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ABSTRACT

As the number and complexity of required technology-related competencies grow, basic teacher education media courses need to develop alternatives to instructor-led lecture-based formats in order to maintain essential components of course content while incorporating new content in expanding technologies. Creating technology-mediated instructional environments that are used as out-of-class assignments is one way to deal with this issue. This paper presents the process of transforming lesson content from lecture-based format to instructional content delivered through the World Wide Web. It discusses visual literacy concepts and details the steps taken to make the Web site instructional and interactive rather than merely informational. Highlights include: (1) defining visual literacy content; (2) design of computer mediated instruction; (3) a research review; (4) student feedback on the Web site; (5) interactive instruction; (6) designing the instruction, including two sample learning activities; and (7) the visual literacy instructional package. Several sample screens are included. (Contains 19 references.) (Author/AEF)

Technology Tools for Restructuring Course Delivery

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Abstract

As the number and complexity of required technology-related competencies grow, basic teacher education media courses need to develop alternatives to instructor-led lecture-based formats in order to maintain essential components of course content while incorporating new content in expanding technologies. Creating technology-mediated instruction that are used as out-of-class assignments is one way to deal with this issue. This paper presents the process of transforming lesson content from lecture-based format to instructional content delivered through the World Wide Web It details the steps taken to make the Web site instructional and interactive rather than merely informational.

Introduction

The dilemma we all face in delivering technology-based courses is how to add new technology information and skills while maintaining essential existing content. Alternative instructional delivery mechanisms must be explored to deal with the dilemma.

The World Wide Web is host to hundreds of thousands of Web sites. Information is accessible day and night, anywhere in the world, on any topic. The Web is also becoming increasingly used for instructional purposes, not just information delivery. The accessibility of information and the ability to create interactive instruction on the Web make it an attractive medium for the delivery of instruction.

Framework

Courses in educational media are often logical places to incorporate new and expanding technology content for undergraduate education majors. At our university, technology components primarily reside in one educational media course. As we have expanded the course content over time beyond planning, creating, evaluating, and using instructional media to include word processing, graphics, multimedia, and the Internet, existing content is continually revised and updated. By critically analyzing course content, components are identified as possible candidates for alternative instructional delivery. In a continuing effort to develop mediated instruction, selected components of the educational media course are targeted for implementation in alternative, computer-mediated formats.

Visual literacy was identified as one course component that might alternatively be taught through a technology-based medium rather than through instructor-led classroom lecture. Since teachers need to be able to understand, interpret, and create visual images for instructional purposes, a basic understanding of visual literacy concepts is crucial not only in planning and developing visual images, but also in evaluating images for instruction. A technology-based instructional package on visual literacy would give students the capability to learn visual literacy concepts as an out-of-class assignment that could then be reinforced through classroom discussion and course assignments, thus freeing up the contact time for other issues.

Defining Visual Literacy Content

Visual literacy is a required topic in the undergraduate coursework for students preparing for the teaching profession at our university. We are bombarded with visual messages from television, film, books, periodicals, billboards, and computer screens. Painters, sculptors, actors, dancers, and other artists also visually communicate messages to us. Educators need to be able to understand how to communicate visually with their students as well as how to help their students interpret what they see. While entire courses can be devoted to the study of visual literacy, in preservice education the need is to focus on basic principles and key factors rather than the entire scope of the

