2006

Purdue Online Writing Lab (OWL) Research Report

Michael Salvo
Purdue University, salvo@purdue.edu

H. Allen Brizee
Purdue University

Dana Lynn Driscoll
Purdue University

Morgan Sousa
Purdue University

Purdue Online Writing Lab (OWL)
Usability Report

Dr. Michael Salvo, H. Allen Brizee, Dana Lynn Driscoll, Morgan Sousa

Key Words:

Usability, user-centered, writing lab, writing center, online writing lab, OWL, writing center, Purdue University, usability testing, participatory design, information taxonomy, information design, open source.

Principle Investigators:

Dr. Michael Salvo, Interim Director, Purdue Professional Writing Program
Tammy Conard-Salvo, Associate Director, Purdue Writing Lab

Key Personnel:

H. Allen Brizee, Ph.D. Student in Rhetoric and Composition, Purdue University
Jo Doran, Ph.D. Student in Rhetoric and Composition, Purdue University
Dana Lynn Driscoll, Ph.D. Student in Rhetoric and Composition, OWL Coordinator, Purdue University
Morgan Sousa, Ph.D. Student in Rhetoric and Composition, Purdue University

Table of Contents

Appendices are available as a separate document titled "OWL Usability Appendices."

List of Figures

Abstract

This report outlines the history of the Purdue Online Writing Lab (OWL) and details the OWL Usability Project through the summer of 2006. The paper also discusses test methodologies, describes test methods, provides participant demographics, and presents findings and recommendations of the tests. The purpose of this report is to provide researchers, administrators, and pedagogues interested in usability and Writing Labs access to information on the Purdue OWL Usability Project. We hope our findings—and this open source approach to our research—will contribute positively to the corpus on usability and Writing Lab studies.

On August 26, 2005, the Writing Lab launched its redesigned OWL. Although the redesign improved on the original site (launched in 1994), tests show the new OWL could be refined to improve usability.

A pilot usability test conducted in early February 2006 showed participants did not understand all the OWL resources and were sometimes confused while using the OWL. Based on the results of the pilot test, we conducted two generations (G1 and G2) of formal usability tests between late February and early July 2006. The results of the tests indicate the following:

- Participants who had previously used OWL preferred the redesigned OWL to the original OWL

However:
- Participants wanted design features the redesigned OWL does *not* currently offer
- Participants took time and number of mouse clicks to complete some tasks than expected
- Participants could not complete some tasks
- Some participants' responses to the redesigned OWL were neutral, which does not represent the *positive* impression the Writing Lab desires for its new OWL.

In addition to the results above, we also encountered two unexpected, but very important, findings: first, usability testing can work as a dynamic, user-centered method of invention; second, previous and new user impressions of the OWL are different. Participants who visited the old OWL and the new OWL reacted more positively than those participants who had not visited the old OWL. We interpret this data as a sign of success for the new OWL. Based on test data, we recommend:

1. Design links/pages around the types of visitors using the OWL (user-based taxonomy)
2. Move the navigation bar from the right side to the left side of the OWL
3. Add a search function
4. Incorporate graphical logos in the OWL Family of Sites homepage
5. Continue testing to measure usability and to generate new ideas for design and content.

Online Writing Lab programmers have integrated some of these changes, and overall, we believe the redesign is a success. Test participants call the new site "impressive" and "a great site." Participant attitudes are probably best described by this unsolicited comment: "It still needs work, but it's better than the old site!" Theory-based, data-driven updates on the redesign continue, and usability testing will work to help the Writing Lab and its OWL users. We believe that the information presented in this report, as well as other open-source venues connected with this project, can positively impact usability and Writing Lab studies and can serve as a guide to inform multidisciplinary research and cooperation.

Introduction

This report overviews the background of the Purdue University Writing Lab and OWL, and it details the ongoing OWL Usability Project. This document also discusses theories and methodologies informing our work. The report describes test scenarios, provides participant demographics, and presents findings from OWL usability tests conducted between February and July 2006. The report presents our recommendations for the OWL based on data-driven findings and user-centered theory. Finally, the report discusses broader implications and applications of our work for usability studies, professional writing programs, Writing Labs, and OWLs.

Purpose
The purpose of this paper is two-fold:

1. To provide researchers and pedagogues interested in usability, user-centered theory, and participatory design information regarding usability tests we conducted on a prominent online writing resource.

