. Well, let's get back to that, what would happen if you only saw one week at a time at all? For example, if you clicked here on week one, only week one popped up?

#9:   Only week Monday, Wednesday and that's the whole?

S: Yes.

#9:   That would be helpful but then again I really like to, I mean because exams in big red letters. And if I was like oh you know, I'll get on, but if it was like, I could see like a, scaled down version and I could look like a week or two ahead and I could see it.

S: So, you think maybe a listing of all the exams and the dates?

#9:   Yea that might be good. I mean, I probably have that in my syllabus but when I check, when I click on the web and then I just looking at week two and just scroll down to week two, and I scroll down one more I would see that we would have an exam. But, I don't know, I just think if it was like more condensed and you could see week for you know like that, then I could see an exam coming up.

S: Ok. I think I understand what you're trying to say.

#9:   I mean she sent me e-mails and everything but I mean, and she sorts in those practice questions and then, that was like a week or a week and a half before the test.

S: So if we could call something like maybe a Quick Glance?

#9:   Yea.

S: And maybe you clicked instead of week 1, 2, 3, you could click on a button we call Quick Glance

#9:   Yea.

S: Or whatever we call it. And it jumps to a generic overview and what would you like to see there? Just the exams or important dates?

#9:   Yea. Important dates like your quizzes due like that.

S: So you're not having to read each block?

#9:   Right. And then another then would be maybe a little note like just a reminder that your test is coming up. Something like that. Just because, I think in my Entomology one I had something like that.

S: Kind of describe that.

#9:   The Entomology one?

S: Yea. The, how it looked. Did you like that?

#9:   Oh yea. I really liked it because it was easy to follow. It had like a web page and then it was like, icons like go to practice test and then you just clicked on that and you would have like all these different whiz quizzes that you could take just for practice. And then you could click on it and get some information off the web about the topic we're talking about. It was called what's hot or what's new. And then like a fake students scores on tests and how they did. It was just different like that. I mean this one is good to. I don't know.

S: Would you like to add some of those things to this?

#9:   Yea, well, the practices quizzes are like the whiz quizzes. But it was just set up differently. Like it maybe it had a icon that said practices quizzes and then for the whole thing you could just do them over and over. I mean these are good. I don't know, I don't know. I just, it's kind of like they're thrown in I think. I mean, I know it's organized but I don't know. I just don't like the way it's set up. Like across.

S: Ok. You're the first person I've heard talk who has experienced the whiz quiz. Can you kind of compare the two of these quizzing systems?

#9:   Yea. What I really liked about the whiz quiz and not about the practice quiz is that when you take a whiz quiz, you, have you ever seen it?

S: Uh huh.

#9:   You, you know, you click your answers and then you hit return. And then you get back like, and then it corrects it for you. But on the practice quizzes, it's like you click it and it then it says no this is wrong, or no the answer is really B. But I like it when that, when I take the whiz quiz is like a real quiz. Hit it and then I will get a score. And then so my goal would be to get a 10 out of 10 at least five times just on what I'm doing. I like it because then I have a score. Not, because I mean when I do a question and they're like no it should be B, I'm not like physically seeing it marked as B you know.

S: Oh, you need to know what it means?

#9:   Yea.

S: What's the correct answer.

#9:   Yea. It tells you what the correct answer is. But I just like seeing it knowing exactly which ones I got wrong, looking at it as a whole, you know.

S: Ok. Now what do you dislike about the practice quiz?

#9:   Well we're really fortunate that we have practice quizzes. And I like that but that's just the main thing. Like that it tells you right away, you know. But I mean overall they're good. I kind of wish they were like the whiz quiz, is like they score it for you and you could see you know. But

S: Which do you like the best?

#9:   Whiz quiz.

S: Ok. That right. Now I have a question, did you experience any of the crashes and the

#9:   For this?

S: For the Whiz Quiz.

#9:   Oh. Maybe a little slowness before exams but nothing like this. When I learned that I had a test on Sunday I couldn't get a test, I mean I studied my notes but then I was like, 9:00 I was like ok, I'm going to try to study. And that's pretty early lots of people are in class you know. Couldn't get on, couldn't get a single

S: You're kidding.

#9:   No. And the first test it crashed. And she, I mean it was real frustrating for us because she's like, well we'll have the test in a week. So we were like yea, but gosh but I don't know why like the server goes down. And it kind of stinks because that's a great way to study. And it seems like everybody was on it. But it really wasn't like that for my Entomology course. And then like, well I don't know when I should start studying this to make sure not, to make sure everybody else isn't studying. And then it will crash. So then I'm like well I hope she moves the test but I don't know. She told us after the first one she wouldn't do it anymore.

