

EVALUATION OF THE GRAPHICAL INTERFACE TO A WORLD WIDE WEB-  
BASED COLLEGE COURSE OFFERED THROUGH THE UNC-CH SCHOOL OF  
PUBLIC HEATH DEPARTMENT OF MATERNAL AND CHILD HEALTH

by  
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This study describes a questionnaire survey of and interviews with students of the UNC-CH School of Public Health Department of Maternal and Child Health. The survey and interviews were conducted to evaluate the design of an interactive study guide offered as part of a World Wide Web-based college course.

The results of the study identified a discrepancy in the perceived success of the design of the study guide between students who used the guide for the college course and those who used the guide as a supplemental educational resource only. Based on the results, the investigator suggests a number of recommendations to improve the experience of all students using the study guide.

Headings:

World Wide Web -- Teaching

Distance Education -- Evaluation

Universities

## **Table of Contents**

<b>I. Introduction</b>	<b>2</b>
<b>II. Literature Review</b>	<b>5</b>
<b>III. Methodology</b>	<b>24</b>
<b>IV. Results &amp; Discussion</b>	<b>33</b>
<b>V. Recommendations</b>	<b>47</b>
<b>VI. Conclusion</b>	<b>52</b>
<b>Works Cited</b>	<b>53</b>
<b>Appendices</b>	<b>58</b>

## **I. Introduction**

Over the last few years university departments have increasingly viewed the World Wide Web as a medium for delivering both local and distance education college courses (Bothun, 1998). While most of the Web-based course content is currently text-based, the emergence of interactive and multimedia components has added a sophisticated new dimension to the types of content and instructional tasks educators can present to their students through the Web interface. By using Web-based interactive components such as exploratory images, data simulations, multimedia presentations, and self-grading quizzes to transform classroom tasks to the Web medium, the instructor can overcome many of the limitations of traditional asynchronous learning environments such as a lack of immediate teacher responses to student questions. As a result, university departments can deliver cost-effective educational opportunities to on-campus and distant students as a supplement or alternative to the traditional in-class experience. This ultimately provides students with more choices in which to customize their learning experience (Smith, 1997).

Using interactive components to facilitate the implementation of classes designed for World Wide Web delivery is not without its pedagogical issues. As the distinction between educational presentation and application fades, the design and application of the interactive elements of the Web-based class must come under scrutiny as the student's primary means of achieving educational goals. The design of the class as an interactive World Wide Web experience is typically the purview of a software or Web developer who must address both the students' needs for an engaging Web interface and the teacher's needs for maintaining clear instructional goals. That is, effectively designed Web-based classes should motivate students to explore the course content by capturing a diversity of learning styles while providing an engaging educational experience (Kapur & Stillman, 1996). The same design should also convince the instructor that a level of

intellectual exploration comparable to the traditional classroom student/teacher didactic is encouraged without becoming a distraction from the course's educational goals (Ragan, 1999). How well the developer manages to balance these needs within the design should determine, at least in part, the overall success of the Web-based class as an educational experience.

No formal design guidelines have been established for balancing student and teacher needs in the design of a Web-based course. Instead, developers must piece together best-known methods derived from user interface design guidelines (Gibbs & Teal, 1998), computer-based instruction design (Milheim, 1996), and multimedia design sources (Kaplan, 1997) among other sources. One such Web-based course that was developed under this model is MHCH 103 Reproductive Physiology offered through the University of North Carolina - Chapel Hill (UNC-CH) School of Public Health (SPH) Department of Maternal and Child Health (MHCH) during the Fall Semester 1999. The core component of this one credit class is the "Interactive Study Guide to Reproductive Physiology" (<http://cdlhc.sph.unc.edu/reprophys/>). The Study Guide is a modular, Web-based tutorial that employs interactive elements, such as self-grading quizzes and "explorable" images, to teach incoming MHCH students fundamental reproductive physiology concepts outside of a traditional classroom setting. Initially created as an educational supplement offered to all MHCH students, the first use of the Interactive Study Guide in the first official class context of MHCH 103 marked the next phase in the use of the Study Guide as an educational tool. The transition offered an opportunity to determine the effectiveness of the developer's strategy in capturing both student and instructor needs in the Web-based educational tool design.

In order to determine the value of the Study Guide as an educational tool, this study queried the students and instructor of MHCH 103 about their attitudes and experiences using the Study Guide. The study also targeted the general MHCH student population who may have used the Study Guide as an educational resource. Did students find the interface interesting to use? Did they feel that the design was amenable to their learning style or is it too rigid? Did the design of the Study Guide motivate them to learn? Did

the instructor believe that the Web-based interface maintained a clear focus on the educational goals he wished to present? Did the instructor feel that the Study Guide provided new and innovative ways to approach the teaching of public health? In order to address these questions, the investigator extrapolated a set of design principles for developing an interactive Web-based educational tool from the literature. The investigator then developed and distributed questions that addressed each principle from learning and teaching perspectives. By correlating positive and negative student and instructor responses to the specific design principles, the usefulness of the Study Guide as a tool to teach public health education could be assessed. Negative responses also aided the investigator in identifying a number of areas for improvement in the interface design and use of the Study Guide. The results of this study should lead to an improved Interactive Study Guide to Reproductive Physiology experience for future MHCH students.

## **II. Literature Review**

Current literature suggests that university departments consider the World Wide Web to be an essential direction for expanding the quality and variety of educational services provided to students. As an asynchronous medium for delivering educational content, the Web integrates readily into a department's existing distance learning initiative. According to Bothun (1998), nearly every university has some distance learning course offerings on the Internet. Like traditional means of distance education such as mail, and more recently email, the Web removes barriers to learning imposed by time and place. Unlike traditional distance education, however, the Web's capacity for visual and interactive content is better suited to accommodate a student population with more diverse learning needs. The result is that departments now have a means to attract students from the growing population of off-campus, part-time, disabled, and working professionals who are searching for educational opportunities that fit a busy lifestyle. This ultimately allows the university to remain competitive in the market for educational, technical, and training opportunities available on the Internet (Kaplan, 1997).

University departments are also viewing the World Wide Web as a tool to support traditional campus-based classes. The literature is replete with examples of Web technology that has been integrated into existing classes by instructors (Owen, 1996), (Kapur & Stillman, 1996). In most of these examples, however, content is relegated to static pages of administrative or illustrated lecture information. Frayer (1999) argues that this use alone does not capitalize on the real strengths of the Web as a delivery medium. The real power of this technology is "to make available real-world situations, aid visualization, facilitate collaborative activity among students, support analysis and synthesis of information, simulate complex environments and provide continual feedback" (p. 14). By using this "deeper technology" (p. 14) to create interactive components such as exploratory images, data simulations, multimedia presentations, and

self-grading quizzes, the instructor can translate fundamental classroom tasks to the Web medium. The result is that educational content and experience that was communicated through in-class participation can now be delivered to campus/distant students entirely or partially through participation in what is now commonly referred to as the "virtual classroom". According to Karen Smith (1997), director of the Faculty Center for Teaching and Learning at the University of Central Florida, this technology adds "choices as to how, when, and where students access learning opportunities" (p. 40). These choices will provide students and instructors with the freedom to customize their learning and teaching experiences.

The specific goal of this thesis is to evaluate effective use of interactive components, such as self-guided quizzes and explorable images in the MCH Study Guide as the means of capturing student and instructor pedagogical needs. As an educational medium, the Web offers both students and teachers opportunities to transform the educational process. Unlike software off the shelf, however, this relatively new medium for educational delivery does not offer simple directions for its effective use. No step-by-step instructions for the design of a Web-based curriculum are identified in the literature. It appears that university departments wishing to develop Web-enabled programs must take their lead from distance learning guidebooks directed towards a corporate audience or from the diverse literature of existing asynchronous learning environments. While guides for the development of on-line corporate training programs, such as *The McGraw-Hill Handbook of Distance Learning*, tend to focus on the benefits of the Web as a delivery medium (e.g. easily updateable, collaborative), they do not provide sufficient clues as to the specifics of effective Web-course design. We must instead comb the literature of analogous educational environments and case studies for recurring ideas. Compiling these themes will allow us to construct a reasonable set of principles that can be employed as a test to determine whether or not the interactive components of the Web-course were used effectively.



## Benefits of Web-enabled Courses

### The Learner's Perspective

One of the most discussed benefits of the Web as an educational delivery medium is the Web's potential as a learner-centric environment. Smith (1997) defines a learner-centered model of education:

An education process that pushes students to the center changes the teacher's role to one of facilitator, guide, and coach. It places emphasis on students as active participants in the process of finding, organizing, analyzing, and applying information in novel ways to solve problems. Students become part of a learning community where they collaborate to discover information from a variety of sources, including peers, teachers, experts, real-world data, simulations, and experiences. Ultimately, they apply that information in novel ways to solve problems, communicate ideas, and continuously add to their knowledge base. (p. 36)

Smith indicates that the transformation of the learner to *active* participant is a fundamental concept of the learner-centric environment. According to learner-centered educational theory, students learn best when they actively participate in the learning process, more commonly referred to as "active learning" (Neill, 1999, p. 14). In the Web environment this participation may include the use of simulations, models, experiences, and role playing in order to create an understanding of the content to be learned. Instructors who incorporate active learning concepts in the design of their Web-enabled course indicate that students who are more actively engaged in the course tend to take ownership of their education (Sosabowski et al., 1998; Pilgrim & Leung, 1996). They also report that students perceive responsibility for learning the materials and are more motivated to learn (Neill, 1999). Direct access to course content also allows students to have an impact on the direction of the subject matter and even upon their learning environment. Components such as personal class Web pages can facilitate this by allowing students to express their own ideas thus promoting the student's self-perception as a learner (Kapur & Stillman, 1996). Most case studies tend to agree on the basic premise that even though students may prefer different levels of interaction within the learner-centric environment, they must all be encouraged to engage in and reflect upon the direction of their own learning for the learning environment to be effective.

The literature correlates Smith's assertion that the active learner is fundamental to an effective learner-centered environment. Case studies identify the dialogue between students and teachers (Salmon, 1998), between peers (Solloway & Harris, 1999), and between students and the course materials (Carlson et al., 1996) as important components of active learning. No better illustration for the significance of these components can be found than in the failure of their application. Solloway and Harris (1999) discuss their virtual classroom project from the course proposal to development and implementation. They based their class upon the idea that a learner-centric environment should "facilitate the sharing of students' ideas and new insights and encourage the involvement of all participants by posing pertinent questions" (p. 13). Once the class was implemented, however, discrepancies emerged between the students' expectations of the level of support they would receive from the instructor and the instructors' expectations. The instructors' hands-off approach during the orientation process confused students. Many reported that the failure to provide adequate help and training for the on-line peer discussion isolated students in the class community. Other students reported frustration in the absence of an authority to guide them in how to interpret class readings. Only when instructors increased correspondence by phone and email with concrete instructions on how to proceed intellectually in the virtual classroom did student satisfaction ratings for the class improve (Carlson et al., 1996). While the students in this study were evidently given all the tools they needed to construct a successfully collaborative virtual classroom, they were unable to actualize the instructor's goals because the human instructional component was sorely lacking.

Smith (1997) identifies the support of multi-modal learning strategies as a key benefit of a learner-centric educational environment such as the Web. She indicates that:

Traditional, lecture based approaches to education emphasize receptive, reflective, abstract, analytic, and linear learning styles. A collaborative, learner-centered approach offers opportunities for all styles to succeed, provided adequate information delivery, analysis, and application opportunities are made available to students. Adding technology-supported learning options improves and greatly expands the ability to accommodate style variations. (p. 37)

Multi-modality, when defined as the accommodation of diverse learning styles and preferences for the same educational processes, benefits students by maximizing the avenues through which active learning can occur. For instance, some students may choose to print out assignments from the Web and read the materials in a linear fashion, others may prefer to use the Web's hyperlinks to jump from one relevant topic to another or interactively explore multimedia models and simulations at their own pace. Smith believes the primary challenge of university departments ultimately should be to match technological educational components used in a course with the dominant learning styles identified in the student population (Smith, 1997). The Web, as a learner-centric environment that fosters active learning, makes possible the capture of a significant number of student learning styles and interactivity preferences.

### **The Instructor's Perspective**

Case studies of instructor use of the Web in distance or campus-based classes catalogue a diversity of teaching benefits. The Web presents instructors with a tool that is at once a podium for reporting information, a palette for illustration through multimedia, a medium for discussion, a virtual library, and a tool for collaboration. Instructors point to the Web's ability to centralize management of class content as a key benefit. For instance, the Web allows instructors to incorporate diverse legacy teaching materials such as video, audio, images, software, and text into a single presentation repository that is available to students for both formal and ad hoc learning (King, 1998). The ability to rapidly update this content and distribute it to students effortlessly is also seen as a time management advantage (Chute, 1999). Instructors point to the Web's support of multimedia and interactive components as a key for faculty that wish to develop innovative teaching styles (Kapur & Stillman, 1996). For example, instructors can have students participate in the development of class materials for future students (Owen, 1996) or develop the class themselves as a cooperative effort (Behpour, 1999).