   Redesigning this resource from a user-centered perspective is challenging. Besides the obstacles of testing, redesigning, and publishing live files to the Web, the OWL has a huge global user base. The OWL contains vast amounts of writing information in diverse media, collected and posted by numerous site designers over the last ten years. Therefore, usability is a critical concern.

2. To provide Writing Lab researchers, administrators, and pedagogues information on improving the usability of online resources.

   Creating usable Web-based material is challenging because most Writing Labs do not employ designers, or usability experts. In addition, it is often beyond the scope and funding of Writing Labs to conduct usability tests on their Internet material or to organize a collaborative project between Writing Lab administrators, students, and faculty (see Purdue OWL Usability Project below).

Goals
The primary goal of this project is to provide an open source base for expanding usability studies and improving the usability of OWL material. We hope to assist those involved in usability and Writing Labs in collecting information on test methodologies, test methods, and test participants. In addition, we also hope to provide the findings and recommendations for the Purdue OWL as a possible guide for improving the usability of other online resources. This report, in its discussion, seeks to inform other efforts towards improving the usability of web-based instructional materials. Ultimately, the OWL Usability Research Group offers this report to help others decide how best to employ usability research methods.

That is, we have an interest in promoting publication of effective and usable web-based pedagogical material. If institutions of higher learning determine that usability tests are integral to their local project goals, we hope this report will help them identify the methodologies and methods that best fit their given contexts and needs.

Scope
The scope of this paper covers a range of subject matter. First, we overview the history of the Purdue Writing Lab and its OWL to provide context. Second, we discuss theories and methodologies that guide our research. Third, we describe the conceptual goals and design parameters of the tests. Fourth, we detail the tests themselves, including information on methods, participants, and findings. Fifth, we discuss our recommendations. Last, we posit possible applications and implications of data we collected and conclusions we formed for usability and Writing Lab studies. Toward an open model of research, we include in Appendix 1 all our sample testing materials. We encourage readers to adopt and adapt these materials. However, we ask readers to cite this report in their work.

Audience
We expect the audience of this document to be composed of scholars, researchers, designers, and practitioners in the following areas:

- Professional communication: esp. usability, user-centered theory, participatory design
- Writing Labs and OWLs
- Human-computer interaction (HCI)
- Taxonomy and information architecture
- Graphic design
- Web design and content management.

With such a diverse readership, we have made every effort to address the concerns of technical and non-technical readers alike. Please contact the research group to clarify technical detail, pedagogical context, or research methods.

Usability Test Conclusions
Despite notable upgrades, the new website does not incorporate many features participants expect. The OWL redesign does not provide participants with as much navigational information as it should, thereby leaving participants indifferent in their impressions of their experience with the OWL. Although inconclusive, three areas of interest for future research follow: gender-based usage patterns, second and foreign language acquisition issues, and first-time and returning user patterns. Future testing will focus on these and other related areas.

OWL Recommendations
In order for the OWL to best fulfill the redesign goals outlined by the Writing Lab, and in order to remain aligned with Purdue's commitment to the land grant university mission, we recommend the following:

1. Design links and pages for the types of visitors using the OWL (user-based taxonomy)
2. Move the navigation bar from the right side to the left side of the OWL pages
3. Add a search function
4. Incorporate graphical logos in the OWL Family of Sites homepage
5. Continue testing to measure usability and to generate new ideas for design and content.

This list represents the five most pressing issues for our OWL usability. Number one, taxonomy, has been and remains a serious challenge to the site's organization and usability. Many issues regarding visual design have at their root taxonomic causes. As we move large numbers of resources from the original to the redesigned OWL, taxonomic challenges will continue to grow in importance and visibility for OWL users.

Accessibility and Collaboration
As we have discovered in our testing and through the work of Stuart Blythe (1998), usability testing and writing center pedagogies have much in common. Central to both are the concepts of accessibility and collaboration. In articulating the goals of writing centers, Stephen North (1984) describes the importance of a writing center being a welcoming space that is accessible and usable for writers. A goal of usability testing, then, is to make physical space, virtual space, product, and document as usable and accessible as possible.

Harris (1992) and Lunsford (1991) discuss the importance of writing center collaboration in student writing processes. In the articulation of our usability testing methodology and methods, we viewed our OWL as a constantly evolving, complex web of virtual texts. One of our core goals of testing was to elicit feedback from participants regarding the OWL's strengths and areas for improvement. The collaborative nature of our usability testing can be likened to a tutorial where real users interact with our site, provide their preferences, and collaborate on revision.

