

The Effects of Using a Triangulation Approach of Evaluation Methodologies to Examine the Usability of a University Website.

Dana H Smith, Zhensen Huang, Jennifer Preece, and Andrew Sears

Department of Information Systems, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250 USA
 Telephone: 410-455-2646 • Fax: 410-455-1073 • E-mail: (dasmith, zhuang, preece, asears)@gl.umbc.edu

ABSTRACT

The objective of this study was to evaluate the current University of Maryland, Baltimore County website and identify problems that could be addressed in an upcoming re-design project. In meeting this objective we used a combination of evaluation methods in order to triangulate and collect different perspectives on the problems. Heuristic evaluations were performed to gain an overview of the problems with the website. A total of fifty-four Information Systems students participated in this particular portion of the study. Next, focus group sessions were conducted to seek out what individuals want and need from the site, along with specific problems encountered. And finally, thirteen subjects performed usability testing to examine specific issues concerning navigation. Together, these methods provide three different but synergistic perspectives. By gathering test data, observing users, and interviewing a range of individuals on campus, we were able to collect a wide variety of information that was compiled, analyzed, and formally reported to the design group. The analysis of the data collected from the three techniques revealed several key issues in which expert recommendations were made for website redesign. But more importantly, the result of using a triangulation approach in this research illustrates the value of combining inspection methods and testing to identify usability problems on a University website.

2. INTRODUCTION

The World Wide Web has become an important tool that Universities use to market their institution to prospective students and provide University information and services to the campus community. A previous study performed at the University of Maryland, Baltimore County (UMBC) reported that the web is the third most important source of information about a University, following a campus visit and a conversation with current students (Hearne, 1999). As users become experienced with computer and Internet usage, they become dependent on the quick and useful information that websites provide. Information is the central theme of any website. The more a site helps people find the information they are looking for, the more usable it is (Spool, 1999).

Whether user information and behaviors are collected via online surveys or are provided to system designers at each stage of the design process, it is clear that the user must be part of the process to achieve a usable system (Goodwin, 1987). Additional feedback was obtained from a Website Effectiveness Study (Hearn, 1999), performed in 1999 by an external entity; which supplied the university with the opinions of prospective students.

To further the evaluation process, the university requested from the Department of Information Systems a usability study of the website in which results will be considered in an upcoming redesign of the homepage (figure 1). Based on usability problems and opportunities disclosed by empirical testing, one can produce a new version of the interface (Nielsen, 1993). This study will examine several usability inspection methods and user testing, but more importantly will explore the effects of combining several techniques in a triangulation approach in discovering interface usability problems. Several studies of usability inspection methods have discovered that many usability problems are overlooked by user testing, but that user testing also finds problems that are overlooked by inspection. This suggests that the best results are achieved by combining empirical tests and inspections (Nielsen, 1994).

Heuristic Evaluation

Heuristic evaluation is a usability engineering method in which a small set of evaluators examine the user interface to find possible problems using recognized usability principles (the “heuristics”) (Nielsen, 1992). In general, heuristic evaluation is best when performed by many evaluators, as one individual will never be able to find all the usability problems in an interface. It is also possible to improve the effectiveness of the method significantly by involving multiple evaluators. One advantage of heuristic evaluation is it is relatively inexpensive and provides quick results. Experts also say that over 75% of usability problems can be found using heuristic evaluations. However, one problem with this method is the fact that evaluators may not be the true users, and thus may



Considering the growing importance of the Web as a tool, UMBC performs periodic evaluations in the form of online surveys that collect opinions and usage information from site users.

overlook some usability problems.

The system usability principles that evaluators refer to are also called heuristic guidelines. Generally, typical guidelines can be:

- Use simple and natural dialogue,
- Speak the users' language,
- Minimize user memory load,
- Be consistent,
- Provide clearly marked exits,
- Provide shortcuts,
- Provide good error messages, and
- Prevent errors. (Nielsen, 1992 Preece, 1993)

Focus Groups

Considered to be very much like well-designed meetings, a focus group session is a discussion-based interview that produces a particular type of qualitative data (Breakwell, 1995). The purpose of focus group sessions is to acquire the opinions and feelings of individuals on a particular topic. Used alone or in combination with other methods, the aim of focus groups is to get closer to participants' understandings of and perspectives on certain issues (Breakwell, 1995). Again, accepting user input into the design process has many benefits and has become a standard practice in systems development. Early focus on users and tasks is a recommended principle of usability design (Gould, 1985). The beauty in this method is its ability to explore a few people's judgments and feelings in great depth, and in doing so learn how end-users think and feel (Rubin, 1994).