S: Ok. Describe how you would like to encounter the web site.

#9:   What do you mean?

S: How would you like it laid out, how would you like to see it? If you could redesign it how would you do it?

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#9: I don't know if I like the Game Plan. I don't know, it's cute, it looks like kids blocks and everything. And there's the plan. I don't know, I just, I don't know. My biology teacher's home, everybody has like different home pages, but like my biology teachers is just like on the side, in the column. It's like grades, practice quizzes, you know, lecture notes, all this laid out. And then it's got like her office hours and all that. I mean that's simple. I think simpler is better.

S: You think separating each of those components into

#9: Yea. I like something I can just turn on and find my, find stuff. And like there's no reason I think for us to have the 14th of January still on here. Like I'll get on and I have to go all the way down to April. And I wish I could like bookmark it so it would like stays. But I don't know. It's kind of like it's a hassle. I mean if we could just turn it on and be right where we are. That would be great. I mean, but then some people would probably like to have I don't know, I guess with the exam it would be great. But I don't maybe if they could save it somewhere else like previous weeks or something like that.

S: Oh, uh huh. Anything else?

#9: No.

S: Ok. What were some of the problems that you encountered with the web site?

#9: Just the crashing. That was it. Which was a big problem just because I mean, practice quizzes on the web are a really good way, I mean are really helpful for me. I mean if they're like this and not like the whiz quiz. But gosh just when I, even when I, I like to see and I like to have a question pop up and then I have to think about it. But like instead when we get the questions for the test that she gives us with the plus like 1 through 50 questions. We have to look up the answers which can also be helpful. But then again I like to just pick because it's like on the test we're not going to be like looking up the answers we'll be like picking one of the answers. So the crashing was a big pain.

S: Ok. What would you like to see added to the web site and approach this as if you're the designer again? And there are no rules. You can add, take away.

#9: I like lots of pictures. Like if your talking about Erickson. And you know have a picture of him. I mean I know they're in our book but lots of people just use the web page. I mean we read also but it's easier to use. Like lecture on line, just study your notes and stuff. So maybe if they have more photos. Just because I like to know who I'm talking about. I mean I could always read it, you know, in the book but it's like to make it better. And maybe just like more pictures on the Powerpoint. I don't know. I just find those more interesting. Like how it was on our whiz quiz and then on our

Powerpoint pages for Entomology. They had lots of graphics and pictures of bugs and stuff like that.

S: Did you have any problems with Powerpoint? With working your way through it?

#9:   Huh uh. It's very simple.

S: Ok. That's good.

#9:   Yea. It is good.

S: Do you ever print them out?

#9:   The Powerpoint?

S: Uh huh.

#9:   No. I print out the study guides and then I go through the Powerpoint and write the stuff down. But I print out all my practice quizzes to study. My real quizzes for credit is what I print out.

S: Ok. Where would you like to add those pictures? You wanted to add them.

#9:   Just like on the lecture on line. Like the Powerpoint slides. Just like you know, talking about Mr. Erickson, just have a picture of him.

S: Ok. So not necessarily on the top layers. You want the picture in the actual lesson.

#9:   Yea.

S: Ok. If there were no rules, how would you like to use this web site as a student? And the instructor is not making you do anything.

#9:   I think if I didn't have to do anything I probably not follow very well. Just because since I don't' go to class this is what I have to be taught by. So I have to like, I have to have a quiz for credit just to get like some points you know. And I don't know, the, I mean, have to have a study guide so that I'll know what I'm talking about. I mean so I'll know what the tests are going to be on. So if there were no rules, I mean there aren't really rules. The only rules that are like the quizzes. It's not like you have to fill out the study guide. But you know, I have to fill out the study guide just to

S: For you?

#9:   Yea. I like that though. I mean the quizzes aren't bad. I like that nobody is like you have to do this.

S: Oh, ok. So how many times have you gone to class this semester? Just a guesstamation.

#9:   Oh, well, I was going, I mean if I didn't have to play rugby I would go probably to every class. But see another thing is when you go to class it's, it's not many people are there. Just because you don't have to go. So today's like it's mandatory. Everybody's got to be there so I have to go. But

S: And that's today?

#9:   Yea. She's done that like maybe 2 or 3 times. That it's mandatory. I guess it gets tiring not telling that many people when you're teaching. And another thing is like I don't

S: Oh I don't know. I think if the students are getting what they need here and you're providing an opportunity for them here, that's ok. I mean you take advantage of that if you want to or not.