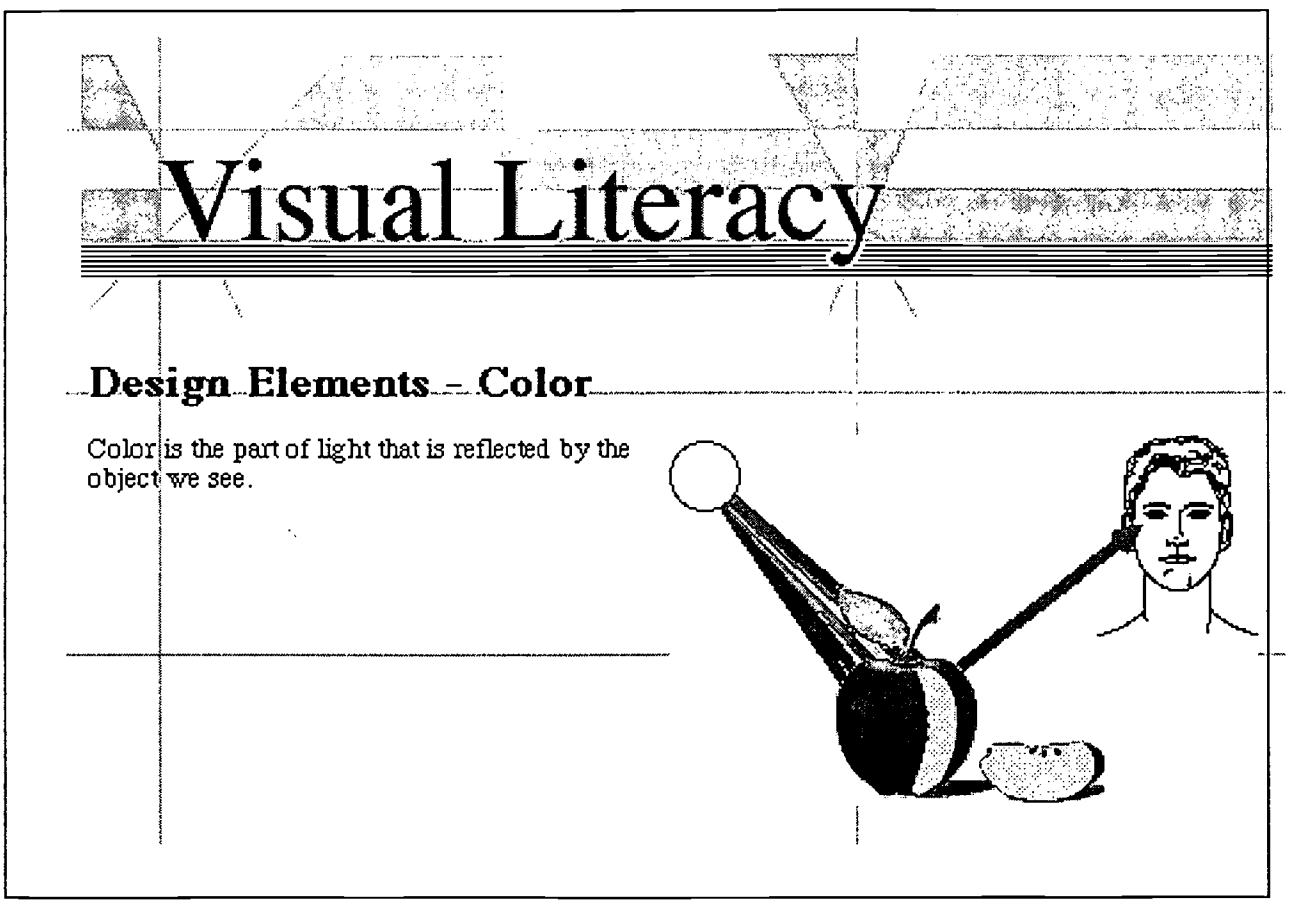
discipline. The content of the lesson in this course includes an introduction to basic visual literacy concepts, visual design elements and principles, factors that impact visual message interpretation, and practical guidelines for producing instructional visual images. This content reflects topics on visual literacy principles from three sources: *Instructional Media and Technologies for Learning* (Heinich, Molenda, Russell, & Smaldino, 1996), *Visual Literacy: A Spectrum of Visual Learning* (Moore & Dwyer, 1994), and *Visual Communicating* (Wileman, 1993).

Design of Computer-mediated Instruction

An instructional design was completed (Kovalik & Shoffner, 1996) to make the transition from an instructor-led lecture-based format to a computer-mediated format. A decision was made to create the instruction in two formats, as a computer-based tutorial and as a World Wide Web site.

After completing the instructional design, storyboards were created for computer-based instruction (CBI) on visual literacy. A subject matter expert and an instructional technology graduate student reviewed the storyboards. Suggestions for changes were discussed with the designer and revisions made where appropriate and necessary. Each CBI screen was designed to contain a minimum amount of text with a related visual image. The images were selected to clarify or illustrate the accompanying text (see Figure 1). All images used in the instruction were either copyright- free clip art or original work of the authors. Obtaining permission to use copyrighted work was too time consuming and potentially too costly. While there are images that would better illustrate a concept, if they were not available copyright-free they were not considered for inclusion in the instruction.