Usability Testing

Usability testing is a method that employs techniques to collect empirical data while observing representative end-users using the product to perform representative tasks (Rubin, 1994). Usability testing is a very important tool that can reveal problems that designer/developers may not detect. The testing should include participants that represent real users that perform real tasks. Usability testing defines the acceptable performance of the system for specific types of users carrying out specific tasks (Preece, 1993). The goal of this method is to collect information about problems and use it to create a product that is easy to learn and use and that also provides functionality necessary for the user to accomplish the objective. If the site contains unclear or inconsistent information or is unpredictable and awkward to navigate, the user may have trouble completing each task. The usability test should reveal problems that a typical user could encounter.

Using these three techniques (heuristic evaluation, focus group sessions, usability testing) to evaluate the website will complement the former research that explored marketing aspects and user opinions, and attempts to discover the problems that current users encounter with the site. Alone, each can provide beneficial feedback, but together the results should reveal key issues that help identify valid problems. The purpose of this study is to examine the effects of a triangulation approach in evaluating the usability of a University website.

3. METHODS

The UMBC website is an extensive site, and it would be nearly impossible to design a usability test to detect every potential usability problem. Therefore, using the three evaluation methods previously mentioned in a triangulation approach might prove to be a more effective approach than any single method. The combination could also identify key issues requiring specific attention.

For the heuristic evaluation of the UMBC website, students

from two sections of the Spring 2000 IFSM 303 course (Human Factors in Information Systems) were used as evaluators. Fifty-four students participated in the study. Heuristic guidelines from Nielsen and Preece were used to gather information. Using the guidelines and a worksheet, the students were asked to browse the UMBC web site with specific tasks in mind. While browsing, the students were asked to record on the worksheet any problems encountered and to identify the task and heuristic violation.

To complement the heuristic evaluations, focus group sessions were conducted as a second method of data collection. Using six to eight participants in each group, this study sought whether the information needs of various groups within the campus community were being met. Further, information regarding problems and experiences using the UMBC website was sought. As mentioned before, information is the central theme of any website. If the information a user requires is not available, then the site is not considered usable to the user.

During the planning stages of the project, it was decided that five different focus groups would be conducted, each consisting of six to eight subjects. Ideally, half the participants would be women; half would be inexperienced with the technology. Although there are numerous groups on campus to consider, this research specifically targeted the ideas, opinions, and experiences of undergraduate students (non-IFSM majors), graduate students (also non-IFSM majors), faculty, staff, and business/alumni. A campus-wide call for participation was issued via e-mail in late February 2000.

After developing and pilot testing the focus group questions, four focus group sessions were scheduled and conducted during March and April 2000. The groups ranged from two participants in the staff group to five in the graduate student group, and each session lasted about an hour. Most focus group researchers agree that between one and two hours is the standard duration for each session involving adults (Breakwell, 1995).

The moderator began the sessions with a brief introduction that explained the general purpose of the focus group and informed the participants that their comments would be considered anonymous and confidential. After personal introductions, the moderator presented three questions, one at a time, and allowed a 20-minute discussion for each. A colleague assisted the moderator by noting the general demographics of the group and comments to each question. Once each focus group session was complete, the participants performed a 30-minute usability test, which is explained next.

Usability testing was the third and final evaluation method used in this study. Usability experts recommend that 6 - 10 participants should be recruited to perform usability testing (Dumas, 1993). The usability test for this project consisted of eight tasks that were to be performed using the UMBC website. If carried out correctly, each task can produce UMBC information that is commonly used by many groups on campus. (e.g., search for e-mail addresses, course offerings, phone numbers, etc.). The focus group participants, who were undergraduates, graduate students, faculty, and staff, completed the usability test. Nearly all the tasks were simple or closed tasks where the user would find a specific answer somewhere on the website. One task was compound in nature, which required the user to find information based on specific criteria. A final task required the user to browse the site and gather information about a specific topic.

Each task was followed by four questions. The first question requested the information that the user found, the second question asked the length of time needed to complete the task, and the third and fourth questions asked if any problems were encountered

and what the problems were. This combination of questions can reveal valuable information on whether or not the information can be found, can it be found easily and in a timely manner, and whether any problems were encountered during the process.