#9:   Yea. It seems though sometimes it's like, I mean, we're in Litton Reeves, 1670 about around.

S: That great big giant one?

#9:   I mean like that room would only be like a fourth full. It'll just be empty almost. So I mean I guess, if I was teaching I think that would kind of aggravate me just because you know you're a teacher and you want to talk to people. But the only thing that my sister said, like her class is so interesting. And I feel like it could come, because it's done on the web or whatever, I mean I'm making better grades than she is. But she said it was so interesting and then when I go to class like you know, before the exam or whatever when she's talking. Or even sometimes in the middle of like topics like you know, just to throw out my study guide you know. I mean I probably go like seven times. But I think it's really boring. I think it's boring. Not, I mean, she's a nice lady and they have Burt Fox is like a TA but I don't know. I think it's kind of interesting stuff we're talking about. And I saw a birthing video that was really interesting. But I don't know. I mean I fell asleep in class one time. And it just kind of drones on and it follows the study guide to the T. So it's just like you go there to fill out your notes. And I mean I could do that back in my room you know. Which I do. I don't know. We've had some fun labs. The labs are fun. Like going and watching the kids and stuff. But I don't know. I think the class itself is kind of boring. And even, like six people in my hall are taking it, all of them. They don't even play sports and they don't go to class. So I don't know.

S: Well, ok. How do you think the computer should be used in a class?

#9:   In any class?

S: In particularly this one?

#9:   Well you have to use it for assignments and stuff. So if you didn't have a computer for this class or if you didn't have access to a computer, then you couldn't like pass the class. But I mean with all the computers that they have here, there's no reason you can't have access to one.

S: Do you like computers being used with courses?

#9:   Uh huh. I think it's helpful. Like if this class, it wasn't a computer course and I wasn't playing a sport, like if it was in the morning, I think it would be kind of hard to make myself go because, I don't know, I really wanted to take the course but I just think it's kind of, it's not as interesting as I thought would be the instructors I think.

S: How would you make the web site look overall? You've kind of touch base on that already.

#9:   Just simplify it. And add more pictures.

S: Ok. How would you rate the quality of the interface the way it is?

#9:   The quality of the

S: Yea, the kind of look and feel and where you click and understanding where to go and that short of stuff?

#9:   I don't know. Like I said I'd put like the icons down here I think.

S: Along the side?

#9:   Yea.

S: Ok.

#9:   That's just the way I personally like it.

S: Ok.

#9:   And I'd say, and not the Game Plan, just like you know, to go to the week schedule, click, something that's simplified. Just because when I first logged on the first time ever I didn't know where to go.

S: So the Game Plan did not mean to you schedule?

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#9:   Right. I mean it supposed to go to the Game Plan but I'm like what's the Game Plan I want to get my notes you know.

S: Oh, ok. So if we didn't change it what would make that easier for you to navigate through it? Maybe a little set of help

#9:   And explanation or something yea.

S: Ok.

#9:   I guess I'd have one right there. But I also don't look for things at the bottom, that's just me. I mean if it's going to catch my attention, I think it should be like bolder.

S: On the side. Ok. How would you rate the quality of the navigation?

#9:   Not to good. Just because I had trouble finding my way.

S: Ok.

#9:   That's just be personally. Once you get hear, I mean once you see this and you click on it then that's ok. Like if you're getting a study guide.

S: Do you think we should come up with the home page at all? Or put everything on this one page?

#9:   I don't know. I kind of like it sometimes when they have like two different ways to get to one thing. You know. So if you do like click here and go to the study guide, click here to go to the Powerpoint. But then you could also look at your week and you could also get access to it.

S: Ok. Excellent. How would you rate the quality of the look and the feel of the web site?

#9:   It looks good. But again, it just kind of bothers me in the way it across. Just because I don't follow things very well across. I mean that's me personally. I'd rather it would go down because I think I don't know, it's just the way I like things organized, going down.

S: How would you rate the quality of the organizational scheme?

#9:   It's very organized. I mean I like how everything's like for Monday it's like everything is there.

S: Is it the same way every time?

#9: Uh huh. It's good just because I know where to look now.

S: Do you have any other comments?

#9: Huh huh.

S: Thanks for your participation. And what I'll do I'll send you a transcript of our cassette tape.