Figure 1. Visual Literacy Website Screen Dealing With the Design Element, Color



Following the design, development, and implementation of the computer-based tutorial, initial formative evaluation was conducted with students in a graduate instructional technology course. Changes were made to correct minor deficiencies, but no major content changes were made. The computer-based tutorial was translated to HTML and uploaded to a Web site. The Web version mirrored the CBI version.

Research Results

The effectiveness of newer interactive technology usage in instruction is open to debate. Moore, Myers, and Burton (1993) state that little actual research regarding the effectiveness of interactive technologies has been conducted and what has been conducted has limited value. Practitioners and researchers call for research that goes beyond traditional comparison studies. Grabowski and Pearson (1988), Slee (1989), Reeves (1986), Kozma (1991), and Moore et al (1993) have made calls for conducting research on the instructional strategies related to the specific attributes of the interactive medium. Hannafin (1992) identified the areas of constructivist models of teaching and acquiring knowledge, hypermedia, and cooperative teaching and learning as innovative instructional strategies that need to be addressed in emerging technology research.

In keeping with these recommendations for examining instructional strategies in technology-mediated instruction, a research study was designed to determine the effects of varying instructional strategies on visual literacy instruction (Shoffner, 1997; Shoffner & Dalton, 1998). The study used a completely crossed 2 (organizational strategy) x 2 (delivery strategy) x 2 (management strategy) factorial design, post-test only control group design. Organizational strategies employed included criterion-referenced, objectivist instruction and problem-based, constructivist instruction. Delivery strategies employed included the local, computer-based instruction and the web-based instruction described above. Two management strategies were used, participation by individuals and cooperative dyads. One hundred thirty-eight undergraduate education students were randomly assigned to treatment groups and a control group and received self-paced instructional treatments. Two weeks after treatment, section instructors collected subject-created instructional media (poster and overhead transparency). At that time, each subject completed a 30-item objective achievement instrument during a regular class session. Subject instructional media products were assessed using a checklist that rated appropriate use of visually literacy concepts. Results from these two measures were combined to produce a measure of achievement. Learners were assessed on performance (achievement), and instructional efficiency (achievement divided by time spent on treatment).

Achievement measures for all treatment groups showed significantly higher levels of achievement when compared to the appended control group. Using multivariate and univariate analyses of variance, data were examined to determine what effect varying instructional strategies had on learning (achievement and instructional efficiency). Results indicated no statistically significant differences between any treatment groups. In particular, results indicated no significant differences in achievement between the computer-based tutorial and the web-based instruction.