4. RESULTS AND DISCUSSION

This section provides a brief overview of the results from each evaluation method, followed by a summary of key issues identified by using a triangulation approach.

Fifty-four students performed heuristic evaluations. As a result, 255 problems were reported. The results were analyzed, summarized, and the top seven are as follows:

- 29 complain of long pages,
- 25 mention use of color,
- 20 are related to broken links,
- 20 are related to navigation support,
- 18 suggest changing some of the menu names,
- 15 complain that they received outdated or incomplete information, and
- 15 report that they can not go back to previous pages, or can not find a link back to UMBC home page when they were in a specific sub-site.

Five focus group sessions were successfully conducted; one of which was the pilot study. Due to project deadlines, one targeted group (business/alumni) was not scheduled or conducted. In all, 19 subjects (15 women, 4 men) participated in the sessions. The recorded comments from each focus group session were analyzed and grouped according to theme, and an overview of the most common responses follow.

While the moderator sought both online information needs and problems encountered with the site, the overwhelming response across all groups was the need for more information. The groups not only wanted to find the information they need but also wanted to be informed of events occurring on campus. Very few problems with the site were discussed.

Naturally, there were many similarities between several of the groups. One issue that surfaced was the desire for information that already exists on the website. Another suggestion from all groups was the need for information on how to use the website, or where and who to go to for various types of information on campus. Several groups also complained about outdated or non-existent web pages. The students desire and expect academic information on faculty web pages.

During the usability-testing phase, we found that while most of the users were familiar with the web site, there were still numerous problems encountered as the participants performed each task. On average, the length of time to complete the test was 20 minutes: the shortest completion time was 15 minutes, the longest was 35 minutes. Although there were a variety of problems overall, 37% of the users had problems with each task. The majority of the problems encountered centered on the fact that the users were unsure where to find the information; therefore they had trouble completing the tasks in a reasonable amount of time.

Thus far, a summary of the major outcomes of each evaluation method has been presented, and independently they provide insight into potential problems with the site or deficiencies of information. While each method provides helpful feedback, analyzing together the results from all three methods helps to identify key issues that were summarized and reported to the design team.

The key issues are organized into three categories: Navigation Problems, Information Design Issues, and Information Needs. Finally, a listing of "other requests" is presented which describe numerous ideas that the study participants offered (primarily

through the focus group sessions).

Navigation Problems

Like most aspects of usability, navigation is invisible when it is working. But when there is a problem, users can get completely stuck. In fact, navigation problems frequently caused users to give up (Spool, 1999). There are six general guidelines suggested that encourage good navigation: avoid (1) frames, (2) orphan pages and (3) long pages; provide (4) navigation support and (5) consistent look and feel; and (6) avoid narrow, deep, hierarchical menus (Preece, 2000). Although all are not discussed here, some are mentioned to resolve several of the findings in this research.

One issue that repeatedly generated discussion during the focus group sessions was the lack of information on how to use the website and where to find things online. The heuristic evaluations and usability testing verified that many users experience problems while navigating the site or searching for specific information. During usability testing, numerous participants did not know where to begin when presented with a specific task. Providing good navigation support by adding a *site map* link on the home page may increase user understanding of how the site is organized, thereby decreasing the confusion of not knowing where to go to find things online. Another guideline to consider for this particular problem would be to provide a consistent navigation panel on each page. By providing consistency, users feel that they know where they are at all times and not lost in the site. It has also been suggested that people learn faster when what they see and do is consistent (Schneiderman, 1992). Another important feature that the home page should offer is a prominent *search* feature, as many users are search-dominant and do not want to bother navigating to their destination link-by-link (Nielsen, 1999). Lastly, providing descriptive link titles may increase user understanding and usability of the site.

Social event information, both on and off campus, is an important issue for students. This particular topic was discussed at great length during all three of the student focus group sessions. Many mentioned that they learned of event information by reading the posters on the walls in the student center stairwell or heard about an event after it happened. It was obvious during the focus group sessions that the students did not know that this information is available online. Similarly, the usability test revealed that some students did not know where to find off-campus activities on the website. Again, a strong site map would help with this particular issue. But, because this topic seems to be very important to the students, providing additional descriptive information on the homepage regarding social events or activities may improve their awareness of the existing information.

One of the top five problems identified during the heuristic evaluation involved menu names. Many of the students found the names confusing or unclear. The results of the usability test revealed similar problems, as some of the students were unsure where to look for information because the link titles were not descriptive. The better users could predict where a link would lead, the more successful they were in finding information (Spool, 1999). Once again, for navigation purposes, provide clear understandable menu and link names.

