# Web Site Design: A Case Study in Usability Testing Using Paper Prototypes

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*Paper prototypes are a low-tech, low-cost, but highly effective, form of usability testing for web site design. Creating a web site is relatively easy, given the technology and tools now available. All too often, web site developers tend to be enamored with the technology and forget the needs of end user. As a result, many web site developers delay usability testing until their web site is completely designed, only to uncover significant interface, content, or structural problems with the site once the customers try to use it. Significant redesign may be impossible due to time, cost, or personnel constraints.*

*This paper discusses the benefits of using paper prototypes to conduct usability testing of a web site for Mercer University's School of Engineering Center for Excellence in Engineering Education (CE$^3$). These benefits include the following:*

1. *Low cost, both in terms of time and materials required to create the prototype;*
2. *Critical feedback from users, who appear more willing to suggest significant flaws when the site design is obviously very rough;*
3. *Willingness on the part of the designers to change the design, since they have invested minimal time and effort into creating a paper prototype; and ultimately*
4. *Improved usability.*

*This paper also discusses how to create a paper prototype, how to conduct a usability test with the prototype, and what to do with the test results. This process can be used to enhance the usability of any web site.*

*The design of the CE$^3$ is a project of a team of senior technical communication students in the Department of Technical Communication at Mercer University. This paper also discusses the importance of training technical communicators to be user advocates.*



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## BACKGROUND

Mercer University is a small, comprehensive, university comprised of eight colleges and professional schools. The Macon, GA, campus is home for 2,500 undergraduate students in liberal arts, business, education, and engineering; as well as graduate students in law and medicine. The primary mission of the School of Engineering is to educate practicing engineers and the faculty's primary focus is teaching, not research. Therefore, the faculty are committed to teaching excellence and to creating rich learning environments for the students, including the opportunity for hands-on, active learning experiences. To meet this challenge, the School of Engineering's Department of Technical Communication assists the engineering faculty in exploring new ways to incorporate instructional technology in the classroom. To support this effort, the author founded the Center for Excellence in Engineering Education ($CE^3$). Creation of a web site to provide a collection of teaching and learning resources for the faculty was the first step in fulfilling the mission of the $CE^3$.

## CREATING THE FIRST PROTOTYPE

The first step in creating the $CE^3$ web site was to conduct an evaluation of existing sites that supported faculty development at other institutions of higher education. Over 40 web sites were examined. Many provided information on face-to-face training sessions and campus resources, while others provided links to on line instructional technology applications. The author chose to create a site that provided downloadable tools, tips, and techniques that could be immediately used by the faculty in course preparation and delivery. This approach was based on the premise that it was more appropriate, given the limited resources available, to show faculty how the technology and resources could be used, rather than to doing it for them. This approach has worked well at many institutions that are similar to the writer's (Culp, 1999).

Second, over 100 resources were collected and evaluated based on their relevance to the purpose of the $CE^3$ site. These resources were culled and eventually organized into five categories: (1) tools, (2) resources, (3) classroom strategies, (4) teaching with technology, and (5) other. Figure 1 is the preliminary organization of the site, which represents a holistic prototype (Boling and Frick, 1997) of the entire top-level structure of the site and the five strands that exemplify the primary features.

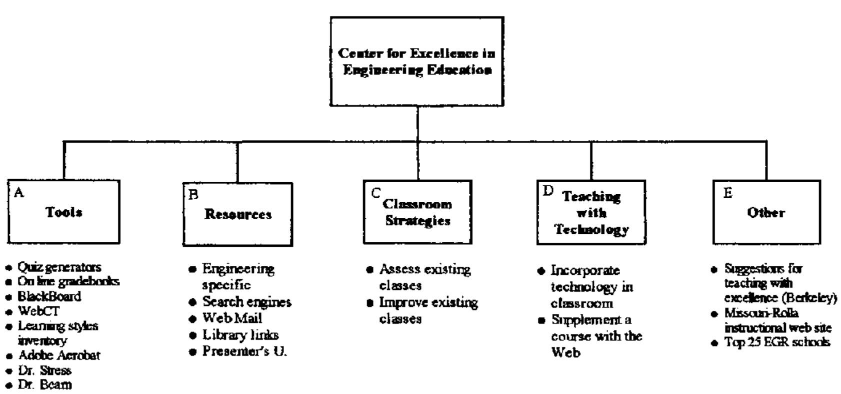


**Figure 1: Preliminary design of $CE^3$ web site.**



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Using construction paper and markers, a paper prototype was assembled within several hours. Each strand was identified by a unique paper color and consisted of a handwritten "splash" page containing an index to strand elements. Each element in the strand was represented by a separate page containing a brief description of that element. Strands were tabbed A-E; elements were tabbed A1, A2, etc. The paper prototype was assembled into a three-ring binder. No visual design was included since separating content from design allows the designers as well as the users to remain focused on content (Fuccella and Pizzolato, 1999).