Perhaps the greatest value of the Web-based class for the instructor, however, comes in the transformation of the instructor's role within the learner-centric environment. The Web-based class provides an opportunity for the instructor to assume a broad range of

roles that often are subordinate to the role of lecturer in the traditional classroom setting. Neill (1999) argues that instructors should relish the change and become active as "...coach, facilitator, learner, presenter, and questioner. Remember, you are media too" (p. 6). The notion of the instructor as "media" is key to understanding teaching in the new Web environment. Without a physical presence, the instructor becomes a component of the Web's learning interface. Case studies indicate that the instructor should feel encouraged to approach his or her new role as mentor (Smith, 1997) and collaborator (Salmon, 1998). This implies that the instructor's level of interaction with students as interface may vary from active participant in the learning experience, to guide who remains outside of the discussion group and whose voice may be more of peer than authority. This diversity of roles is important for developers of the Web-enabled class when considering how to best incorporate the instructor's unique teaching style within their design. It is evident that both students and teachers have much to gain from the use of Web-enabled courses in their educational development. Many challenges exist, however, that will have to be met before Web-enabled learning can be integrated into standard educational practice. Many of these challenges are sure to be overcome by the establishment of standards and guidelines which all instructors and learners can follow.

### **Design Guidelines - Resources**

The developer of the Web-enabled class mediates among the materials, instructors, and students, carefully considering the diverse approaches towards learning and teaching that can occur within the boundaries of the learner-centric environment. The literature indicates that until recently the primary designers of Web-enabled courses were the instructors themselves (Frayer, 1999; Smith, 1997). While instructors may have very clear ideas on how to teach their material in the traditional classroom environment, they may not be prepared for the difficulties or opportunities presented to them by the Web medium. As current literature is directed towards a first generation of developers, verified and tested guidelines that could assist in managing the delicate balance of student and teacher needs have not gone through the iterative processes needed to separate them from anecdotal evidence. Without the benefit of standard Web-enabled course design guidelines, instructors as developers must turn elsewhere for direction. Two general

categories of sources may lend inspiration these developers. First, they can extrapolate design strategies from the broad spectrum of case studies and literature surrounding asynchronous learning environments in general. This includes the nascent virtual classroom, distance education initiatives, and computer-mediated instruction. Second, developers can draw upon pedagogical and design principles derived from human-computer interaction theory and multimedia design. A review of these categories identifies the variety of guidelines that are available to developers for inspiration in the design of his or her Web-course. They also reveal how the developers of Web-enabled courses have followed or not followed these principles.

### **Design Guidelines for Distance Education (the Virtual Classroom) and Computer-based Instruction**

A set of standards for the development of asynchronous distance and campus-based educational applications emerged in 1999 from the final report of the three-year long Innovations in Distance Education (IDE) project. Directed by faculty from Penn State, Lincoln and Cheyney Universities (Ragan, 1999), the report's focus was to establish "...a set of guiding principles to be developed and articulated by faculty deeply immersed in the process of designing and developing a distance education program" (p. 2). However, the scope of the project exceeded its original intentions and the report is ultimately less about distance education and more about "what makes for an effective educational experience, regardless of where or when it is delivered" (p. 2). The report defined five categories of course design guidelines - "Learning Goals and Content Presentation" (p. 4), "Interactions" (p.4), "Assessment and Measurement" (p. 5), "Instructional Media and Tools" (p. 6), and "Learner Support Systems and Services" (p. 7). Under each category the guiding principles are intended to provide a philosophical foundation for effective teaching and learning strategies. For example, Principle 2.2 states, "Social interactions between learners enrich the learning community and should be encouraged and supported throughout the instructional design of educational programs" (p. 4). These principles are comprehensive in the educational issues they address and are certainly a good source of guidelines for the creation of any Web-enabled course from a holistic perspective.

The term "virtual classroom" is probably the most recognizable appellation for a Web-based learning environment. While the term is readily identifiable in the literature of university initiatives, it is seldom seen in association with discussion of design strategies. Porter (1997), in the only handbook for virtual classroom development identified in the literature, offers little to the developer for designing interactive interfaces outside of indicating their usefulness. The handbook's design and development advice instead centers on the management aspects of the learning environment. Advice includes tips on Web server support and Web site administration tasks such as how often content should be updated and how hyperlink validity should be managed. However, the handbook does address the design of the course Web site from a Graphic User Interface perspective. According to Porter, design of the course homepage should follow the basic tenets of good Web design. This includes paying attention to the use of color, images, and language (Porter, 1997). The developer should also consider designing the site to be as interactive as possible in order to make it easier for learners to learn the course content (Porter, 1997). Overall, little mention is made of how to achieve quality active learning through the interface outside of the simple rules of Web design mentioned.

Many instructors and information technologists have attempted to translate their experiences while developing virtual classrooms into an ordered set of design guidelines. The result of these endeavors has been mixed. Chizmar and Walbert (1999) address the pedagogical and technical issues of creating an interactive Web-based syllabus for a microeconomics course that caters to both on-campus and internet-only students. To aid in development, they selected established pedagogical tenets of the traditional classroom and extrapolated how to translate them to the Web environment. They then used these tenets for the basis of the Web-course design. Their selections for pedagogical guidelines included "Use Active Learning Technologies" (p. 249), "Develop Reciprocity and Cooperation Among Students" (p. 249), and "Respect Diverse Talents and Ways of Learning," (p. 249), among others (Chizmar and Walbert, 1999). Despite this progressive approach to the design, the authors ignored the needs of the internet-based students in favor of the campus-based ones in translating their pedagogy to the Web. For example, while they considered student communication to be essential, they failed to provide tools

that would facilitate cooperation with fellow students and the instructor on the Web. They were not surprised to find that Internet-based students achieved lower cognitive gains than their on-campus counterparts (Chizmar and Walbert, 1999). The authors also assume that every instructor would wish to adhere to the same tried and tested educational principles of the classroom when teaching in the Web environment. As such, their guidelines ignore innovative strategies and approaches to teaching on the Web.

Chizmar and Walbert's use of educational theory as the foundation to their design strategy is representative of a common approach to the virtual classroom. In nearly every case study and article the developers identify one or more general educational theories as the primary drivers of the broader course design. For example, approaching the design of distance education courses from the perspective of knowledge sharing educational theory, Richards et al. (1996) identify key components for a successful course. They identify the act of knowledge sharing as an educator and student who "...create new knowledge and, in doing so, cause an expansion in the universe of discourse relating to that subject" (Chizmar and Walbert, 1999, p. 248). The act of knowledge sharing is portrayed as an interactive process, and any design that facilitates knowledge sharing should be subject to established pedagogic principles. To this end the authors identify three provisions for a pedagogically effective design: adequate assessment, remediation, and a performance support strategy to build skill with the content (Chizmar and Walbert, 1999). The use of educational theory appears to provide developers of distance education with a baseline guide for ensuring that familiar and tested academic principles from the classroom are considered in the design of distance education courses.

Millheim (1996) indicates that interactivity is comprised of five functions: confirmation that learning has occurred, pacing control for lesson speed, inquiry options for student questions and help routines, navigational control through content, and opportunities to combine previous knowledge with new information (Milheim, 1996). Developers can integrate this functionality into computer-based instruction modules by following three general principles of design. First, design interactive programs with comprehensive navigation options that are easy to use (Milheim, 1996). This includes designing easily

accessible help systems. Second, utilize questions that require students to significantly interact with educational materials (Milheim, 1996). Milheim argues that simple "electronic page turning" (p. 227) is not sufficient to maintain a user's attention. Instead, a diversity of strategies to engage the student such as hyperlinks and communication between peers will lead to more responsive students. The final guideline is to evaluate learner responses in a manner that is personally meaningful to the user (Milheim, 1996). This can be achieved by using motivational, confirmational, and instructional feedback approaches. This guideline is also a significant step towards acknowledging multi-modality in the design of educational applications. While written during the nascence of Web as an educational medium, Milheim's article implies that these guidelines also could apply to on-line and virtual education (Milheim, 1996).

### **User Interface Design Guidelines**

Few articles and case studies discuss the use of established user interface design textbooks or resources such as ACM SIG/CHI in the design and development of Web-based courses. This may be a reflection of the differences between information technology specialists and instructors as developers. As mentioned earlier, the literature indicates that most designers of Web-enabled courses are currently the instructors themselves. It is to be expected that instructors in the sciences and humanities are less likely to have had exposure to these design resources than information technology specialists have. One case study was identified where the designers followed a user-centered iterative approach to the design of the interface. The developers of the coMentor Web environment for social theory assessed student needs based on questionnaires and group work sessions, drafted a list of key features based on those needs, and prototyped to test key interface features (Gibbs, Skinner, & Teal, 1998). They believed this student-centered approach would lead to an interface that students would find more interactive and motivating. Surprisingly, the majority of students were dissatisfied with their experience using coMentor (Gibbs, Skinner, & Teal, 1998). Much of this dissatisfaction stemmed from students' confusion over how to use coMentor and how they were to be assessed (Gibbs, Skinner, & Teal, 1998). Technical issues also hampered efforts to smoothly integrate the application into the students' curriculum. It is



possible that issues encountered by coMentor could be indicative of the instructors' failure to fully understand appropriate application of the user interface design guidelines. It may also indicate that standard UI design guidelines do not provide a sufficient foundation upon which Web-based educational development can be based.

### **Multimedia Design Guidelines**

Multimedia elements, such as audio, video, and interactive graphics, are common components of the Web-course interface. The literature surrounding educational multimedia provides fertile ground for uncovering guidelines for these components' effective design and use. One set of guidelines emerged from the Working Group on Interactive Multimedia Pedagogy at the ACM/SIGCSE International Conference on Integrating Technology into Computer Science Education. The goal of Adams, Carswell, and Hall (1996) was "to develop a set of pedagogically sound criteria for the effective design and use of educational multimedia" (p. 182). Taking their lead from educational theory, the eight-member panel of experts identified key issues surrounding multimedia in education. Among the issues to emerge was an acknowledgement that students learn in different ways and at different paces (Adams, Carswell, Hall, 1996). The panel developed their guidelines for effective multimedia as a response to these various issues. Their guidelines divided effective multimedia into learning, instruction, communication, and technology categories, each with their own guiding principles. For example, collaboration, multi-modality, and task validation are all considered criteria of an effective use of technology in the design of educational multimedia (Adams, Carswell, Hall, 1996). While these progressive guidelines provide developers with ample direction, the working group offers no instructions on how to achieve an effective design. For example, while they indicate that customization of the sequence of presentation, speed of delivery, and ability to enable alternative paths are key components of effective use of technology for communication, they provide no specifics as to how to achieve these goals in design (Adams, Carswell, Hall, 1996). They also do not give any evidence - either empirical or anecdotal - as to why these are the most appropriate guidelines to follow. These shortcomings are most likely symptomatic of the nature of the working group as an ad hoc means of initiating professional discourse into a topic.

Multimedia specialist Lawrence Najjar (1998) approaches criteria for effective multimedia design from an empirical perspective. He contends that existing educational multimedia user interface design guidelines are ineffective because:

Unfortunately, the existing educational multimedia user interface design guidelines are based almost entirely on the opinions of experts rather than on the results of empirical research. This provides a weak foundation on which to make design decisions and slows progress in making educational multimedia user interfaces more effective (p. 311).

He sets out to rectify this situation by citing studies from the fields of psychology, instructional design, computer science, and graphic design in support of his guidelines. In Najjar's learner-centric analysis (1998), he suggests relating the content and objectives of the instruction to the needs of the learners through familiar metaphors and analogies. He also encourages designers to engage learners in actively processing information by employing interactive online tasks such as interactive exploration of data (Najjar, 1998) and to help learners integrate information through brief questions concerning recently learned materials (Najjar, 1998). Najjar's primary focus, however, centers upon how to match the media to the information that is to be presented to learners. For instance, he contends that pictures seem to be better than text or auditory instructions for communication of spatial information (Najjar, 1998). The article, while fairly comprehensive from the learner's point of view, fails to address instructor needs such as assurances of quality education and how to capture needed changes to the role of the instructor in the educational interface.

### **Design Guidelines – Assessing Basic Criteria**

Now that we have identified the resources that are available to developers of Web-enabled courses, we can comb the literature for recurring themes. Compiling these themes allows us to construct a reasonable set of guidelines that can be employed as a test for effective use of interactive components in the Web-course. The one selection criterion to which all principles should adhere is that the guideline should help to maintain the balance between student and instructor needs in the learner-centric

environment. From the categories of resources identified, the most evident of the design principles to emerge were:

- The instructional goals, content, and design should be clear.
- The design should encourage interaction with the content through non-distracting means.
- The design should encourage interaction between students and teacher.
- The design should provide adequate means of performance assessment.
- The design should consider student and instructor motivation when using the tool.
- The design should accommodate multiple learning and teaching strategies.

This study was undertaken not only to identify the principles of Web-based course design for interactive interfaces but also to test these principles in a real-world college course. In order to effectively test these principles an understanding of each one within the literature is needed so that perspective can be gained on their appropriate application and on their impact to teaching and learning.

### **The instructional goals, content, and design should be clear**

Because students do not have frequent in-person access to teachers, clarity of design, content, and instructional goals are essential in distance learning courses. Learners in any distance learning endeavor should be given a clear road map for what competencies the students will be expected to master and how he or she can achieve those competencies. Neill (1999) indicates that a learning plan "...gives learners an advanced organizer that helps them consciously set goals, select strategies, regulate their progress, and adjust personal behaviors" (p. 4). Encouraging faculty to identify their basic goals for a course also frees them to think more creatively (Frayer, 1999). Frayer encourages instructors to identify "bottlenecks" in the material that hinder effective learning in order to help instructors match innovative teaching strategies, such as simulations, with the best means for encouraging effective learning (Frayer, 1999).