The top category of problems found during the heuristic evaluation was the occurrence of long web pages. Students complained about scrolling to find information. Similar complaints were reported on the usability test. Web page designers should avoid long pages that force scrolling (Preece, 2000). Users do not like to read material on the screen. They prefer to scan, and fail to scroll to the bottom of long pages (Nielsen, 1998). Using hypertext

to split up long information into multiple pages (Nielsen, 1999) is one way to outline and organize information when attempting to design less lengthy pages.

Another important result of both the heuristic evaluation and usability test is a problem with broken links. This can be very frustrating to the user when searching for online information. Countless and consistent broken links can lead to dissatisfied users, thus a bad reputation. Maintainers of the website should continuously monitor for broken links and repair them as needed.

Information Design Issues

There are several guidelines that support good information design: avoiding (1) outdated or incomplete information, (2) excessive use of color, and (3) gratuitous use of graphics and animation; and providing (4) good graphical design and (5) consistency (Preece, 2000). Two of these guidelines were addressed during the heuristic evaluation and focus groups. *Outdated and incomplete information* generated a fair amount of discussion, but because it also addresses the information needs of the users, it will be discussed in the next section. *Excessive use of color* was the other issue that some of the participants, mostly students, criticized.

The heuristic evaluations and focus group sessions revealed a problem with color choice and consistency. Several students commented that some of the color choices decreased readability; some reported inconsistencies between pages, while others commented on the use of red. Using soft background colors with contrasting color for text should improve readability. Optimal legibility requires black text on white background, and big enough fonts that people can read (Nielsen, 1999). As a general rule, color is useful for indicating different kinds of information, and a change of color should signal a change in information type (Preece, 2000). There are also general color standards that apply to the web and should be considered here. One such standard is the use of blue as a link color, and links that have been viewed usually change to purple or red in color. Using standard link colors provides consistency whether in the UMBC site or elsewhere on the web. Finally, carefully check the use of the color red. Text this color is hard to read, and in some cultures the color red signifies danger.

Information Needs

While seeking the experiences, opinions, and needs of participants during the focus group sessions, we found that there were two features of the site that many of the participants found useful. Although they suggested adding a few more options, most agreed that the capabilities of myUMBC are far better than past systems. The students mentioned that adding student library account information to myUMBC would be helpful. Another feature of the site that was mentioned in a positive manner was the library homepage. Although a few students found it to be cluttered, and many suggested that more e-journals should be available, overall they found the library site to be a good online resource.

The leading complaint in the area of information needs was outdated and incomplete information. All five focus groups identified this as a problem, as did a number of heuristic evaluators. The participants mentioned dissatisfaction with non-existent and out-of-date faculty, department, and sports web pages. Some students mentioned the need to (1) view online course syllabi, (2) seek a way to contact part-time faculty, and (3) research departmental information. Outdated or incomplete information should be avoided as it creates a poor impression with users (Preece, 2000). Again, closely monitoring the information provided on the UMBC website and keeping it up to date will provide users with confidence in the information that they received.

Finally, many suggestions were offered regarding the need for additional online information. Once again, usability testing and heuristic evaluations would not have revealed the lack of some useful online information as did the focus groups sessions.

Examples:

- Add student library account information to myUMBC.
- For advisement purposes, faculty expressed the need for online student academic information.
- Students mentioned the need for more e-journals.
- Faculty requested a way to check library reserves online and easy access to library catalogue system.
- Online grant writing support.
- Online reservations for computer labs and AV equipment.
- Online status information from bookstore on book orders.



Figure 2 - New UMBC Homepage

ders.

5. CONCLUSION

Using a combination of evaluation methodologies was beneficial in this website review. First, additional problems were identified when using more than one approach. Conducting focus group sessions identified various online information needs that otherwise would not have been discovered using heuristic evaluations or usability testing. As mentioned before, information is the central theme of any website. The more a site helps people find the information they are looking for, the more usable it is (Spool, 1999). To further this study, the results of the focus group session could be followed up with another online survey that is more specific to the topic of online information needs. This evaluation tool could possibly validate the results of the focus group sessions.

Second, when using more than one evaluation technique, specific problems can be validated when the problem is identified by more than one technique. It was important to website management team to have valid recommendations to use for the redesign project. The expert recommendations offered to the UMBC website management team were based on problems that were identified by more than one technique. Figure 2 displays the new UMBC homepage that was launched in August 2000.