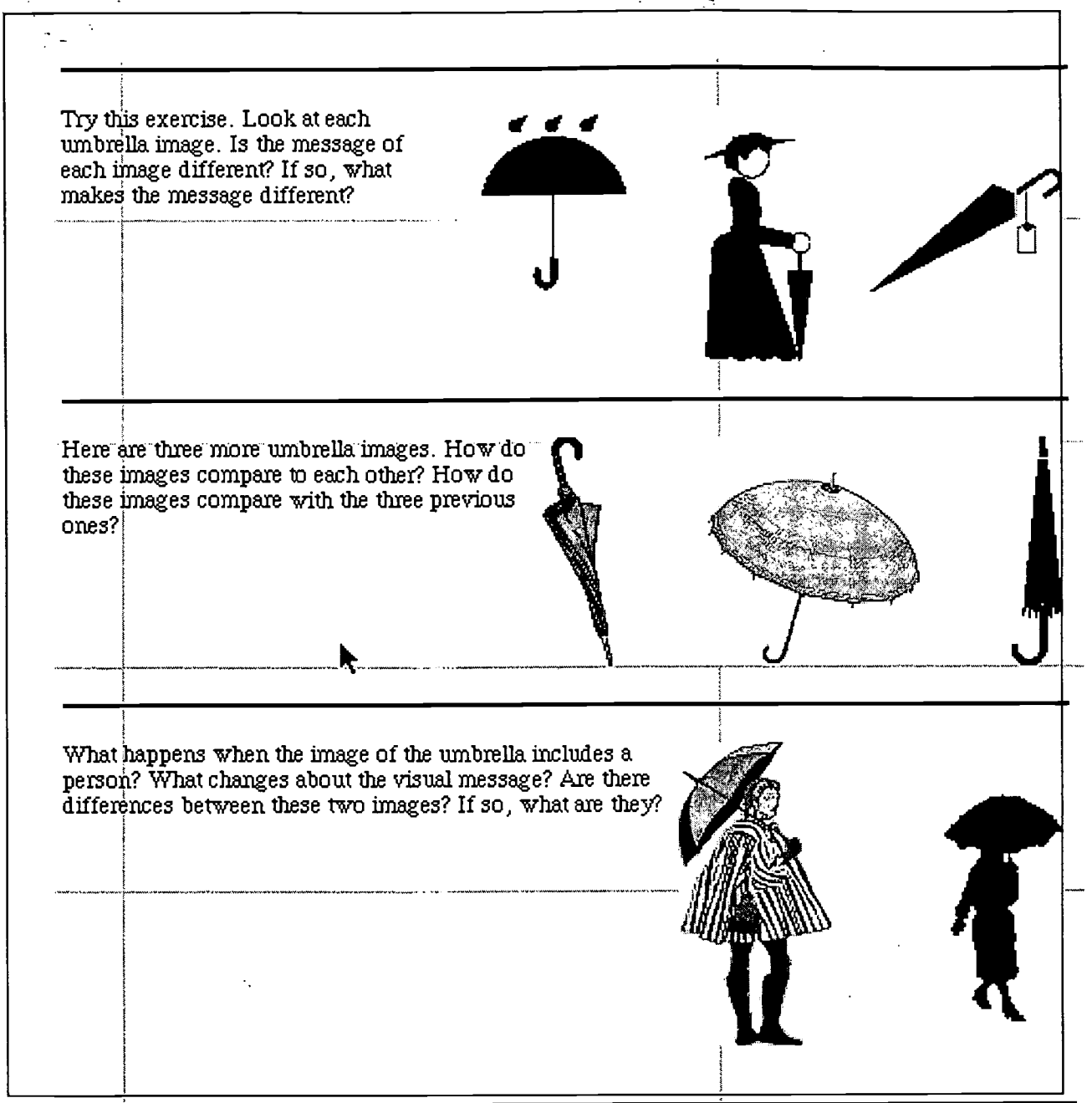
This result was not unanticipated since, in an attempt to control for error, design of the Web versions was highly similar to the respective CBI versions. While initial results indicated that the CBI and web-based instruction were equal in achievement results, we decided to maintain only the Web site. There are several reasons for this decision: (a) Students have consistently commented in course evaluations that the class requires too much time for the credit hours. This perception is largely due to the fact that because of specialized equipment and materials, students must spend much of their out-of-class time in labs to complete assignments and open lab times are not always convenient to student schedules. (b) One of the principles followed in the course is to demonstrate the technology through a variety of instructional delivery methods as well as instructing about media and technology. (c) Some Instructional Technology graduate courses are being redesigned for distributed education. Maintaining this module on the Web makes it accessible to students in these courses as well as the Principles of Educational Media students. (d) Many of the assignments in the courses are dependent on the visual literacy concepts presented on the Web. The information needs to be available on an ongoing basis.

Using web-based instruction allows students to access the site at their convenience, demonstrates an innovative instructional technique, makes it accessible to students in distance learning classes, and makes it available as a reference while completing assignments. The CBI version cannot address all of these issues as easily as the web-based instruction.

Student Feedback

The original Web site provided basic visual literacy information. Even though there are several places in the site where users are queried on the interpretation of visual images (see Figure 2), there is no mechanism to accept user input and provide feedback. Concerned about this lack of interactivity, we continually sought formal and informal evaluative comments and criticism of the site from users. After students completed the Web assignment, they were asked to react to the site in terms of its instructional effectiveness and usability.

Figure 2. Types of Rhetorical Questions Asked in the Original Website



Our results indicate that, overall, users like the Web site. Most feel the site is well organized, self-explanatory, and contains an adequate amount of basic information on visual literacy. A number of users felt they benefited from text/graphic combinations. The ability to see the words and concepts while having the graphic to reinforce the ideas presented was appreciated. User-control was also cited as a positive attribute of the Web site. Students felt that the ability to work at their own pace and the ability to review the information were important to their learning.