Clarity in any written, spoken, or design-based form is promoted as an essential component of many kinds of asynchronous learning environments where direct

student/teacher contact is infrequent. For example, the design of telecourses indicates student-centered instruction should be "clear and understandable, responsive to the ways in which students learn and communicate and acknowledges student's interests and motivations" (Egan et al., 1997, p. 33). Instructors preparing to deliver telecourses to distance learning students are encouraged to achieve clarity for their class by "creating detailed, precise syllabi and interactive study guides" (p. 34) as supplemental class materials. These guides are designed to compensate for the absence of informal instructional/student interactions that would typically take place before, during, or after conventional course sessions. Clear study guides also enable students to "know exactly how to proceed with course assignments, how to make the most of each telecourse session, how to prepare successfully for examinations" (p. 34). A careful selection of course content and the segmentation of sessions into manageable and interesting sections are also recommended (Egan et al., 1997). According to many experts, the primary rule of design of course materials, especially if including multimedia or interactive components, is to reduce the amount of clutter in the design (Najjar, 1998).

**The design should encourage interaction with the content through non-distracting means.**

An understanding of the importance of student interactivity with course content in an asynchronous learning environment is not new to Web-based courses. An instructional strategy that encourages communication between students and content benefits learning by increasing student interest, increasing higher cognitive processing of information, and developing cooperative learning skills (Milheim, 1996). Effective interactivity is comprised of five factors which should be considered in the design of an educational application: immediacy of response, non-sequential access to information, adaptability of communication, bi-directional communication between learner and content, and the length of time between user responses (feedback) (Milheim, 1996). Other researchers echo these design tenets more or less. Wagner (1997) discusses a variety of content interactions to be considered in design. Among these are interaction for exploration that views the content as a "vehicle for defining the scope, depth, and breadth of a new idea" (p. 25). Another significant interaction to consider in design is the interaction for closure

which "means being able to determine what expectations exist and also determine when those expectations have been met" (p. 25). The application of these diverse types of interaction is summarized into a single guideline:

...consider the goals and objectives of a specific learning experience. From this perspective, it is both far more appropriate and effective to begin the process of selecting the strategies and tactics needed to achieve the desired ends of the learning experience...In this way, interaction can serve as an outcome of clearly conceptualized, well-designed, and well-developed instruction and training (p. 25).

Tools which facilitate student interactivity with the content, such as exploratory visualizations, simulations, and self-grading quizzes, must be easy to use and as non-distracting as possible (Pilgrim & Leung, 1996; Milleheim, 1996). These tools are the conduits through which learning occurs. One of the first rules of motivating students to learn is to keep and direct their attention (Yang & Chin, 1997). If the tools are difficult to use, distracting to use, or disruptive to the student's preferred pace of learning, student attention to the content (and thus their motivation to learn) may be negatively impacted.

#### **The design should encourage interaction between students and teacher.**

The significance of making on-line education a social experience is perhaps the guideline for development most encountered in the literature. Nearly every case study and article mentions some attempt to capture student collaboration and teacher/student communication within the course design. Hiltz and Wellman (1997) define the virtual classroom itself as "units of computer-mediated communication that connect interactive human relationships" (p. 44). Email, bulletin boards, newsgroups, synchronous chat systems, computer conference systems, group decision support systems, and homepages on the Web are but a few of the methods proposed to encourage a social presence in the Web-based class.

The value of this social presence permeates all notions of the Web-based class as an active learning environment. Wagner (1997) catalogues the benefits of collaboration and communication to students. Through the interactive interface the student can participate in team building, receive feedback on performance, and increase participation in learning.

Wagner indicates that "The more they [students] perceive collaborative learning as taking place, the more likely they are to judge the outcomes of the Virtual Classroom as superior to those of the traditional classroom" (p. 46). From the instructor's perspective, communication with students provides a medium for course and individual feedback, allows the instructor to clearly articulate expectations, and increases participation of the student in the learning didactic. Interaction also enables the active learner to participate in the instructional/training/performance improvement process. This assures the instructor that successive generations of his or her Web-base course will better accommodate active learning.

**The design should provide adequate means of performance assessment.**

Assessment is essential because it "provides reinforcement, which is intended to correct and direct performance" (Wagner, 1997, p. 23). Other articles echo this sentiment. Feedback is identified as essential for students to create meaning from what they have learned (Egan & Gibb, 1997). Feedback is also critical for instructors because it helps an instructor identify behaviors or procedures that they should stop, start, or continue in the asynchronous learning course (Egan & Gibb, 1997). Essentially, any discrepancies that arise between information content and users' interpretations can be identified for remediation (Richards et al., 1996). The fairness of such assessment is addressed, among other places, in Najjar's proposed principles of educational multimedia user interface design. Najjar's survey of empirical research into the use of multimedia to develop educational applications identifies a small number of studies which support the idea that learning performance improves when the way the learner is tested is similar to the way information is presented to the user. That is, the design of the test should match the kind of information that was learned, and the given test should match the expected learning goals (Najjar, 1998). For example, Najjar indicates that verbal information is best assessed through written exercises, while procedural information is best assessed through illustration or task.

**The design should consider student and instructor motivation when using the tool.**

According to the literature, the effectiveness of asynchronous learning environments depends largely on the extent to which the system designer makes the best use of computer's inherent motivational functions. These motivational functions include such things as immediate feedback, multimedia support, interactive components, and individualization of the learning experience. Multimedia and interactive elements are noted especially for their ability to motivate students by retaining student attention. The degree of flexibility given to the students to control this interactivity can play a role in student levels of attention and motivation. A study by Yang and Chin (1997) indicates that there is a direct correlation between high student motivation and learner control of interactivity. When students are given opportunities to control instruction they feel more confident in tasks and more responsible for their own learning (Yang & Chin, 1997). From various literature reviews, Yang identifies four components of motivation that can serve as dimensions in effective design. These include attention, relevance, confidence, and satisfaction. These dimensions can be achieved in design through directing and keeping student attention to instruction by active participation (attention), ensuring that the content is congruent with pre-established learning goals (relevance), clearly indicating criteria for success in the environment (confidence), and increasing feedback and reward for success (satisfaction). Other studies suggest that the motivational effects of computers cannot always overcome significant learning problems. A study by Carver (1996) indicates that there was no noticeable gain in the performance of the weakest students of a Web-based course. Many students remained unprepared or unwilling to learn in the Web environment. The authors propose that networked hypermedia is effective for increasing the performance only of the average to best students.

**The design should accommodate multiple learning and teaching strategies.**

Identifying that students learn differently and instructors teach differently is critical to the effective design of a Web-based course. As mentioned previously, one of the key benefits of the Web is its capacity to support multiple learning and teaching strategies. As early as 1996 the ACM/SIGCSE Report of the Working Group on Interactive Multimedia Pedagogy identified multi-modality as one of the seven key pedagogical

issues surrounding the use of multimedia in education (Adams et al., 1996). Providing a multi-modal environment where students have the option to collaborate or work alone and learn through task, lecture, or lab as best suits them ultimately allows them to select the educational experiences that best fit the way they learn. The multi-modal interface places new responsibility on the instructor to become familiar with diverse learning styles of the students. Acknowledging this diversity can transform the way the teacher approaches his or her personal instruction and can only benefit the students by sensitizing the instructor to student needs. Smith (1997) summarizes this process:

It falls upon the teacher to constantly recreate the instructional process and offer a variety of choices for approaching information and tasks in order to meet learners' ever-changing, individual needs.... A firm theoretical foundation [of learning theory] offers teachers a starting point from which they can build a series of learning opportunities, responding to all styles and encouraging a wide range of strategies in order to encourage successful learning. Innovative classroom approaches plus access to appropriate technologies will lead to the creation of new learning environments that are flexible and provide a custom education for each student, regardless of class size, time and distance constraints, previous preparation, and personal factors. (p. 37)

Case studies also indicate that the absence of multiple learning strategy support in an Internet-based course can have a negative impact on the effectiveness of the course. In a study of a course taught entirely via email, fifty-four of the sixty-five students who participated in the course indicated that the material could not be successfully taught through email alone (Phoha, 1999). While course components also included textbooks and Web-based syllabus, assignments and teacher-to-student communications were exchanged strictly through email. The author of the class and study determined that this arrangement compromised the quality of education from both a teaching and learning perspective. The students also indicated that the text-based email did not respond to the learning style of some students while other students felt that a loss of interaction with the instructor lead to an inability to receive proper help when needed.



## **Conclusion**

While the Web as a delivery medium for comprehensive and diverse educational experiences is a fairly new phenomenon, the tradition of interactive educational applications is extensive. As such, a study of asynchronous learning literature reveals a broad spectrum of applicable case studies, anecdotal evidence, and analogous research useful in extrapolating design principles for interactive interface to a Web-enabled course. These general guidelines served as a heuristic litmus test for the Interactive Study Guide to Reproductive Physiology as an effective Web-enabled course.

### **III. Methods**

The use of the Interactive Study Guide to Reproductive Physiology in MHCH 103 illustrates a growing trend in university departments to provide asynchronous learning opportunities to campus based and off-campus students. In order to evaluate the effectiveness of the Study Guide as an educational tool, the investigator conducted interviews with the students and instructor of MHCH 103 during the Spring Semester 2000. Because the Study Guide was also available to the general MHCH student population as a supplemental educational resource, the investigator surveyed this population for the study as well. Participation provided the students of MHCH with an opportunity to contribute feedback on the department's Web-based educational initiatives. This feedback should further the department's educational objectives and benefit the students by enhancing the quality of future Study Guide versions.

#### **Background on the Interactive Study Guide to Reproductive Physiology**

The Interactive Study Guide for Reproductive Physiology is comprised of five modules of self-paced learning materials: Male and Female Reproductive Anatomy, Reproductive Physiology, Contraception, Reproductive Health, and Sexually Transmitted Diseases. Each module consists of 15 to 20 Web pages of text and images linked together through navigational components such as a table of contents, a menu of relevant internal links on each page, and "next page"/"last page" arrow icons. To facilitate interactivity with the content, the designer of the Study Guide incorporated features such as exploratory images and diagrams, a comprehensive hyper-linked glossary of terms, and self-grading quizzes. The instructor later incorporated a password protected discussion forum, available only to the students taking MHCH 103, to facilitate interaction between students and the instructor. A brief discussion of each category of interactive features follows in order to provide context for the study.

Exploratory Images: Each module contains at least one image or diagram relevant to the module's particular topic. These images provide more descriptive information when the student uses the computer mouse to "explore" the image (see Appendix A). As the student moves the mouse over the image the mouse pointer will change from an arrow to a hand when it encounters a component that can be "clicked on" for more detail. For example, in the section on Internal Female Reproductive Anatomy a labeled image of a woman's internal reproductive organs is provided for students to explore. Clicking on any text label or anatomical element moves the student, via a hyperlink, to a description and more detailed image of the anatomical element.

Help-Systems: An on-line help system is accessible from each module in the Study Guide through a toolbar graphic located at the top of the first page of each module section (see Appendix A). The help system includes information such as a guide to color-coding used in the Study Guide, a key to all icons used throughout the modules, and instructions to solve commonly encountered problems with the Study Guide. Other help features are incorporated into each Web page design such as helpful hints for exploring the content on each page, icons that indicate the interactive status of an image or diagram, and hi-lighted text boxes of key concepts. A glossary of technical terms (see Appendix A) that can be accessed from any page is also included. These features are included to create the perception of a helpful presence available at all times to the student.

Discussion Forum: An integral part of MHCH 103 is a Web-based discussion forum that allows students to post messages and questions to each other and the instructor. The messages appear as lists of topics that lead to the full content of the message when selected with the computer mouse. The discussion forum was not an original component of the Study Guide, but was added as part of the on-line course by the instructor. It is password protected and available only to students participating in MHCH 103 for credit.

Self-Grading Quizzes: Each learning module concludes with a quiz of ten to twelve multiple-choice questions (see Appendix A). Students select their answers from a drop-down menu located next to each question and then submit or clear their quiz answers

when finished. When submitted, the quiz is graded automatically by a script developed in the Perl programming language. Once graded, the script returns the results of the quiz to the student (see Appendix A). These results not only include the number of correct and incorrect answers but also a brief explanation of each question's correct answer. A course of action for the student to take based on his or her score follows the explanations. If a student misses more than one or two questions the student is informed that more study may be required before going on to the next module. Otherwise the student is directed to start the next module and a link to that module is provided. Currently the instructor does not have access to the results of the quiz. They are provided solely for the benefit of the students.

Evaluation Form: Students, staff, and guests who used the Interactive Study Guide to Reproductive Physiology can voluntarily submit an anonymous evaluation of the Study Guide following the completion of the last module (see Appendix A). The evaluation form offers several multiple-choice and short questions that attempt to track the use patterns of and user attitudes towards the Study Guide. Once completed and submitted, the survey responses are electronically mailed to the department for data collection. The instructor does not have access to these responses.

### **Distribution and Collection of Data**

The target population for this study was students of the Department of Maternal and Child Health at the University of North Carolina - Chapel Hill who used the Study Guide either for the in-class requirements of MHCH 103 or as an educational supplement to other course work. Those in the target population who use the Study Guide as a supplement only were mailed cover letters towards the end of the 1999 Fall semester explaining the study and inviting them to participate (see Appendix B). Accompanying this letter was a survey of thirteen questions (see Appendix B) and a self-addressed stamped envelope. The survey consisted of ten short-answer questions concerning the student's experience using the Study Guide and three questions to gather student background with Internet and Study Guide use. A letter of introduction to the study (see Appendix B) by Dr. Pierre Buekens, the Department Chair of Maternal and Child Health,

was emailed to all the MHCH students one week after the surveys were mailed. Approximately forty-two students were mailed the survey packet. A follow-up letter (see Appendix B) and second copy of the survey were mailed to those who had not responded to the original request within three weeks of the first mailing.