According to Boling and Frick (1997) paper prototypes offer three benefits that electronic prototypes do not. First, they are truly "hands on" since the designers must physically manipulate the content. The process of cutting and pasting, sorting, and labeling the various strand elements forced the student designers to become very familiar with the content elements. Second, because the paper prototype was portable, we were able to take in into the individual faculty offices and conduct the tests quickly and efficiently. Third, Boling and Frick (1997) contend that "Paper prototypes seem inherently less 'finished' or 'real' than do electronic prototypes. Your subjects may feel more comfortable working with paper prototypes and criticizing them than they would if the Web pages seemed to exist already" (p. 322). Our experiences also suggest that this seems to be true.

Another advantage of usability testing with paper prototypes is that no computer skills are necessary since there is no online manipulation of material (Firstenberg, 1999). However, we did not feel that this was particularly relevant to our testing since the majority of the engineering faculty are skilled computer users. Paper prototypes also appear to enhance team building skills and because they are so versatile, they facilitate regular usability testing (User Interface Engineering, 2000).

## USABILITY TESTING OF THE FIRST PAPER PROTOTYPE

The purpose of the first usability test was to determine if the top-level site structure was self evident and the strands were named appropriately. Additionally, we wanted to determine if the elements in each strand were logically grouped and were of interest to faculty. Teams of two technical communication students administered the test individually to six faculty members. In each test, one student faced the faculty member and held the prototype up so that it could be manipulated based. Using Nielsen's (1999a) usability testing protocol, the faculty member was instructed to "Pretend that your finger is the mouse and point to anything on the page that you would like to click on. Please tell me what you think would happen if you clicked there" (Nielsen, 1999). The second student recorded each faculty's response to the various test elements. Three questions were asked:

1. Locate each of the following items:
    - Berkeley's suggestions for teaching excellence
    - Web CT
    - How to motivate students
    - ListServs
    - Writing a good syllabus
2. Which of these items would you click on? Why?
3. What did you expect to find that is not available?

The results of this preliminary test indicated significant flaws in the nomenclature of the primary strands and the organization of the material in each strand. Faculty willingly offered suggestions for major site redesign and reorganization, in part, we believe, because it was obvious that this was a rough draft and significant time had not been invested in site design yet.

## USABILITY TESTING OF THE SECOND PAPER PROTOTYPE

Figure 2 represents the second iteration of the $CE^3$ web site. Based on the results of the first usability test, four of the five major strands were renamed and reorganized. Because the prototype was still in paper form, the reorganization consisted of reshuffling the pages, albeit into a variety of configurations, until we felt we had addressed all of the usability issues raised during the first test.

The second paper prototype contained rudimentary visual design and navigation features. A mock up of the splash page for each strand was developed, which included a navigation bar across the top of each page. The bar represented links to each of the five strands. The left hand margin of the splash page contained links to information elements within each strand. The paper prototype consisted of ~ 40 pages, which were tabbed and again mounted in a three-ring binder.