The ability to access the tutorial at their convenience and to print the information were also cited as advantages of the web-based instruction. As indicated previously, student complaints about the work involved in the course centered around the need for lab time. The availability of the instruction at any time is an advantage for learners. Students also commented on the change from a classroom lecture-based format to the self-instructional format. When information is presented in lecture format, some students concentrate on writing comprehensive notes rather than on listening to, and trying to understand, content. With the web-based instruction, students can review

the information as needed. When students are equipped with content knowledge, class discussion and reinforcement of the content becomes more meaningful. Previously, class time was devoted solely to presentation of visual literacy content. Within that framework, students applied visual literacy concepts to projects with varying success. Since the introduction of the web-based visual literacy site, there has been a dramatic positive increase in the quality of student-created projects. This increase may be partly attributable to classroom discussion, reflection, and critique of visual messages.

Students also provided suggestions for improvement. The majority of suggestions focused on the lack of interactivity. Students indicated they would like to experiment with basic design elements and principles. They also commented that there is a need for interactivity and feedback from the site. The perception was that they could have retained more if it was more interactive.

This emphasis on lack of user interaction from the students and our own recognition that the Web could be more interactive caused us to look for ways to provide interactivity and feedback. Although questions were asked to encourage the student to think about further applications of the information, we had not provided the learner with meaningful ways to test his/her understanding of the concepts or to practice visual literacy skills. Interactive exercises would greatly improve the site. We therefore began to address the identified problems and recommend revisions.

Interactive Instruction

Changes in technology have advanced the potential use of the Web beyond sources of information to interactive instructional mediums. Links to related sites, areas to input data, and ways to send information to and from multiple sites offer one type of interactivity, but there are other possibilities.

Our goal was to modify the visual literacy Web site to make it more instructional and interactive. Instructional strategies designed to improve learning include embedding problem-solving activities, enabling question-and-answer sessions, and adding evaluation measurements. Looking first to interactivity, the original visual literacy Web site included only two interactive functions, pacing and navigation. Our goal was to add the functions of confirmation and inquiry. Additionally, we investigated computer-mediated testing options including single multiple-choice, multiple multiple-choice, single point-and-click, multiple point-and-click, free response, and simulation (Foster and Olsen, 1997).

We first concentrated on ways to add interactivity to the Web site. Several strategies were identified, including providing a realistic problem to be solved using visual literacy concepts, displaying multiple images and asking students to identify relevant visual literacy elements, and providing a visual representation of a concept to be interpreted from multiple cultural perspectives. Options for revision of the visual literacy Web site ranged from a complete reworking of the site, to the addition of a separate path for activities, to making minor modifications, such as adding a multiple choice quiz. Recognizing the strengths of the existing Web site, we decided to build two paths. One path would maintain the current content, the second path would provide the learner with a series of problem-based options. In this way we felt we could best accommodate differing learning styles.

Allowing learners to determine their own learning strategies may be preferable to over-structuring that experience (Kinzie & Berdel, 1990). As noted by Kovalik & Dalton (1997),

> One way learners structure their learning experiences is by exercising control over various lesson attributes including instructional sequence, pacing, and options. Learner control removes the learner from a prescribed, regimented, predetermined lesson sequence and allows freedom of movement in and between lesson components. This freedom often enables the learner to structure the learning experience in a way that may best facilitate fusing new information with preexisting knowledge (p. 162).

Although the Web site allows for movement between lesson components, other learning options were not available. The addition of a path containing relevant exercises provides navigational choice. A learner can elect to traverse the Web site in a linear fashion and then apply knowledge gained by working through the exercises, or, alternatively, a learner can initially try the exercises and refer back to the tutorial to search for answers and gain clarification.

Designing the Instruction

The discussion next focused on designing instruction to meet the needs of our target audience, undergraduate teacher education majors. Of particular concern was the need to provide these learners with the

ability to evaluate and interpret visuals as well as to create instructionally effective visuals, such as overhead transparencies and classroom handouts. We therefore wanted to incorporate meaningful problems that dealt with both creation and interpretation.