While this study focused on heuristic evaluations, focus groups, and usability testing, it would be interesting to build on this study to include other inspection methods. Perhaps including cognitive or heuristic walkthroughs would result in different outcomes. But overall, examining the effects of a triangulation ap-

proach could prove to be beneficial in website evaluations.

6. ACKNOWLEDGEMENTS

The authors want to thank Mr. John Fritz for his assistance throughout the project. We also want to thank all the subjects for their participation in the study.

7. REFERENCES

- Breakwell, G., Hammond, S., & Fyfe-Schaw, C. (Eds.). (1995). *Research Methods in Psychology*. London : Sage Publications.
- Dumas, J. S. & Redish, J. C. (1993). *A Practical Guide to Usability Testing*. Norwood, NJ: Ablex Publishing Co.
- Goodwin, N. (1987). Functionality and Usability. *Communications of the ACM*, 30(3), 229-233.
- Gould, J. D. & Lewis, C. (1985). Designing for usability: Key principles and what designers think. *Communications of the ACM*, 28(3), 300-311.
- Lipman Hearne, (1999). *UMBC Web Site Effectiveness Study*. [Online]. Available: <http://www.wses.com/wses/g.html> [2000, March 22].
- Nielsen, J. (1992, May 3 - 7) Finding usability problems through heuristic evaluation. Paper presented at the Proceedings on the Conference on Human Factors and Computing Systems: CHI'92, Monterey, CA.
- Nielsen, J. (1993). *Usability Engineering*. San Diego, CA: Academic Press.
- Nielsen, J. & Mack, R.L. (1994). *Usability Inspection Methods*. New York, NY: John Wiley & Sons, Inc.
- Nielsen, J. (1998) *About Jacob Nielsen*, [Online]. Available <http://www.useit.com> [2000, April 20].
- Nielsen, J. (1999). *Designing Web Usability*. Indianapolis, Indiana: New Riders Publishing.
- Preece, J. (1993). *A guide to Usability: Human Factors in Computing*. Reading, MA: Addison-Wesley.
- Preece, J. (2000). *Online Communities: Designing Usability and Supporting Sociability*. New York, NY: John Wiley and sons.
- Rubin, J. (1994). *Handbook of Usability Testing*. New York, NY: John Wiley and sons.
- Schneiderman, B. (1992). *Designing the user interface: Strategies for effective human-computer interaction* (2nd Ed) Reading, MA: Addison-Wesley.
- Spool, J. (1999). *Web Site Usability: A Designer's Guide*. San Francisco, CA: Morgan Kaufmann Publishers, Inc.

Related Content

The Decision Maker's Cognitive Load

Lehan Stemmet and M. Daud Ahmed (2015). *Encyclopedia of Information Science and Technology, Third Edition* (pp. 6466-6474).

www.irma-international.org/chapter/the-decision-makers-cognitive-load/113104/

Attribute Reduction Using Bayesian Decision Theoretic Rough Set Models

Sharmistha Bhattacharya Halder and Kalyani Debnath (2014). *International Journal of Rough Sets and Data Analysis* (pp. 15-31).

www.irma-international.org/article/attribute-reduction-using-bayesian-decision-theoretic-rough-set-models/111310/

Stock Price Trend Prediction and Recommendation using Cognitive Process

Vipul Bag and U. V. Kulkarni (2017). *International Journal of Rough Sets and Data Analysis* (pp. 36-48).

www.irma-international.org/article/stock-price-trend-prediction-and-recommendation-using-cognitive-process/178161/

Classification of Polarity of Opinions Using Unsupervised Approach in Tourism Domain

Mahima Goyal and Vishal Bhatnagar (2016). *International Journal of Rough Sets and Data Analysis* (pp. 68-78).

www.irma-international.org/article/classification-of-polarity-of-opinions-using-unsupervised-approach-in-tourism-domain/163104/

Hybrid Artificial Intelligence Heuristics and Clustering Algorithm for Combinatorial Asymmetric Traveling Salesman Problem

K Ganesh, R. Dhanalakshmi, A. Tangavelu and P Parthiban (2009). *Utilizing Information Technology Systems Across Disciplines: Advancements in the Application of Computer Science* (pp. 1-36).

www.irma-international.org/chapter/hybrid-artificial-intelligence-heuristics-clustering/30714/