The three students who registered for MHCH 103 during the Fall semester 1999 received an email cover letter explaining the study and inviting them to participate in a voluntary thirty-minute telephone interview (see Appendix B). The interview questions (see Appendix C), and an introduction to the study from Dr. Pierre Buekens, the Chair of the Department of Maternal and Child Health, accompanied the cover letter (see Appendix B). The student interview sheet consisted of the same ten short-answer and multiple-choice questions concerning the student's experience using the Study Guide as the student survey. No less than ten business days after sending the cover letter the investigator conducted a follow-up telephone call with each student in order to obtain the individual's consent to participate in the study. During this telephone call the investigator followed a script to ensure that relevant study information was conveyed uniformly to each student (see Appendix C). The thirty-minute telephone interview was scheduled when the investigator received the student's consent to participate. If the student declined to participate, the investigator thanked them for their time and ceased contact. Dr. Pierre Buekens, MHCH Department Chair and the instructor of MHCH 103, also agreed to participate in the study. The investigator employed a second sheet of interview questions that addressed the Study Guide from an instructional perspective to collect data from Dr. Buekens (see Appendix C).

### **Survey and Interview Questions**

All surveys and interview sheets included three multiple-choice questions that addressed the respondent's awareness of the Guide as an available resource, access to the Guide, and the respondent's familiarity with the Web as a tool. These questions were included in order to identify the impact factors external to the Study Guide, such as an inability to access the Guide, on student and instructor use of the Study Guide. The first multiple-choice question asked both the students and the instructor to indicate how frequently they

accessed the Study Guide (Student Survey Question (SS) 1, Student Interview Question (SQ) 11, Instructor Interview Question (IQ) 11). The scale of frequency ranged from "did not know that the Interactive Study Guide was available to me", to "often - used weekly this semester". It was expected that the respondents involved in MHCH 103 would access the Study Guide with more frequency than other students in the department. The second multiple-choice question asked all participants to rate their familiarity using the World Wide Web (SS2, SQ12, and IQ12). Respondents could subjectively place themselves into one of three groups - Not familiar at all, Somewhat familiar, and Very familiar. Finally, all participants were asked to select the locale from which they most frequently accessed the Study Guide (SS3, SQ13, and IQ13). Choices for this question included: School of Public Health computer lab, Other UNC computer lab, Work or office computer, Home computers, Laptop you purchased for school through the Carolina Computer Initiative, and Other.

Ten short-answer questions comprised the majority of the survey and interview sheets. Each question corresponded, in part or entirely, with a design principle that the investigator identified in the literature as a guideline for the development of an effective Web-based educational interface. These design principles included:

- The instructional goals, content, and design should be clear.
- The design should encourage interaction with the content through non-distracting means.
- The design should encourage interaction between students and teacher.
- The design should provide adequate means of performance assessment.
- The design should consider student and instructor motivation when using the tool.
- The design should accommodate multiple learning and teaching strategies.

Responses to these questions were used to determine qualitatively the Study Guide's performance to the design principles. Successful application of the design principle in the Study Guide would correspond with positive responses to the associated questions while failed or partially successful application would correspond with negative or indifferent responses to the associated questions. In addition to identifying evident weaknesses, the short-answer format also allowed respondents the time to suggest enhancements and improvements to the Study Guide that may not have been otherwise

captured. Survey and interview questions corresponded to the design principles as follows:

The instructional goals, content, and design should be clear

The first short-answer question asked students to report whether they felt the instructor's goals for the class materials, such as the topics to be covered and student performance requirements, were clearly defined in each section of the Guide (SQ1, SS4). A follow up question asked students what they felt should have been more clearly defined. The instructor's question concerning clarity was worded in the same manner as the student question (IQ1). To gain additional perspective, the instructor and students were asked how difficult or easy it was to learn how to use the Study Guide (SS10, SQ7, and IQ7). As a follow up, they were asked if anything in particular made learning to use the Study Guide easy or difficult such as navigation through the Guide or the computer itself. By addressing clarity of goals and content from both the students' and the instructor's perspective, the designer could validate that the overall format of the content did not interfere with learning or teaching.

The design should encourage interaction with the content through non-distracting means

The Study Guide was designed to encourage students to interact with the class through the use of hyperlinks to glossary terms, explorable images, and a toolbar to link key Study Guide resources such as help topics and a table of contents. To determine if the Study Guide was successful in providing a sufficient degree of interactivity to enable learning, students were requested to elaborate upon features that were useful or distracting to them while learning the content (SQ2, SS5). The same question was reworded for the instructor's interview in order to capture the teacher's perspective. The instructor was asked to identify those interactive features that were useful or distracting to teaching the course content (IQ2).

The design should encourage interaction between students and teacher

Both the students and the instructor then were asked if the Study Guide encouraged frequent and meaningful interaction between the students and between students and the

instructor (SS6, SQ3, IQ3). Students were asked as a follow up if the level of interaction was a benefit or a disadvantage to learning the materials. The instructor's follow up question asked if the level of interaction he perceived from the students was a benefit or a disadvantage to helping him teach the materials. Communication was also addressed in the specific context of giving and receiving help. Students were asked to identify where they went the most to get help with Study Guide use or content (SS8, SQ5). The instructor was asked how often he felt students actively requested help from him through the Study Guide or through office visits, phone calls, and email (IQ5). Comparing student and instructor answers in this specific context could identify possible failure on the part of the Study Guide to provide adequate channels of communication. This failure could, in turn, impact the student's motivation to use the Study Guide or his or her ability to learn the Study Guide as a tool.

#### The design should provide adequate means of performance assessment

In order to determine if adequate means for assessing student performance had been integrated into the Study Guide, students were requested to gauge how well the interactive quizzes at the end of each section of the Study Guide (SS7, SQ4) helped them to learn. A follow up question asked them to evaluate the usefulness of the feedback they received from these quizzes. To validate the student's perceptions of how well they were learning, the instructor's interview included a question that asked him to gauge the usefulness of the quizzes in helping him to verify student learning (IQ4). Follow up questions included whether the instructor felt the quizzes and quiz feedback sufficiently captured the course's key learnings and if he relied on additional methods for verification of learning.

The ability to capture feedback on the quality of teaching and the educational tool itself is also essential to providing adequate mechanisms to assess performance. Instructor Interview Question I5 asked the instructor if he felt as though appropriate mechanisms to capture anonymous feedback concerning the Study Guide and its use in the course were provided. The adequacy of this component in the Study Guide is essential to ensuring



that students have a threat-free channel to express their attitudes and opinions concerning the Study Guide as an educational resource and a key component in an on-line course.

The design should consider student and instructor motivation when using the tool

The literature indicates that a number of variables can determine a student's level of motivation to use an educational tool. Student interactivity with and interest in the content, flexibility of the tool, and adequacy of help are all identified as determinants to motivation. Instead of addressing these specific aspects of motivation in individual questions, MHCH student attitudes about motivation were captured in two more general questions. Both MCHC 103 and general MHCH students were asked to report their level of motivation to use the Study Guide as a learning tool (SQ9, SI6). As a follow up, the students were asked if anything about the Study Guide in particular motivated or deterred them from using it. All the students also were invited to report their perceptions of the Study Guide as an interesting or uninteresting way to learn about reproductive physiology and health issues (SQ12, SI9). These questions were intended to provide some measure of the Study Guide's success in motivating students to learn as well as identify any specific weak links in the design such as failing to get appropriate help using the tool or providing a tool that is uninteresting to use.

Since the instructor originally petitioned for the development of the Study Guide, it was assumed he was motivated to use the tool in teaching. As a result, only a single question was included to address instructor motivation. Instructor's Question 8 invited the instructor to report his perception of the Study Guide as an interesting or uninteresting way to teach reproductive physiology and contraception concepts. The instructor's survey also included a question to capture the instructor's perception of student motivation (IQ6). This question was used to identify discrepancies between student and instructor perceptions about student motivation for using the Guide as a learning tool. As a follow up, the question requested the instructor to identify elements of the Guide, such as accessibility, design, and interest in the materials that may have deterred or motivated students to learn. Discrepancies in perceptions about student motivation could indicate possible gaps in student/teacher communication that the designer would need to address.

### The design should accommodate multiple learning and teaching strategies

The students and instructor were next asked if the Study Guide accommodated the particular way in which they learn or teach (SS11, SQ8, and IQ8). Students were asked to elaborate upon those features or aspects of the Study Guide that accommodated their particular style of learning as well as identify any aspect or component of the Guide that may have made learning more difficult for them. Effectively designed interactivity in the Study Guide should accommodate multiple learning and teaching strategies. The instructor's question also asked if the Study Guide had changed their teaching style in any way from their typical classroom pedagogy. This question was intended to gauge the level of flexibility in the Study Guide to accommodate new and innovative ways of teaching.

### Satisfaction

The last short answer question asked both students and the instructor to gauge their overall satisfaction with the Study Guide (SS13, SI10, and IQ10). Participants also were requested to identify any areas for improvements that may have come to their attention while using the Guide. Results from this question were analyzed to determine which design principles the response addressed. Then, the answer was integrated into discussion of that particular design principle. For example, if a student indicated that they were generally satisfied because they found the quizzes to be an effective way to learn, their response was included under discussion of performance assessment. Analyzing any requests for improvement also enabled the investigator to capture possible issues not identified in responses to other questions as well as identify suggestions for value-added improvements to the Guide. These requests were incorporated into the discussion of changes to make to the Study Guide to improve its performance.

## IV. Results & Discussion

Two of the three students who registered for MHCH 103 during the fall 1999 semester consented to participate in the study. The course instructor and Study Guide organizer, Dr. Pierre Buekens, also consented to be interviewed. Of the 42 surveys mailed out to the other students of the Department of Maternal and Child Health, 18 were returned (42.9% response rate). All 18 returned surveys were considered usable in the results.

### Multiple-choice Questions

All 20-student respondents (100.0%) offered information concerning the frequency with which they used the Study Guide. Table 1 summarizes these results.

**Table 1. Frequency of Use (SS1, SQ11)**

Frequency of Use	Frequency of Response	Percent of Sample
a. Didn't know it was available	4	20%
b. Knew it was available but didn't use	11	55%
c. Rarely used	3	15%
d. Occasionally used	0	0%
e. Often used	2	10%

At the Beginning of the 1999 fall semester, Dr. Buekens announced the availability of the Study Guide to MHCH students in a general department-wide electronic mailing. The success of this mailing is unclear. Fourteen of the 18 survey respondents remarked that they at least knew of the Study Guide as an educational resource available to them (answers b & c). However, only 3 of the 18 survey respondents chose to use the Study Guide at any length. One of the students who did use it commented, "I'm not aware of other students' use of this Study Guide. I never heard anyone talk about it despite a very high interest rate in Repro Phys." As expected, both the students (and the instructor) of MHCH 103 indicated that they frequently accessed the Study Guide (answer e).

Although few respondents appeared to use the Study Guide outside of MHCH 103, all respondents supplied information concerning their familiarity with the World Wide Web. Table 2 summarizes these results.

**Table 2. Familiarity with Web (SS2, SQ12, IQ12)**

Frequency of Use	Frequency of Response	Percent of Sample
a. Not familiar at all.	1	5%
b. Somewhat familiar.	6	30%
c. Very familiar.	13	65%

The results are weighted heavily towards a high degree of familiarity with the World Wide Web for all MHCH students. However, both MHCH 103 students indicated only a general familiarity with the Web (answer b). The instructor of MHCH 103 reported more familiarity (answer c) but also offered that his answer was strictly in terms of browsing and using the Web for research. In terms of development of Web applications, he rated his familiarity as "Not familiar at all".

Considering the lack of students who used the Study Guide, it is not a surprise to find that only 6 of the 20 student respondents chose to answer the question concerning the most frequent location of use of the Study Guide (SS3, SQ13). The results in Table 3 show a distribution among home use, the Public Health computer lab, work or office, and other UNC campus computer lab. The single answer of "Other" was not elaborated upon by the respondent. Both MHCH 103 students identified their primary location of use to be another UNC computer lab. The instructor responded that he used the Study Guide via his "Work or Office Computer". A few students did make comments on their use of the Study Guide in the margins near this question. One student wrote, "Did not take the class" and another replied "Never did". These comments were interpreted as non-responses to the question. Another individual noted that he did not look at the Study Guide because he couldn't logon to the site. This response was noted as a technical issue with access.

**Table 3. Location of Use (SS3, SQ13)**

Location of Use	Frequency of Response	Percent of Sample
a. School of Public Health computer lab	1	16.7%
b. Other UNC computer lab	3	50.0%
c. Work or office computer	0	0.0%
d. Home computer	1	16.7%
e. Laptop /Carolina Computer Initiative	0	0.0%
f. Other _____	1	16.7%

### **Short Answer Questions: Performance in Relation to Design Principles**

All three of the interview participants chose to respond to the ten short-answer questions (SQ1-10, IQ1-10). However, only four other MHCH students answered any of these questions (SS4-SS13) and not every question was answered in each case. This lack of response can be attributed to the fact that only three survey participants responded that they had used the Guide at all. Notes from students in the survey's margins gave some indication as to why students failed to use the Guide. Students cited technical issues, ethical issues, belief that the Guide was for the class only, and belief that the Guide would be reviewed as reasons for their decision not to use the Guide. One respondent explained:

Please note that there are 2 reasons I have not used this program: 1. I am a medical student and have covered most of these concepts previously. 2. I am ethically & religiously opposed to contraception & do not desire to learn more about it, as I do not feel this to be an important public health issue.