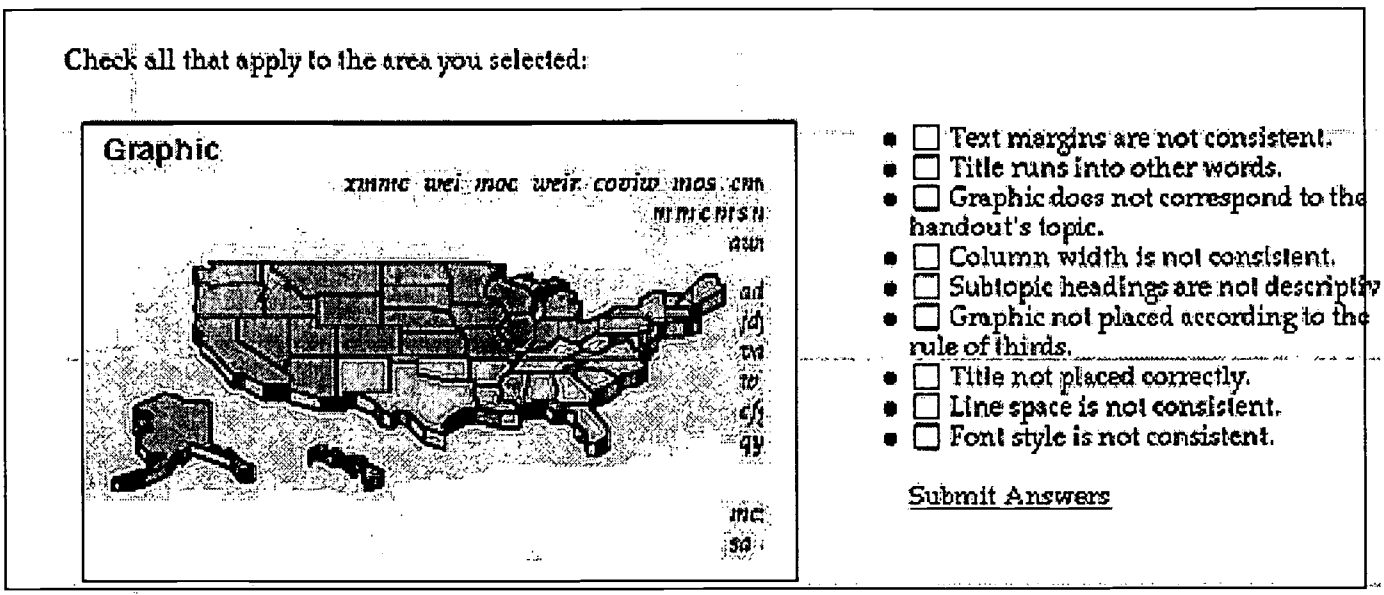
While it would be possible to find instructional activities and images that are already created for this purpose, avoiding copyright complications again became an issue. Also considered was linking to existing visual literacy Web sites for instruction. There are a number of visual literacy sites which could have been used for information but none that we found with instructional activities. We also rejected linking to established sites because of the possible navigation difficulties it would present the learners, the potential wait time for downloading, and the possibility of sites not being available. As Web utilization capabilities change, this issue might be revisited.

The decision was made to develop original activities and possible problem-solving activities were discussed. Guided by a self-paced instructional module (Kovalik, 1995), we brainstormed ideas to identify appropriate activities. Five activities were selected for possible inclusion on the Web site. These activities are: critiquing a handout, identifying design elements and design principles, creating a visual message, selecting appropriate visual messages, and perceptual interpretations of visual messages. Plans are to develop all of these activities; however, only two have been completed to date. Work continues on the remaining exercises which will be added to the site when completed. The two completed activities are described here.