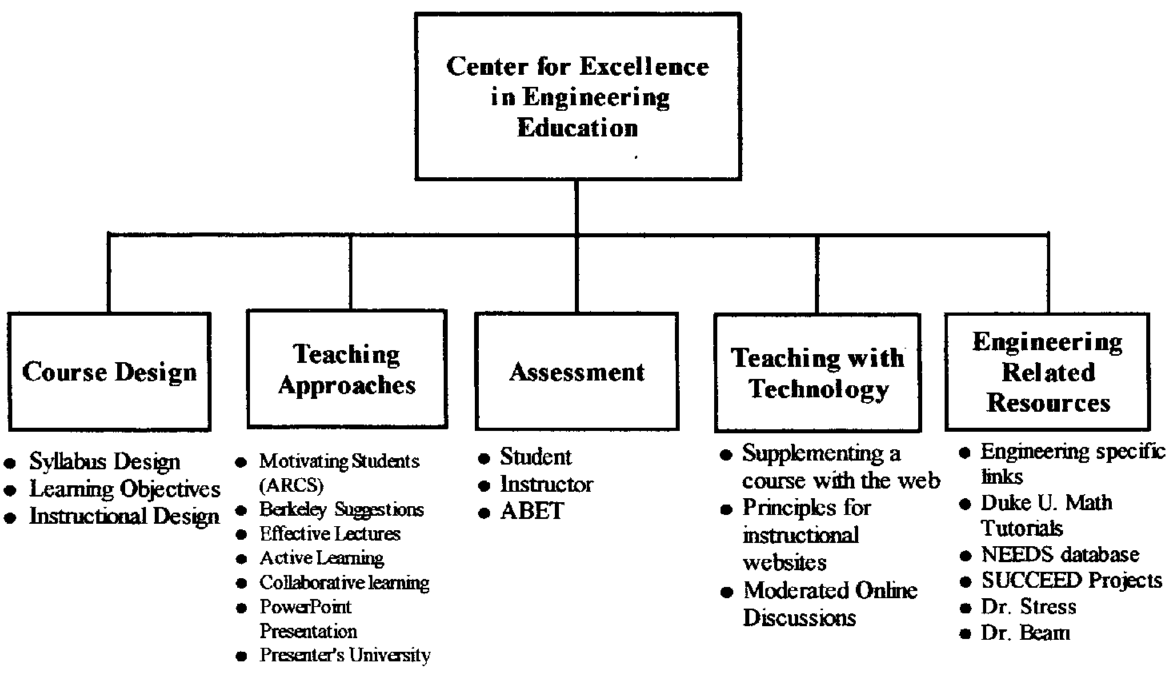


**Figure 2: Second iteration of $CE^3$ web site.**

The purpose of the second usability test was to evaluate the new organization of the site and the navigation aids. The usability protocol again consisted of pairs of students and six faculty volunteers (different individuals from those who participated in the first usability test). The tests were conducted in the individual faculty offices using the same seating configurations as employed in the first test. One student read the usability script, which described the site



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purpose and test protocol. Faculty were asked locate five elements on the site by following these instructions (given orally): "I (the student) will act as the computer, turning the pages to maneuver through the site. Simply press the link and speak aloud the option you have chose. We ask that you use a speak-aloud protocol to allow the observer to understand and document your thought process as you navigate through the web site." The usability test took ~30 minutes to complete.

## FINAL VERSION

The second usability test uncovered small organizational and nomenclature problems, as well as highlighted some navigational issues that confused the faculty. These errors were resolved in the final version of the web site. The last usability test was conducted on the fully developed version of the web site. Six additional faculty were given the site URL and asked to evaluate the site using a usability checklist for clarity of communication, accessibility, consistency, navigation, design and maintenance, and visual presentation (Sullivan, 1996). This test occurred in each faculty member's office and the faculty recorded their responses on checklist, then mailed the checklist to the author.

## DISCUSSION

An issue of increasing relevance to technical communicators is that of user-centered design, which has three principles: "(1) an early focus on users and tasks, (2) empirical measurement of product usage, and (3) iterative design whereby a product is designed, modified, and tested repeatedly" (Rubin, 1994, p. 12). Usability testing is one technique that ensures good user-centered design. Our experiences in conducting usability tests with paper prototypes of a complex web site have led us to the following conclusions.

First, usability tests with paper prototypes are inexpensive and time saving devices for identifying user interface and design issues. The prototypes are quick to assemble and even in their rough forms can give the user a good idea of content, organization, and navigation features of a site (Rettig, 1994). When problems with site layout and design are identified, the prototypes are easy to refine.

Second, both users and designers appear to be willing to suggest changes to the prototypes, even if the changes require significant reorganization or redesign. Because hours and days of designer time have not been invested in constructing and programming, the designers are much more receptive to user suggestions and less interested in defending their design (Nielsen, 1999a). And the users, recognizing that the prototype is only a rough model, felt freer to criticize and make recommendations.

Third, multiple tests with small number of users are more useful at identifying problems than elaborate usability tests (Nielsen, 2000). Our first usability test identified at least 50% of the usability problems with the site. Once these were corrected, we were able to use the second test to conduct a more in-depth evaluation of the fundamental structure of the site, in addition to uncovering some organizational issues missed during the first usability test. The third usability test (on the full-blown site) revealed even fewer problems than tests one and two.

Fourth, paper prototypes allowed us to separate content from the visual design. All too often, web sites sacrifice content for visual appeal, as soon becomes evident by any cursory visit to the WWW. Because we wanted this site to be used by the faculty to enhance their teaching approaches, appropriate, concise, well-written and usable content was paramount. Paper prototypes allowed us to concentrate on content with being distracted by visuals.

Finally, usability testing with paper prototypes was an excellent way to introduce the technical communication students who designed the $CE^3$ site to the issues of usability and user-centered design. They were able to see directly how users interfaced with the site design and why usability testing is so critical in the design of web-based materials. With the proliferation of web sites and web-based information, a knowledge of usability testing of web sites becomes even more crucial. Our experience has shown that usability testing with paper prototypes is a win-win situation for both the designer and the end user.

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## ABOUT THE AUTHOR

Helen Grady has taught in the B.S. in Technical Communication program at Mercer since 1991. Prior to Mercer, she managed a technical publications division in Research Triangle Park, NC for 10 years. She received a M.S. from CUNY in 1978 and will complete an Ed.D. in Instructional Technology and Distance Education, Nova Southeastern University, in Oct. 2000. She is responsible for establishing the Center for Excellence in Engineering Education at Mercer and has been active in educating engineering faculty in instructional technology and active learning strategies. She is a member of ASEE, IEEE, AAUW, and a senior member of STC.



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