As a result of this general lack of use outside of the class, responses from only seven participants in total (four student surveys, two student interviews and one instructor interview) were used to determine the Study Guide's performance to the design principles. Table 4 summarizes the students and instructor's assessment of the Study Guide's performance to the design principles.

**Table 4. Perceived Success of Study Guide Design**

<b>Location of Use</b>	<b>MHCH 103 Students (n=2)</b>	<b>Non-class Students (n=4)</b>	<b>Instructor (n=1)</b>
Clarity of goals, content and design	high	N/A	high
Encourage interaction with content	high	low	high
Encourage interaction with students/teacher	moderate	N/A	high
Adequate performance assessment	high	N/A	low
Consider student/teacher motivation	moderate	low	(assumed high)
Accommodate multiple teaching/learning styles	moderate	low	high

A "high" level of success indicates that the target group did not find many issues with the Study Guide's performance in relation to this design principle. Individuals could still provide suggestions for value-added changes to the design but in general had positive learning/teaching experiences. A "moderate" result indicates that at least part of the group identified weakness in the design that impacted learning or teaching but in general comments were overall positive. A "low" response indicated that negative comments concerning the design of the Study Guide in this category significantly outweighed positive responses. A response of "N/A" indicates that there was not enough data to make an assertion from the group in that category.

The results identify differences of opinion between the students and instructor over the Study Guide's performance in relation to several principles, most noticeably performance assessment. The results also identified significant differences of opinion between students who participated in MHCH 103 and those who simply used the Study Guide as a supplemental educational resource. MHCH 103 participants consistently identified a more positive performance in general than the survey respondents. Unfortunately, the incomplete state of many of the survey responses limits the amount of detailed qualitative analysis that can be done comparing these targeted groups. A more comprehensive picture of Study Guide performance emerges if the results are compiled. This picture also serves to identify areas for improvement to the Guide that would make its use more appealing to the students and instructor. Since the sample size is so small, this exercise is best served if the Study Guide's performance is addressed on a principle by principle basis in more detail.

The instructional goals, content, and design should be clear.

According to the students of MHCH 103, the Study Guide succeeded in providing clear and organized access to the class content that enabled, rather than hindered, learning. While the students believed the language of the modules to be highly technical and the content complex, they acknowledged that the goals, content, and design of the Study Guide were clear. One student remarked, "Having the outline of content on the left-hand side of each page helped a lot. I could always tell where I was and what I was supposed to be focusing on." Students were also appreciative of the Study Guide's ease of use. One student commented that there were always choices on the Web page to get you to do what you wanted to do. They mentioned the multiple ways one could hop between pages, such as arrow icons or the Web browser's "Back" button, as an example.

The instructor generally concurred with the students in their assessment of the Study Guide's clarity. He noted no concerns for his course goals in the design and applauded the ease of navigation of the Guide as a successful organizational component. However, he also acknowledged the complexity of the content and commented that learning would have been better served if the language and detail of the modules was simplified. To improve the clarity, he suggested that more complex information could be provided through hyperlinked articles instead of serving as the backbone of each module.

The instructor did identify a weakness of the Study Guide's organizational clarity that impacted students not using the Guide in a class context. Students of MHCH 103 are provided with an on-line syllabus that includes course information, contact information, and a course schedule. These components are not available to students other than those taking the class. Given the technical complexity of the content and non-linear structure of the Study Guide, the lack of an example guideline or a syllabus to follow could make taking advantage of the content more difficult. Students would be left to their own interpretation as to which concepts are important to study and the order in which the concepts should be studied. As a result, the instructor's goals for the content could lose integrity as students individualize their experiences to a point where no two students have studied the same things. The fact that none of the survey respondents provided any

commentary on the Study Guide's clarity could be interpreted as a symptom of this individualization of the Study Guide's learning goals.

The design should encourage interaction with the content through non-distracting means.

From the class instructor's perspective, the interactive components were crucial to the success of the Study Guide because:

If not for them, I could have just given them [the students] a book instead.

The interactive components provided a flexible stream of discussion that allowed us to follow ideas or thoughts and link them logically with sources of data. I didn't have any concerns about the student's use of these features, but we could have used more in the class.

The students tended to agree with this assessment in their responses. However, the particular interactive components that they found useful to learning varied from individual to individual. For example, both MHCH 103 students indicated that the content's technical language and concepts were challenging to understand. To aid in understanding the content, the students relied upon different interactive components provided by the Study Guide. For one student, the hyperlinked glossary became the key learning resource because it provided immediate meaning for technical terms. The other student identified the exploratory diagrams and images as the key learning resource. She commented, "I did find that it helped me to remember the material if I spent some time exploring them [the images]. I guess because you do an action as you try to learn something." The students of MHCH 103 did note some problems with the functioning of some of the interactive components, especially the glossary. In particular, returning from the glossary entry back to the page of origin positioned the user at the top of the page instead of the place in the text where the hyperlinked term was located. This caused confusion because the student then had to find their place on the page again.

In contrast to MHCH 103 class participants, students who used the Guide as a supplemental educational resource had little to say concerning interactivity. While some mention is made of the usefulness of hyperlinks between sections of text, other



interactive features are barely mentioned, if at all. One student did note difficulty accessing the glossary, but did not elaborate. Technical issues also were cited as a reason the exploratory images were passed over by another student. Overall, the results indicate that students who participated in the class used the interactive features for more involved learning than did students using the Guide as a supplemental resource. There are not enough responses from survey respondents to determine if this was due strictly to technical issues or if other reasons played a role.

The design should encourage interaction between students and teacher.

Student and instructor perspectives of the Study Guide's success in encouraging interaction between students and teacher reveal that the design strategy only achieved a moderate level of success. One evident weakness of the Study Guide's design was the fact that only class participants had access to the on-line discussion forum. Those students who did have access did not understate the forum's importance to their success in the class. The forum is described as a "home base" and a place to "...get a response to your question pretty quickly". They also had praise for the quality of discussion they were able to conduct through the forum. The students cited one classmate in particular who drove many of the discussions and became an invaluable resource for information and interpretation of the content because of her experience in the field. The students also indicated that the discussions were often so engaging they got off topic and needed to be reset by the instructor.

The discussion forum also became the primary source for receiving help. One student commented:

It was very easy to get help. I had never had a class on the Internet and so didn't know what to expect or what type of help I'd need. Between asking questions of other students and Pierre I think I got most of the help I needed.

The fact that the interactive help features were not mentioned by any of the students or instructor may indicate that the discussion forum alone provided an adequate level of interpersonal help.

The instructor also identified the discussion forum as a key driver to class-related communication. He noted that students requested help and voiced their comments, suggestions, and concerns about the class primarily through the discussion forum. In fact, he acknowledged that there would have been an inadequate level of student/teacher interaction without the forum. From his perspective, the forum added value to his teaching strategy by setting up each participant as a peer source for help and information, thus providing the students with additional educational resources.

Despite the generally positive review of the forum, the students and instructor did identify several shortcomings of the Study Guide in providing adequate student/teacher interaction. Much of the interaction that students perceived as essential to learning came from attending the in-class meetings and not the forum. One student commented,

When it comes down to it personally, I saw the modules as a tool to go through the materials but to me the class meetings that we had, where you could talk to the speaker you had a question for, were more important. Maybe because it then seemed easier to conceptualize the information. I also feel that going through the modules sometimes seemed long. Discussion with other students, like you get in the class meetings, helps to kind of break that up.

The students reported that the semester's first in-class meeting was the primary means through which they learned of the instructor's expectations for the class. This in-class meeting also served as an introduction to the Guide and provided students with the opportunity to "walk through" the Guide with the instructor and ask questions concerning its use. One student found this walk through to be critical to getting a handle on the content and suggested that more of this guidance would have benefited her understanding the physiology module in particular.

The instructor also identified shortcomings of student/teacher interaction within the Study Guide design that impacted his ability to receive feedback concerning the Study Guide and class. The Guide included an evaluation form that the students could submit anonymously. However, the instructor was not provided access to the results. The

evaluation results were emailed instead to a school account that had not been maintained for several years. As a result, the instructor "didn't have a good feeling about getting appropriate feedback through the Guide itself."

Finally, it is difficult to overlook that students who did not participate in the class did not have access to either the discussion forum or the in-class meetings. The lack of a tool for peer and instructor communication for these students may have accounted for the fact that no survey respondents commented upon interaction in the surveys. One student did mention that it was easy to get help through the Study Guide, but in general survey respondents did not comment either negatively or positively upon the lack of peer or instructor interaction.

The design should provide adequate means of performance assessment.

Questions concerning performance assessment produced a significant difference of opinion between students and instructor concerning the adequacy of the Study Guide. This difference in opinion implies that the developers did not consider instructor's needs when integrating performance assessment strategies into the design of the Study Guide. While none of the survey respondents found reason to use the quizzes, MHCH 103 students voiced a generally positive opinion of their usefulness. The quizzes were seen as motivation to get through the modules and incentive to focus on the details of the readings. One student remarked:

In the end I felt like I accomplished something when I took the quiz, especially when I felt the section was long or complicated. The feedback also helped me to see what I needed to read closer.

The other MHCH 103 student agreed but suggested limiting the scope of the questions. She reported that, although the quizzes were useful, they covered so much content that unless you were taking notes the whole time it was often difficult to remember the specifics needed to adequately answer the questions.

In contrast, the instructor did not consider the quizzes to be strengths of the Study Guide as designed. The quiz results were not available to him but were only reported back to

the student. Therefore, he could not follow up on how the students were learning through the Study Guide. Outside means of performance assessment such as monitoring the discussion forum, face to face meetings and a final paper were employed instead. The instructor noted that changing this policy to allow the results to be electronically mailed to him would be a significant benefit to the class and make the Study Guide a more self-contained learning environment.

The design should consider student and instructor motivation when using the tool.

Responses to questions that examined the motivational aspects of the Study Guide's design revealed significantly different levels of motivation to use the Study Guide depending upon enrollment status in MHCH 103. Students taking the class reported that they were more motivated to use the Guide for learning than those students who only used the Study Guide as a supplemental resource. The four non-MHCH 103 students who responded to the questions remarked that there was little to motivate them to use the Guide or to learn the materials. Instead, they each identified a deterrent to using the Study Guide including "[a lack of] time", simplicity of the materials, and two responses that can be construed as a failure to provide a learning style amenable to the student. One student indicated that she was "...more comfortable learning physiology from texts I have used previously" while another voiced a disdain for sitting in front of a computer screen to learn. When asked if they found the Study Guide an interesting way to learn about reproductive health only one of the four survey respondents commented in the affirmative.

By comparison, the MHCH 103 students generally seemed to find the Study Guide to be an interesting way to learn about reproductive health. One student admitted:

I'm a bit intimidated by the Internet because you could find yourself alone and without a way to get any direction. I thought I might be left alone in this class but there was always help available through the forum.

Despite initial concerns, students reported high levels of motivation to learn the class materials through the Study Guide. The primary source of their motivation appeared to be their interest in the materials rather than the Study Guide design itself. Where the

Guide did succeed in enhancing student motivation to learn was by providing a clear interface to the materials that interested them. One student reported:

I had no trouble accessing the Guide from school. So that wasn't something that stopped me from using it. The level of language also made the Guide easy to use. It was very clear and simple to understand. ...I think overall I realized that if it was that simple to explain these concepts to me then it just might be that simple for me to understand everything. That was motivating.

Students also pointed out the interactive quizzes as a factor in their motivation. The students perceived each module's quiz as "a good marker" to help keep learning on track. The feedback provided by the quizzes also helped to drive learning since it offered clarification of the technical concepts and made review easier. Although other interactive features, such as the exploratory images, were identified as helpful learning tools, no mention was made of them as a motivational factor.

The instructor's observation of student motivation in his class did not correlate entirely with the student's own perceptions. While the students cited an inherent interest in the material as their primary motivational driver, the instructor suggested that the flexible design of the class might have been significant to the students. The instructor noted that the class received a 4 out of 5 in its semester-end evaluation in support of this perception. The difference of opinion is not a surprise considering that class design and the teaching didactic are both part of the instructor's domain of responsibilities, while following a personal interest in a particular topic falls to the purview of the student. With regards to students using the Study Guide outside of MHCH 103, the instructor remarked that he "didn't have a clue" what they were doing with the Guide or if they were motivated to use it.

Other comments from the interviews indicate that, despite enjoying their Study Guide experience, some students saw limits to the Study Guide as a tool to learn about reproductive health. While the Guide was lauded for its "straight-forward and relevant information", this praise was qualified by one student in a description of the Guide as a good learning environment "to supplement time in class or if it really fits how you prefer

to learn". This limit on the Study Guide's ability to engage every learner was reinforced when the student warned, "If you're used to a more interactive learning style with students and the professor you might find something lacking." These comments do not necessarily imply that students were not motivated use the Study Guide to learn for this particular class, but it does identify the impact that the accommodation of learning style has on student interest in their learning environment. Students are less likely to be motivated to use a learning environment that does not accommodated their personal learning style over one that does.

The design should accommodate multiple learning and teaching strategies.