Activity 1 - Critique A Handout Based On Visual Literacy Concepts

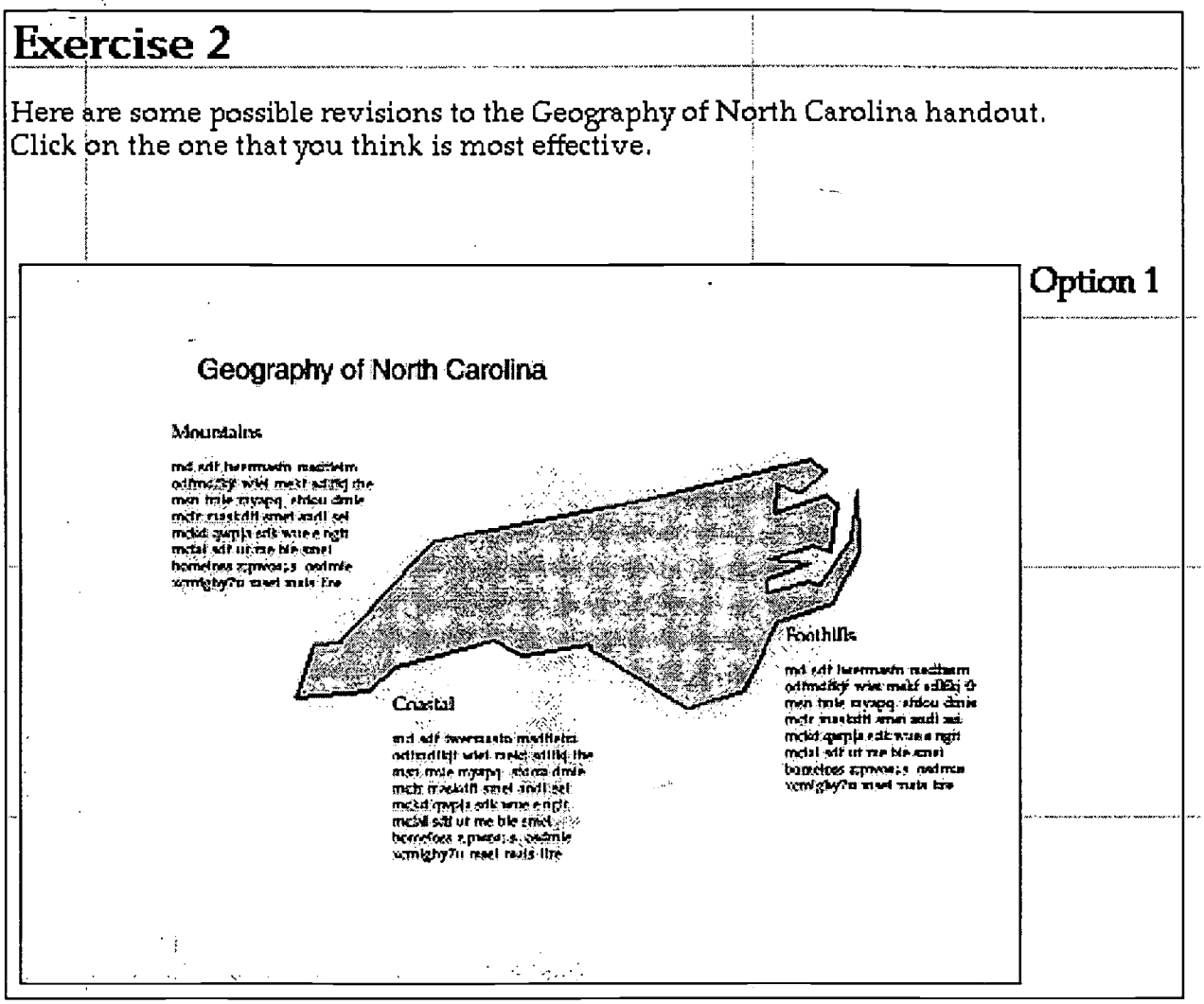
This exercise was based on an exercise created by Annette Lamb (1996). Dr. Lamb graciously allowed its inclusion on the Web site. In this activity, the user is presented with the image of a handout that contains errors (see Figure 3). The user is then asked to critique the handout by clicking on a portion of the handout. Each selectable portion of the image may contain multiple visual literacy errors.

Figure 3. Exercise to Critique a Handout



After selecting an area to critique, users see a list of possible errors. The user clicks on all errors that apply to the selection. This approach incorporates a multiple multiple-choice evaluation strategy. This multiple multiple-choice test strategy enables a broader evaluation of learner conceptual understanding since the learner must consider all options as possible correct responses rather than eliminating options until only one "best" answer remains. Feedback is based on choices made by the user. If the user made inaccurate or inappropriate responses, the feedback provides an explanation of why another choice is more appropriate. Users choosing correct responses are congratulated. Following this activity, the user is presented with the option of viewing revised handouts and accompanying explanations of their respective strengths and weaknesses for instructional purposes. (see Figure 4).