V I T A

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EDUCATION

1994 - 1998   Virginia Tech, Blacksburg, VA

Doctor of Philosophy in Education

Instructional Systems Development

- Dissertation: "A Case Study Using Scenario-Based Design Tools and Techniques in the Formative Evaluation Stage of Instructional Design: Prototype Evaluation and Redesign of a Web-Enhanced Course Interface"

1992 - 1994   Salem-Teikyo University, Salem, WV

Master of Arts

Curriculum and Instruction

- Thesis: "Comparing Student Recall of Music Fundamentals Using Multimedia Technology vs. Traditional Instructional Methods"

1985 - 1990   Concord College, Athens, WV

Bachelor of Science in Education

Music Education

- Applied Areas: Trumpet and Percussion
- Concentration in Jazz Education

1985 - 1989   Concord College, Athens, WV

Regents Bachelor of Arts

PROFESSIONAL EXPERIENCE

1998   Virginia Tech, Blacksburg, VA

Office of Distance and Distributed Learning

- Research Associate
- Assistant to Dr. Tom Wilkinson, Director, Office of Distance and Distributed Learning

1996 - 1998   Virginia Tech, Blacksburg, VA

Faculty Development Institute Administrative Assistant

- Assistant to Dr. John F. Moore, Director, Educational Technologies
- FDI Workshop Facilitator, Instructor, and Developer
- Assisted FDI faculty and participants during workshops. Knowledge required: Designing, Managing, & Evaluating Distance Learning Courses, Interactive Video Conferencing, Synchronous & Asynchronous

Tools, Course Management Packages, FileMaker Pro (database management & dynamic WWW publishing), Adobe Photoshop, Adobe Acrobat, Adobe Distiller, Adobe Exchange, Microsoft PowerPoint, Microsoft Word, Microsoft Excel, Homepage Design and Development, HTML Editors, WWW Searching & Navigation, Video Capture, Scanning and Editing Images, and Macintosh and PC Operating Systems

1995 - 1997   Concord College, Athens, WV

Technology Consultant

- Drafted Concord's Strategic Technology Plan
- Designed and Developed the College Web Site
- Designed the Campus Network Architecture
- Drafted Computing Rules, Regulations and Etiquette Manual
- Received Successful EPSCOR Technology Grant
- Prepared and Delivered Computer Development Workshops for over 60 Faculty (PC & Mac Operating Systems, PowerPoint, Word Processing, Spreadsheets, Networking, WWW)
- Developed Data Management Systems Using Excel and FileMaker Pro
- Drafted a Comprehensive Assessment Plan for the Bachelor of Science in Education (Music K-12)

1995 - 1997   Concord College, Athens, WV

Adjunct Assistant Professor, Division of Business and Economics

- BGEN 210 (3CrH), Introduction to Computers in Business (DOS, Word Processing, Spreadsheets, and Databases)
- BGEN 420 (3CrH), Introduction to the Internet (History and Development of the Internet; Systems; Media(s); Research Techniques; and WWW Page Development)

1990 - 1997   Mercer County Board of Education, Princeton, WV

Educator/K-12

- Instrumental Music
- Choral Music
- General Music
- Systems Operator: Wade Elementary and Sun Valley Elementary IBM Lab

1986 - 1991   Concord College, Athens, WV

Coordinator, Summer Advising Program

- Program Operation
- Organized Faculty and Staff
- Scheduled Freshmen and Transfers
- Processed Advising Paperwork

1989 - 1990   Kanawha County Board of Education, Charleston, WV

Instrumental Music Director/Sissonville High School

- Concert Band
- Marching Band
- Jazz Band

PRESENTATIONS

1996   IVLA Conference, Cheyenne, WY

International Visual Literacy Association (IVLA)

- ***"Steps and Procedures in Designing a Portfolio: A Scenario-based Design Approach."*** Steps and procedures in the design and development of a professional portfolio. Theoretical foundation: the design and development of an electronic portfolio management system using a scenario-based design approach

- ***"Visual Design and Layout of a College Web Site."*** The design and development of a college world wide web site: A bottom-up approach to interactivity and visual appeal

1996   Computer & Technology EXPO, Beckley, WV

The Computer Technology EXPO (Sponsored by Concord College & Co-Sponsored by Cellular One and WOAY-TV 4)

- ***"Technology and Future Jobs."*** Discussion and roundtable: Current trends in corporate hiring related to technology.

PROFESSIONAL MEMBERSHIPS

- IVLA • International Visual Literacy Association
- AECT • The Association for Educational Communications and Technology
- AAHE • American Association for Higher Education
- EERA • Eastern Educational Research Association
- MENC • Music Educators National Conference
- IAJE • International Association of Jazz Educators

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