The results concerning multi-modality in the design strategy generated a wide range of responses both in support of and in opposition to the Study Guide. Several MHCH 103 and non-class students were concerned with the limitations of the computer as a medium for education. "I prefer to learn using paper, books, etc. Reading a computer screen makes my eyes hurt. They get dry," remarked one survey respondent. Another student cited the limits that the computer placed on communication as an impediment to learning in the manner she preferred. According to the student, computer-mediated communication left noticeable gaps in the student/teacher didactic:

This was a new experience for me learning through the Internet, but I think I was still able to work well in the Guide. I prefer the interaction in class, though, rather than doing all the work over the computer. For one reason, I think we could have used a little more feedback from the professor in the discussion forum. ...I think my learning would have been enhanced if he had interacted more in the discussion forum.

In regards to the Study Guide itself, several students perceived a flexibility of design that readily accommodated the learning style they preferred. The self-paced organization of the Study Guide was cited in particular. "I liked that it was flexible. I could do less one week if I was busy and then double up the next," commented one student. Interactive components also were considered key elements of that flexibility. One student who reported being very satisfied with her learning experience suggested that the glossary was critical to her positive learning experience. She suggested that the ability to have the glossary up at all times would be a good improvement to the Guide. Another student

who also reported being very satisfied commented that she even would have preferred to do more work through the Guide, such as longer papers or more short papers because that's what "enhances my learning." She suggested mini-reports or summary questions at the end of each module "to make you slow down and think."

The instructor also acknowledged the Study Guide's flexibility as a trait that had a positive impact on his teaching style for the class. In addition to commenting that his overall teaching experience with the Study Guide left him very satisfied, the instructor indicated that the the flexibility of the Study Guide allowed him to:

...focus on specific points of interest to the students instead of going over everything from cover to cover. The Guide was flexible enough so that we could follow a line of study depending on our interests at the time.

The instructor also noted that the Study Guide encouraged a high level of participation in the class through the discussion forum. As a result, he felt as though he got to know his entire class well. This was in direct contrast to his experience in the traditional classroom environment where only a small minority of students ever seemed to participate. The instructor ultimately was surprised how the Study Guide accommodated a more personalized teaching experience: "I thought that the Internet would add distance to this course but it didn't. I had a high level of interaction with these students."

Not every aspect of the Study Guide was considered as flexible, however. The instructor noted that the Study Guide placed some limitations on teaching that would not exist in a traditional classroom environment. For instance, the class still required face-to-face meetings because the Study Guide did not have multimedia functionality to show movie and sound clips. The instructor noted that some learning experiences simply do not translate to the Web medium. There is no practical way, for example, to support a practicum, shadow public health professionals on the job, or show samples of contraception through the Web. Finally, the instructor pointed to the fact that there was no system in place for him to make updates or changes to the Guide. Although part of this was on account of his lack of training and the appropriate software, he remarked that adding a strategy for updates would be an improvement that would aid his teaching of the

class considerably. Even though class participant satisfaction indicates that the Study Guide was generally successful in providing teaching and learning strategies, the weaknesses identified by students and the instructor indicate that the Study Guide has significant room for improvement in the design.



## V. Recommendations

Based on the results, this study recommends several improvements to the design of the Study Guide. The following recommendations are categorized by design principle, although some suggestions consider more than one principle. Suggestions for new features that Guide users contributed also are incorporated into these recommendations. Implementation of the recommended changes should make the Study Guide a more useful tool to future MHCH users.

### Clarity of instructional goals, content and design

**Issues:** Students taking the class remarked that the language of the Study Guide was often technical and the content very complex for an introductory class. Additionally, several students not participating in the class commented that they didn't use the Study Guide because they perceived the content to be review. The Study Guide also did not provide a syllabus or recommend a strategy of use to students not taking the class. As a result, these students may not have received the maximum benefit of using the Guide.

**Recommendations:** As per the instructor's suggestions, the content of the main Study Guide sections should be reviewed for complexity and simplified where necessary. Students not participating in MHCH 103 would also benefit from inclusion of a syllabus so that they may follow along with the class at their own pace. The designer and instructor should also consider providing advanced topics that expert users would find interesting to read and useful to their studies. These topics could be linked from the main section to keep the body of the Study Guide introductory materials only. They also could compose the body of a second expert edition of the Study Guide.

### Interactions with the Study Guide content

**Issues:** Several students reported technical issues with the interactive components. One noticeable issue was encountered with the functioning of the glossary. Returning from the glossary entry back to the page of origin positioned the user at the top of the page instead of the place in the text where the hyperlink term was located. Students also cited slow loading graphics as an issue. Despite these issues, both the students and the instructor believed that more interactive features would benefit the Guide.

**Recommendations:** First, any technical issues with existing interactive features should be identified and fixed. Then the scope of use of interactive features in the Study Guide should be expanded, based on student and instructor needs. Some suggestions from participants included a glossary that could remain available in its own window at all times, hyperlinks to advanced topics and a WebBot to maintain link farms. The instructor also requested that multimedia clips be incorporated as an essential teaching aid. Some of these new features could form the backbone of an advanced version of the Study Guide.

### Interaction between students and teacher

**Issues:** This study identified three significant weaknesses in the interaction between students and instructor through the Study Guide. First, only class participants had access to the on-line discussion forum. This may have alienated users not taking MHCH 103 by isolating them in the learning environment. Secondly, students mentioned no use of the Study Guide's help features. For students taking MHCH 103, the in-class experience and discussion forum seemed to have filled this roll adequately. However, the only help that non-class students would have had was the Guide's help features. The fact that they mention little use of these features indicates that they may have been an inadequate source of help. Finally, the Study Guide's evaluation form was not designed to provide the instructor with the anonymous feedback concerning the Study Guide. Instead, the results of this form were emailed to an unmonitored inactive account. As a result, the instructor felt as though he did not have an adequate means of obtaining anonymous feedback concerning the Study Guide.

**Recommendations:** The most significant improvement that can be made is to find ways in which to involve non-MHCH 103 students in discussion concerning the Study Guide content. Students could be given access to the class discussion forum or provided with their own discussion forum. Access to a forum should help create a community of users outside of the class and motivate students to use the Guide. The instructor should also evaluate the level of interaction he has with these students. Monitoring a non-class discussion forum could attract students seeking discussion on or clarification of advanced topics. Furthermore, by providing an interactive tutorial, non-class students could garner the same benefits of a Study Guide "walk-through" that the classroom discussion provides to MHCH 103 students. This feature would also benefit students of the class who needed an occasional refresher. As a final recommendation, Study Guide evaluation forms should be forwarded to the instructor instead of the department. This would enable the instructor to have a source of continuous anonymous feedback concerning the Study Guide that would help him more quickly adjust to the needs of the students.

#### Performance assessment

**Issues:** Some students suggested that the questions on the quizzes covered too many details of the content. This made an accurate evaluation of learning difficult. The instructor also noted that he had to depend on multiple external means of evaluating student performance, such as papers or monitoring the discussion forum, because the results of the quizzes currently are not forwarded to the instructor.

**Recommendations:** In keeping with the concept of advanced and introductory versions of the Study Guide, a set of simplified questions could be constructed to replace the current end of module quizzes. The existing quizzes can then be modified and integrating into the advanced Study Guide edition. As an alternative, the instructor could assess the difficulty of each existing question and then redesign the quizzes to present a gradient of difficulty from the first to last question. This should enable students to more accurately assess their level of knowledge for each module. Finally, the instructor should consider the implications of monitoring the quiz results. While student motivation for studying for the quizzes may increase, the students also might consider the Study Guide

to be a less flexible self-paced learning environment. One potential compromise would be to monitor the quizzes without considering the grades part of the assessment for the class.

#### Student and instructor motivation

**Issues:** Only three of the eighteen survey respondents chose to use the Study Guide at any length. Given that so many respondents indicated a high level of familiarity with the Web as a tool, it seems unlikely that training with the Web was a factor in the lack of motivation to use the Study Guide. There is also only scant evidence that implicates lack of access to the Study Guide or technical problems in the low level of use. When asked about motivational factors directly, these students provided several reasons for not using the Guide. These included a lack of time, a belief that the content was too basic, a perception that the content was review, and a dislike of computers as an educational medium.

**Recommendations:** In order to increase use of the Study Guide it is evident that students not participating in the class need to be more involved in the Guide as an educational environment. Students taking MHCH 103 indicated that their primary motivation to use the Study Guide was an interest in the content. If this holds true for the other students, then providing information that the more advanced students find relevant should provide students with more reason to use the Guide. This expert content could be the backbone of the second edition of the Study Guide mentioned previously. It also stands to reason that greater access to features of the class that students found motivating, such as the discussion forum could improve use of the Guide, especially to students not just seeking expert content. A discussion forum should help motivation by creating a community of users as well as providing an informal means of communication with the instructor as an expert. To improve the chances that students will find the discourse of the forum useful, other instructors in the department could rotate turns answering questions on the forum.

Accommodation of multiple learning/teaching strategies

**Issues:** Several students voiced concern about the computer as a viable medium for education. Their comments suggest that the student/teacher didactic of the classroom cannot be replaced easily by interactive features and occasional in-person meetings. The instructor also identified some limitations that the Study Guide as a learning environment imposes on learning, such as the inability to shadow health professionals or show contraception samples over the Web. The instructor also noted that he had no means to update his teaching materials on the Study Guide.

**Recommendations:** No significant changes to the Study Guide are recommended outside of those suggested under other design principles. It is hoped that those changes reflect positively in student and instructor attitudes towards the Study Guide as a medium that accommodates their particular learning/teaching styles. Still, the instructor should be encouraged to allay student concerns over the computer as a learning medium and provide alternatives for those students who simply cannot learn through a computer.

The students and instructor did make several suggestions that they believe would add value to the Study Guide for future classes. Among these are to request students to complete and submit a mini-report on-line at the end of each module in order to make students consider the content more. However, the best recommendation that can be made is to persist in evaluating the Study Guide from the perspective of its users. Identifying the student and instructor attitudes towards their educational experiences should allow the developers to redesign the Study Guide when needed in response to changes in student and instructor needs. Providing a development strategy that gives the instructor more control to update or change the content is a positive step in this direction.

## **VI. Conclusion**

This study was conducted to determine the value of the Interactive Study Guide to Reproductive Physiology as an educational tool to the students and instructors of the Department of Maternal and Child Health. A series of design principles was extrapolated from the literature to use as a gauge for the Study Guide's performance. The study results show that, within the context of the Study Guide's use in MHCH 103, all the design principles were addressed at least adequately except for performance assessment. The results also revealed students using the Study Guide as a supplemental resource had little motivation to learn reproductive health concepts through the Study Guide. Those that did had very mixed opinions concerning the Guide's adequacy. This discrepancy of opinion between class and non-class users suggests that the Study Guide's design possesses several weaknesses that will need to be addressed in order for the Study Guide to be a useful resource for the entire MHCH student population. It is hoped that the suggestions provided lead to an improved Interactive Study Guide to Reproductive Physiology experience for future MHCH students.

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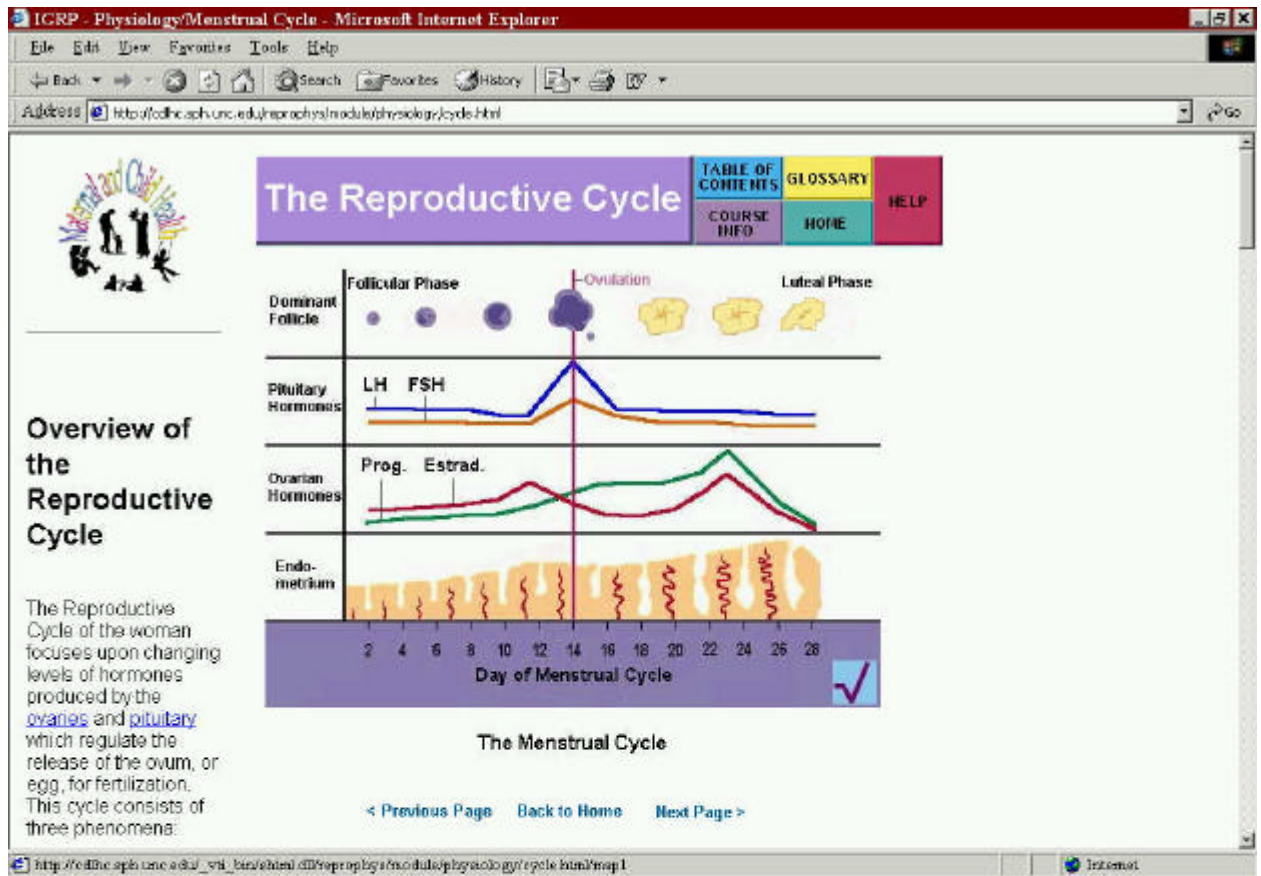
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## Appendix A: Interactive Features




Exploratory Image

Reproductive Physiology - Glossary - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print View

Address http://odbc.aph.ucc.edu/reprophys/module/tutor/glossmain.html



# Glossary

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)

---

**hypothalamus**

The hypothalamus is responsible for the secretion of gonadotropin-releasing hormone (GnRH).