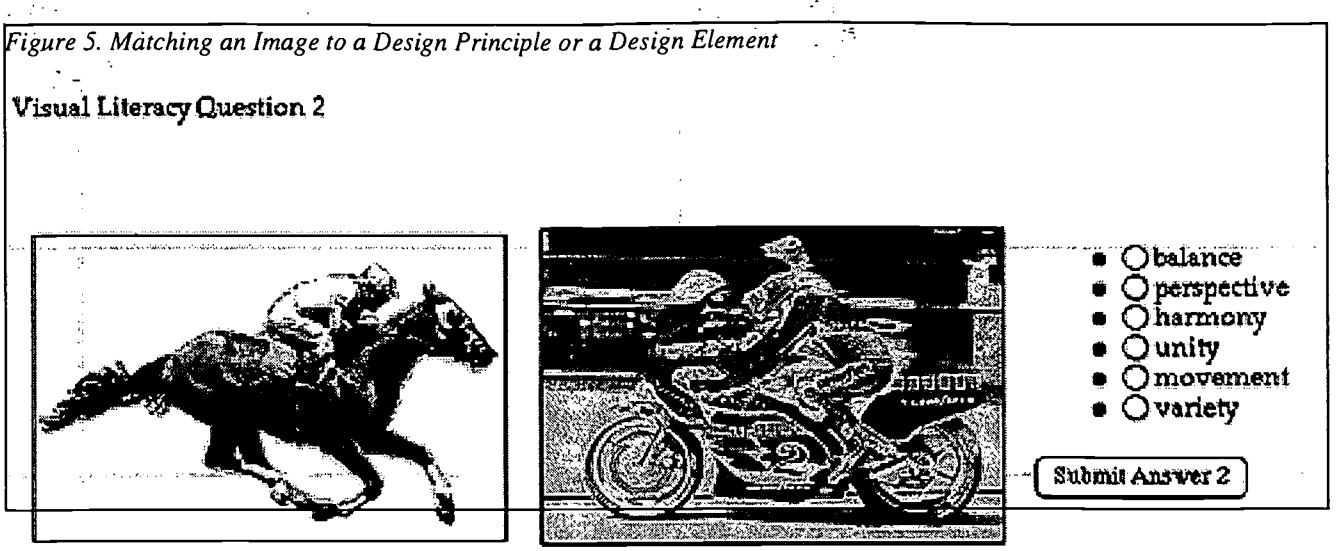
Figure 4. Strengths and Weaknesses of the Handout



Activity 2 - Identify Design Elements And Design Principles

Two graphic images are presented to the user that illustrate a visual literacy concept. The user is asked to indicate which visual literacy concept, element, or principle the image represents. The matching between image and design element/design principle exercise is designed to reflect a single multiple-choice evaluation strategy. For each image, the user is given a selected list of design elements or design principles. The user clicks on the design element or the design principle that the image represents (see Figure 5). Feedback consists of informing the user as to the correctness of his/her response and an explanation of misinterpretations where appropriate.

Figure 5. Matching an Image to a Design Principle or a Design Element



The Visual Literacy Instructional Package

We are currently evaluating the effectiveness of the two additions to the site while developing additional ones. We are confident that the proposed changes will improve the instructional effectiveness of the Web site. The use of examples and nonexamples has been an effective instructional strategy in face-to-face classroom instruction. We have seen improvement in student-produced media by employing this technique in the educational media course. In the classroom, examples of student-created posters and overhead transparencies are critiqued. The ensuing classroom discussion provides reinforcement of learned visual literacy concepts. Our goal is to provide similar reinforcement through the interactive exercises on the Web site. While it is important to provide students with a basic conceptual understanding of visual literacy, that is, to provide them with information, it is equally important to provide ways they can practice using this knowledge. It is not enough for preservice teachers to be able to simply recall or recognize correct answers about visual literacy on a criterion-referenced test. In preparing to become teachers, undergraduate education majors must be given the opportunity to actively use and incorporate visual literacy concepts in order to strengthen their visual literacy skills.

Conclusion

Modifying existing preservice teacher education programs to incorporate new content reflecting a growing emphasis on technology requires identification of instructional strategies that allow for maintaining existing course content while adding new content. Technology-mediated instructional delivery is one alternative to classroom contact time. Transforming course content to self-contained, self-paced, computer-mediated formats gives students the opportunity to learn content through out-of-class assignments at their convenience. Using the World Wide Web as the delivery mechanism increases accessibility for students. Instruction on the Web, however, must be more than information. Students need to be given opportunities to practice their knowledge using content in meaningful ways. Additionally, students need feedback related to their progress.

The capability of the Web to provide interactive instruction makes it an effective instructional delivery medium. As we continually update technology courses to address the innovations, the Web will increasingly be used as an effective alternative delivery medium. This paper has presented the transformation of lecture-based course content to computer-mediated instruction on the World Wide Web. We welcome you to visit the visual literacy Web site at http://www.educ.kent.edu/vlo and to share your comments and suggestions with us.

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