**I**

**ilium**

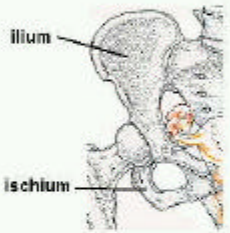
The dorsal and upper one of the three bones composing either lateral half of the pelvis.

**ischium**

The dorsal and posterior of the three principal bones composing the pelvis.

**isthmus**

The segment of the Fallopian tube that has a thick muscle wall, narrow segment, and is closest to the uterus.



Done Internet

## Glossary

Reproductive Physiology - Glossary - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Mail

Address http://olc.ach.unc.edu/reprochys/module/tutor/framesn.html

- [navigate the virtual course](#)
- [Get in touch with the professor](#)
- [Get an overview of all the pages in the Interactive Guide](#)

[Back to Home](#)

## Legend for Navigation and Information

---

When you see the checkbox on an image it means that the image is interactive. You may click on different parts of the image with your mouse to discover more information about the image.

**Hints** Whenever you see the "Hints" bar, it means that study tips or helpful notes on navigation follow. Reading these will help you to get the most from the Study Guide.

[< Previous Page](#)  
[Back to Home](#)  
[Next Page >](#) You'll see these buttons below almost every large image and at the bottom of each page. The "Previous Page" button will take you back to the page coming just prior to your current page in the section if you click on it with your mouse. The "Back Home" button will take you back to the very first page of the Interactive Study Guide. The "Next Page" button will take you to the very next page in your current section.

These numbering markers correspond with the numbered selections in the "Overview" section of many pages. They are not clickable with the mouse.

[estrogen](#) When you see underlined words anywhere in the Interactive Guide you can use your mouse to click on the word to find out more information about that term. Some underlined words will take you to other relevant pages in the Interactive Guide and others will take you to the glossary for a definition of the term. In each case you may return to your place by **clicking the "Back" button or arrow on your web browser.**

---

**Click on the "Back" button or arrow on your web browser to go back.**

Done Internet


## Help System

ICRP - Physiology/Quiz - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Copy Paste

Address http://olhc.aph.usc.edu/physmodule/physiolog/physquiz.html



## Self-test Physiology Quiz

### Instructions

Please fill in the ID boxes, choose the best answer from each pop-up menu, and then click "Submit".

You should receive your results in just a few seconds. You may print this page from your browser to have a permanent record of the questions.

First name

Last Name

- True or False: the reproductive life of the woman is characterized by the cycle of ovulation and menstruation.
- During the Follicular Phase of the menstrual cycle the \_\_\_\_\_ begins to secrete \_\_\_\_\_ which acts on the \_\_\_\_\_ to begin secreting \_\_\_\_\_.
- Which physiological phenomenon is **not** the result of hormonal changes during the Follicular Phase?

Done
Internet

## Self-Grading Quiz

**Confirmation of Physiology Quiz**

---

Hello, Student X

**Here's how you did.**

**Question 1**

Your answer for Question 1: B  
Correct answer was: A. True  
**Question 1 was incorrect!**  
Reproductive life begins at first menses (menarch) and continues about thirty years until menopause. During that time a woman will experience a monthly cycle of ovulation and menstruation.

**Question 2**

Your answer for Question 2: B  
Correct answer was: C. hypothalamus, GnRH, pituitary, FSH  
**Question 2 was incorrect!**  
During the Follicular Phase of the menstrual cycle the hypothalamus begins to secrete gonadotropin-releasing hormone (GnRH) which acts on the pituitary gland to produce follicle-stimulating hormone (FSH).

**Question 3**

Your answer for Question 3: C  
Correct answer was: D. Cervical mucus becomes thicker and more opaque

Done Internet

## Quiz Results




ICRP - Course Evaluation - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Copy Paste

Address http://oche.aph.unc.edu/reprophys/module/evaluation.html



**Instructions**

We would love to know what you think about this study guide. Please take some time to complete this evaluation questionnaire by selection your response from the drop down box next to each question. Then click your mouse on the "Submit" button at the bottom of the page. To clear your answers and start the evaluation again click on the "Reset Questionnaire" button at the bottom of

**Thank You for taking the time to complete this evaluation.**

1. Are you currently a graduate student in Public Health at UNC-CH?

  - A. Yes
  - 2. No

2. How many years of experience do you have using computers?

  - A. less than 1 year
  - 2. 1 year to 3 years
  - 3. more than 3 years

3. How familiar were you with reproductive physiology concepts **before** you used the Interactive Study Guide?

  - A. This was my first exposure to reproductive physiology concepts.
  - 2. I have studied reproductive physiology before on my own.
  - 3. I have studied reproductive physiology before in a class.

4. How much did time you need to complete the Interactive Study Guide? (Please add up all the times from your different visits to the Guide.)

  - A. less than an hour

Done Internet

## Guide Survey

## Appendix B: Survey Packet



THE UNIVERSITY OF NORTH CAROLINA  
AT  
CHAPEL HILL

Student Research Projects  
School of Information and Library Science  
University of North Carolina at Chapel Hill

CB# 3360, 100 Manning Hall  
Chapel Hill, NC 27599-3360  
Phone: 919-962-8366

Greetings,

I am a student at the School of Information and Library Science at UNC where I am pursuing a Masters of Science in Information Science. I am also one of the developers of the Study Guide to Reproductive Physiology that is currently used in MHCH 103 - Introduction to Reproductive Physiology and Contraception and also is available to you as a supplemental educational resource. My Master's Paper examines the effectiveness of the Study Guide's interactive design in helping students learn about reproductive physiology. As part of the select group of students and educators who may have used this educational tool your feedback is very valuable to me.

I would like to invite you to participate in a study that will help to determine the future development of the Interactive Study Guide as a Web-based course and supplemental educational tool offered by your department. I'm interested in learning whether you used the Interactive Study Guide, in understanding how helpful you felt the Study Guide was to learning about reproductive physiology, and in finding out what kind of improvements you think should be made to make the Study Guide a better experience for students. By completing the brief survey included with this letter, you will be helping the Department of Maternal and Child Health Web developers find ways to improve the Study Guide's interactive design for future users.

You can be assured that all responses are entirely confidential and will only be seen by myself and my Master's Paper advisor, Dr. Barbara Wildemuth, Associate Professor, School of Information and Library Science, UNC-CH. Your responses may be quoted in my Master's paper, but an identification number or fictitious name (i.e. *student x*) will be assigned to your response so that your real name will never be used. Once the Master's Paper is completed, any connection between your responses and the identification number or name will be destroyed. Your participation in this study is completely voluntary. You are free to refuse to participate without penalty and without jeopardy.

If you are interested in sharing your experiences using the Interactive Study Guide to Reproductive Physiology, simply fill out the included survey at your leisure and mail in the self-addressed stamped envelope provided. No further action will be required on your part. You may keep this cover letter as evidence of your consent to participate in this study. The number of expected participants for this study who may fill out the survey is thirty-five. Three additional students and one instructor will be interviewed. If you do not wish to participate in this study you may simply discard the survey or return to me unanswered. For further information about this study, please feel free to contact Barbara Wildemuth at 962-8072 or myself at (408) 765-6884 or email me at cervd@ruby.ils.unc.edu. I will be happy to answer any questions you may have.

This study has been approved by the Academic Affairs Institutional Review Board (AA-IRB) of the University of North Carolina at Chapel Hill. Please feel free to contact the AA-IRB if you have questions (contact David A. Eckerman, Chair, CB #4100, 201 Bynum Hall, UNC-CH, NC 27599-4100, (919) 962-7761 or email aa-irb@unc.edu.) Thank you kindly in advance for your cooperation and your time.

Sincerely,

D.Jay Cervino

## **Interactive Study Guide to Reproductive Physiology Survey for Students**

The following survey will ask you about your use of the Internet, in general, and your use of the Interactive Study Guide to Reproductive Physiology, especially as it refers to your learning style and interaction with the Guide. If you have not used the Guide for a while you can refresh your memory by going to <http://cdlhc.sph.unc.edu/reprophys/>. **Even if you have not used the Study Guide**, please respond to the first two questions.

Your input is very valuable to helping us identify the strengths and weaknesses of the Study Guide's design and will help the School of Public Health determine how to best improve the Study Guide for future students. Your responses to these questions are voluntary. Please feel free to decline to answer any of the questions should you feel it necessary. Feel free to write on the back of this survey if you need more room to answer.

---

For these first three questions, please circle the letter that you feel fits best.

1. How often did you use the Study Guide to Reproductive Physiology to help you study reproductive physiology and contraception concepts?
  - a. did not know that the Interactive Study Guide was available to me
  - b. knew that the Interactive Study Guide was available as a class but did not use
  - c. rarely - used once or twice this past semester
  - d. occasionally - used several times this past semester
  - e. often - used weekly this semester
  
2. How would you rate yourself in how familiar you are using the World Wide Web?
  - a. Not familiar at all. Rarely use.
  - b. Somewhat familiar. Browse the web.
  - c. Very familiar. Use the Web for research.
  
3. Where did you most often access the Interactive Study Guide when you used it to study reproductive physiology and contraception concepts?
  - a. School of Public Health computer lab
  - b. Other UNC computer lab
  - c. Work or office computer
  - d. Home computer
  - e. Laptop you purchased for school through the Carolina Computer Initiative
  - f. Other \_\_\_\_\_



8. In your experience, how **easy** was it for you to get **help** from the Study Guide to navigate, use features, take quizzes, or get information about the Study Guide when you needed? With which features or in which situations was it difficult to get help when you needed it, if any? In general, where did you go most frequently to get the help you needed: the Study Guide help section, the instructor, other students, or elsewhere?
  
9. How **motivated** were you to use the Study Guide as a learning tool? Was there anything in particular that motivated or **deterred** you from using this Guide, such as accessibility to the Study Guide, the design of the Study Guide, or interest in the material?
  
10. In your experience, how **easy** or **difficult** was it for you to learn how to use the Study Guide? Was there anything in particular, such as navigation, interactive components, or the computer itself that made the Study Guide easy or difficult to learn?
  
11. Students learn in many different ways. Some students prefer to learn by asking questions of the teacher and other students while some students learn by browsing and exploring the materials. Others prefer reading and taking notes. Did you feel that the Study Guide was **accommodating** to the way you prefer to learn? Were there any aspects of the Study Guide in particular that you feel especially accommodated your particular learning style? Did anything about the Study Guide make it more difficult for you to learn the way that you prefer?

12. Did you find the Study Guide to be an **interesting** way to learn about reproductive physiology and contraception? What made using the Study Guide an interesting or **uninteresting** experience for you?
13. Overall, how **satisfied** are you with your experience using the Study Guide as a tool to learn about reproductive physiology and contraception? What changes would you make to the Study Guide to improve it for future students?

Thank you for your participation in this evaluation. Please mail the survey form to:

D. Jay Cervino  
4948 Poplar Terrace  
Campbell, CA 95008

Good Day, MCH students,

I would like to invite you all to participate in a study that will help the Department of Maternal and Child Health advance the use of Web technology in the delivery of interactive educational materials to its students. Many of you may know that the department makes the **Interactive Study Guide to Reproductive Physiology** available to all MCH students on the World Wide Web (<http://cdlhc.sph.unc.edu/reprophys/>) as an educational resource for learning about reproductive physiology concepts. As a student who may have used the Interactive Study Guide this past semester, either as a supplemental resource or as part of MHCH 103, your experience using the Study Guide is very valuable to helping our department improve the design of current and future Web-based educational materials.

Please take a moment to review the study and see if you would like to volunteer to participate. By participating in this brief study you will have the opportunity to provide valuable feedback into how students learn best using interactive Web-based educational materials. This in turn will help our department meet its objective of enabling the student to translate their interest in public health issues into leadership for improving the health of women, children, and families.

Should you have any questions concerning this study, don't hesitate to contact the study investigator D.Jay Cervino at 408-364-9521 or myself.

Thanks for your time,

Dr. Pierre Buekens  
MCH Chair





THE UNIVERSITY OF NORTH CAROLINA  
AT  
CHAPEL HILL

Student Research Projects  
School of Information and Library Science  
University of North Carolina at Chapel Hill

CB# 3360, 100 Manning Hall  
Chapel Hill, NC 27599-3360  
Phone: 919-962-8366

Greetings,

I am a student at the School of Information and Library Science at UNC, where I am pursuing a Masters of Science in Information Science. I recently sent you information concerning a study I am conducting to explore the effectiveness of the Interactive Study Guide to Reproductive Physiology's interactive design in helping students learn about reproductive physiology. As part of the select group of students and educators from the Department of Maternal and Child Health at UNC-CH who may have used this educational tool, your feedback is very valuable to me.

I would again like to invite you to participate in a study that will help to determine the future development of the Interactive Study Guide as a Web-based course and supplemental educational tool offered by the Department. I'm interested in understanding how helpful you felt the Study Guide was to learning about reproductive physiology and what kind of improvements you think should be done to make the Study Guide a better experience for students. By completing the brief survey included you will be helping the Department of Maternal and Child Health Web developers find ways to improve the Study Guide's interactive design for future users.

You can be assured that all responses are entirely confidential and will only be seen by myself and my Master's Paper advisor, Dr. Barbara Wildemuth, Assistant Professor, School of Information and Library Science, UNC-CH. Your responses may be quoted in my Master's paper, but an identification number or fictitious name (i.e. *student x*) will be assigned to your response so that your real name will never be used. Once the Master's Paper is completed, any connection between your responses and the identification number or name will be destroyed. Your participation in this study is completely voluntary. You are free to refuse to participate without penalty and without jeopardy.

If you are interested in sharing your experiences using the Interactive Study Guide to Reproductive Physiology, simply fill out the included survey at your leisure and mail in the self-addressed stamped envelope provided. No further action will be required on your part. You may keep this cover letter as evidence of your consent to participate in this study. The number of expected participants for this study who may fill out the survey is

thirty-five. Three additional students and one instructor will be interviewed. If you do not wish to participate in this study you may simply discard the survey or return to me unanswered. No further contact will be made with you. For further information about this study, please feel free to contact Barbara Wildemuth at 962-8072 or myself at (408) 765-6884 or email me at cervd@ruby.ils.unc.edu. I will be happy to answer any questions you may have.

This study has been approved by the Academic Affairs Institutional Review Board (AA-IRB) of the University of North Carolina at Chapel Hill. Please feel free to contact the AA-IRB if you have questions (contact David A. Eckerman, Chair, CB #4100, 201 Bynum Hall, UNC-CH, NC 27599-4100, (919) 962-7761 or email aa-irb@unc.edu.) Thank you kindly in advance for your cooperation and your time.

Sincerely,

D.Jay Cervino

## Appendix C: Interview Packet

### Interactive Study Guide to Reproductive Physiology Interview Schedule for Students of MHCH 103

#### To read prior to interview:

The following interview will ask you ten questions concerning your experiences with the Interactive Study Guide to Reproductive Physiology, especially as it refers to your learning style and interaction with the Guide. There are also three brief questions about your use of the Study Guide and the Internet in general. If you have not used the Guide for a while you can refresh your memory by going to <http://cdlhc.sph.unc.edu/reprophys/> prior to the interview.

Your input is very valuable in helping us identify the strengths and weaknesses of the Study Guide's design and will help the School of Public Health determine how to best improve the Study Guide for future students. Your responses to these questions are voluntary. Please feel free to decline to answer any of the questions should you feel it necessary.

14. Did you feel that the instructor's goals for the class material, such as the topics to be covered, the key concepts, and student performance requirements were **clearly defined** in each section of the Study Guide? What do you feel should have been more clearly defined?
15. The Study Guide was designed to encourage students to interact with the class materials through the use of hyperlinks to glossary terms, images you could explore with your mouse, and toolbars linking Study Guide sections. In your experience were these features **useful or distracting** to helping you learn the content? Why?
16. Did you feel that the Study Guide **encouraged** frequent and meaningful **interaction** between the students and the instructor? Between students? Did you feel that the levels of interaction the Study Guide encouraged were a benefit or a disadvantage to helping you learn the materials? Why?
17. Could you gauge how well you were learning by taking the **interactive quizzes** at the end of each section of the Study Guide? Do you feel the **feedback** you received from these quizzes was **useful** in helping you to learn reproductive physiology and contraception concepts? Why or why not?
18. In your experience, how **easy** was it for you to get **help** from the Study Guide to navigate, use features, take quizzes, or get class information when you needed? Which features or in which situations was it difficult to get help with when you needed, if any? In general, where did you go to the most to get the help you needed: the Study Guide help section, the instructor, other students, or elsewhere?

19. How **motivated** were you to use the Study Guide as a learning tool? Was there anything in particular that motivated or **deterred** you from using this Guide such as accessibility to the Study Guide, the design of the Study Guide, or interest in the material?
20. In your experience, how **easy** or **difficult** was it for you to learn how to use the Study Guide? Was there anything in particular, such as navigation, interactive components, or the computer itself that made the Study Guide easy or difficult to learn?
21. Students learn in many different ways. Some students prefer to learn by asking questions of the teacher and other students while some students learn by browsing and exploring the materials. Others prefer reading and taking notes. Did you feel that the Study Guide was **accommodating** to the way you prefer to learn? Were there any aspects of the Study Guide in particular that you feel especially accommodated your particular learning style? Did anything about the Study Guide make it more difficult for you to learn the way that you prefer?
22. Did you find the Study Guide to be an **interesting** way to learn about reproductive physiology and contraception? What made using the Study Guide an interesting or **uninteresting** experience for you?
23. Overall, how **satisfied** are you with your experience using the Study Guide as a tool to learn about reproductive physiology and contraception? What changes would you make to the Study Guide to improve it for future students?

For the following questions please tell me which response you feel fits best.

24. How often did you use the Study Guide to Reproductive Physiology to help you study reproductive physiology and contraception concepts?
  - f. did not know that the Interactive Study Guide was available to me
  - g. knew that the Interactive Study Guide was available as a class but did not use
  - h. rarely - used once or twice this past semester
  - i. occasionally - used several times this past semester
  - j. often - used weekly this semester
25. How would you rate yourself in how familiar you are using the World Wide Web?
  - d. Not familiar at all. Rarely use.
  - e. Somewhat familiar. Browse the web.
  - f. Very familiar. Use the Web for research.

26. Where did you most often access the Interactive Study Guide when you used it to study reproductive physiology and contraception concepts?
- g. School of Public Health computer lab
  - h. Other UNC computer lab
  - i. Work or office computer
  - j. Home computer
  - k. Laptop you purchased for school through the Carolina Computer Initiative
  - l. Other \_\_\_\_\_

This concludes the interview. Thank you kindly for your time.

## **Interactive Study Guide to Reproductive Physiology Interview Schedule for Instructors of MHCH 103**

### **To read prior to interview:**

The following interview will ask you ten questions concerning your experiences with the Interactive Study Guide to Reproductive Physiology, especially as it refers to your teaching style. There are also three brief questions about your use of the Study Guide and the Internet in general. If you have not used the Guide for a while you can refresh your memory by going to <http://cdlhc.sph.unc.edu/reprophys/> prior to the interview.

Your input is very valuable to helping us identify the strengths and weaknesses of the Study Guide's design and will help the School of Public Health determine how to best improve the Study Guide for future students. Your responses to these questions are voluntary. Please feel free to decline to answer any of the questions should you feel it necessary.

27. Did you feel that your educational goals for the class, such as the topics to be covered, the key concepts, and student performance requirements were **clearly defined** in each section of the Study Guide? What do you feel should have been more clearly defined?
28. The Study Guide was designed to encourage students to interact with the course materials through the use of hyperlinks to glossary terms, images the student could explore their mouse, and toolbars linking Study Guide sections. In your experience were these features **useful** in helping you teach the course content? Why or why not? What concerns, if any, do you have about the use of these features to present the class materials to the students?
29. Did you feel that the Study Guide **encouraged** frequent and meaningful **interaction** between the students and the instructor? Between students? Did you feel that the levels of interaction the Study Guide encouraged were a benefit or a disadvantage to helping you teach the materials for this class? Why?
30. How **useful** do you feel the Study Guide's **interactive quizzes** were in helping you **verify** that students were achieving the educational goals you established for this course? Do you feel the **quizzes** and quiz feedback sufficiently captured your key learnings for each section of the Study Guide? Did you rely on additional methods of verification? If so, what were they?
31. As a course with fewer in-class sessions than the average college course, students are required to take greater responsibility for their own exploration of the course materials. What concerns, if any, did you have regarding the students' ability to remain **motivated** for the duration of the course in this learning environment? What aspects of the Study Guide in particular do you feel may have deterred or motivated

- the student from using the Guide such as accessibility, design of the Study Guide, or interest in the class materials?
32. How often did students actively seek help from you by means of the Study Guide and through other means such as phone and office visits with regards to the course materials or class requirements? Do you feel that the Study Guide provided appropriate mechanisms for the students to contact the instructor or give anonymous course feedback? Why or why not?
  33. Did the use of the interactive Study Guide in your class cause you to change your **teaching style** in any way? If so, how? Was there any aspect of the Study Guide in particular that you especially felt **accommodated** your particular teaching style? Did anything about the Study Guide make it more difficult for you to teach the way that you prefer?
  34. Did you find the inclusion of the Study Guide in your class to be an **interesting** way to teach Reproductive Physiology and Contraception? What made using the Study Guide to teach an interesting or **uninteresting** experience for you?
  35. In your experience, how **easy** or **difficult** was it for you to learn how to use the Study Guide? Was there anything in particular, such as navigation, interactive components, or the computer itself that made the Study Guide easy or difficult to learn?
  36. Overall, how **satisfied** are you with your experience using the Study Guide as a tool to teach Reproductive Physiology and Contraception? What changes would you make to the Study Guide or this class in general to improve it for future students?

For the following questions please circle the letter that you feel fits best.

37. How often did you use the Study Guide to Reproductive Physiology to help you teach reproductive physiology and contraception concepts?
  - k. rarely - used once or twice this past semester
  - l. occasionally - used several times this past semester
  - m. often - used weekly this semester
  
38. How would you rate yourself in how familiar you are using the World Wide Web?
  - g. Not familiar at all. Rarely use.
  - h. Somewhat familiar. Browse the web.
  - i. Very familiar. Use the Web for research.

39. Where did you most often access the Interactive Study Guide when you used it to teach reproductive physiology and contraception concepts?
- m. School of Public Health computer lab
  - n. Other UNC computer lab
  - o. Work or office computer
  - p. Home computer
  - q. Laptop provided by Carolina Computer Initiative
  - r. Other \_\_\_\_\_

This concludes the interview. Thank you kindly for your time.



## **Study Recruitment Telephone Scripts**

### **Script for potential student participants from MHCH 103:**

#### **To be read at start of recruitment telephone call:**

Good Afternoon, my name is D.Jay Cervino. I am a Master's Student in the School of Information and Library Science at UNC. I recently sent you information concerning a study I am conducting for my Master's Paper research. This study examines the effectiveness of the Interactive Study Guide to Reproductive Physiology that you may have used in MHCH 103 this past semester.

As mentioned in the information I sent, I am calling to get your consent to participate in a brief telephone interview with you. The interview will last no longer than thirty minutes and consist of questions that ask you to relate some of your experiences using the Study Guide such as how useful you felt the Study Guide was in helping you to learn the class materials. You are under no obligation to participate in this study.

Would you be interested in participating in this study?

#### **If the participant answers yes:**

I'd like to set up a day and time to interview you. The interview will take no longer than thirty minutes of your time. What day and time for the telephone interview is convenient for you?

#### **Once interview day/time is arranged:**

I will contact you by telephone on \_\_\_\_\_ at \_\_\_\_\_ to conduct the interview. Please keep the study information letter I sent you earlier as evidence of your participation in this study. Should you need an additional copy of the letter, have any questions concerning the study, or wish to cancel or change the day or time of the interview please feel free to contact Dr. Barbara Wildemuth at (919) 962-8072 or myself at (408) 765-6884. Thank you kindly for your time and participation.

#### **If the participant answers no:**

Thank you kindly for your time.

## **Script for potential educator participants from MHCH 103:**

### **To be read at start of recruitment telephone call:**

Good Afternoon, my name is D.Jay Cervino. I am a Master's Student in the School of Information and Library Science at UNC. I recently sent you information concerning a study I am conducting for my Master's Paper research. This study examines the effectiveness of the Interactive Study Guide to Reproductive Physiology that you may have used to teach MHCH 103 this past semester.

As mentioned in the information I sent, I am calling to get your consent to participate in a brief telephone interview with you. The interview will last no longer than thirty minutes and consist of questions that ask you to relate some of your experiences using the Study Guide such as how useful you felt the Study Guide was in helping you to teach the class materials. You are under no obligation to participate in this study.

Would you be interested in participating in this study?

### **If the participant answers yes:**

I'd like to set up a day and time to interview you. The interview will take no longer than thirty minutes of your time. What day and time for the telephone interview is convenient for you?

### **Once interview day/time is arranged:**

I will contact you by telephone on \_\_\_\_\_ at \_\_\_\_\_ to conduct the interview. Please keep the study information letter I sent you earlier as evidence of your participation in this study. Should you need an additional copy of the letter, have any questions concerning the study, or wish to cancel or change the day or time of the interview please feel free to contact Dr. Barbara Wildemuth at (919) 962-8072 or myself at (408) 765-6884. Thank you kindly for your time and participation.

### **If the participant answers no:**

Thank you kindly for your time.