Our colleagues in the Purdue Writing Lab have written about inter-program collaboration in chapter nine "Dialogue & Collaboration" by Linda Bergmann and Tammy Conard-Salvo in the forthcoming book, *Marginal Words*, Hampton Press.

Background

The following section outlines the background of the Purdue Writing Lab and the OWL, and discusses their impact on Internet-based writing instruction. This section also details the goals of the redesigned OWL and provides data on OWL users.

Lastly, the section reviews pilot testing of the OWL in Dr. Michael J. Salvo's spring 2006 English 515 course (Advanced Professional Writing: Usability) and highlights the background of the user-based changes proposed in this document.

Purdue Writing Lab and OWL
The Purdue Writing Lab first opened its doors in 1976 and soon became a guiding presence in writing center theory and practice. The numerous awards presented to the Writing Lab testify to its history of excellent in-person, one-on-one tutor-based writing instruction. By providing access to innovative writing resources, the OWL is part of this history because it promotes global outreach. Writing Lab outreach began with a collection of paper-based resources physically mailed to users upon request. Later, these resources became available electronically through GOPHER, precursor to the World Wide Web. The Writing Lab entered the Web by launching its OWL in 1994. In 2005, the Writing Lab redesigned the OWL according to standards-based guidelines, providing improved access and fostering resource sustainability.

The Purdue OWL was the first of its kind and is still one of the leading online writing labs in the world. Every year, millions of users from across the globe access the writing resources made available by the OWL. The following is a breakdown of usage from September 1, 2005 through April 30, 2006:

Website:	31,736,172 hits from over 125 countries
Email tutoring:	3,175 emails answered
Handouts accessed:	18,000,000
PowerPoint presentations accessed:	500,000
Pages Linked to OWL:	2,520 added during this time

(Source: Purdue Writing Lab Annual Report, 2005-2006)

To help the OWL better serve its users, technical coordinators use precise data collecting applications to track OWL users while they navigate the site. Based on needs highlighted by the user data, and to better organize and present the OWL's vast library of resources, the Purdue Writing Lab redesigned the OWL. This redesigned site launched on August 26, 2005, boasting new resources and cutting-edge organization based on a database-driven content management system. The goals for this redesign include:

- Maintain writing support for all users
- Develop library-like features
- Achieve a more interactive environment
- Ensure accessibility of materials and navigability of the site, including 508 compliance
- Transition from a print-based to an electronic-based culture (the Web)
- Utilize advantages of Web-based material
- Ensure scalability—management of 200+ handouts
- Develop multiple identities appealing to a wide variety of users
- Provide good pedagogical material
- Remain committed to the mission statements of the OWL and the Purdue Writing Lab
- Create a flexible design so users can navigate and read information in their preferred way
- Attract new users.

In addition to collecting information on users' needs, OWL coordinators have tracked the types of users accessing the site. This information enables the coordinators to address user needs and develop helpful resources. Data reveal that OWL users fall into these categories:

- Primary and secondary teachers (grades K-12)
- English as a Second Language (ESL) teachers and ESL students
- English as a Foreign Language (EFL) teachers and EFL students
- Purdue faculty, staff, and students
- Non-Purdue college instructors and students, including other OWLs
- Professionals seeking writing assistance
- Professional and corporate trainers
- Government trainers
- Active duty, retired, and transitioning military personnel
- Parents of students, including home-schooling educators.

Along with improving organization by developing a more effective taxonomy, OWL designers hope to improve navigation and ease of use by meeting users' various needs. This report outlines the first steps in reaching these improvements. The next section details how the Purdue OWL Usability Project seeks to meet these goals.

The OWL Usability Project
The purpose of the Purdue OWL Usability Project is to help the Purdue Writing Lab fulfill its goals for the Purdue OWL Family of Sites outlined above. In addition, the project will help ensure best possible accessibility and usability of the Purdue OWL Family of Sites. Finally, the project will help scholars and professionals dedicated to the usability of online learning resources such as the OWL by providing access to research, data, conclusions, and recommendations through the OWL website at http://owl.english.purdue.edu/. The following sections outline the multidisciplinary cooperation, methodologies, methods, and pilot test that informed the first two generations of OWL usability tests.

Multidisciplinary Cooperation
As outlined in the Purpose section above, the Writing Lab faces many challenges in its OWL redesign: testing, redesigning, and publishing live files to the Web; appealing to and assisting a huge global user base; creating and posting a large number of writing resources in diverse media; organizing resources developed over ten years into a usable online architecture. Compounding these obstacles is, of course, rallying the available resources to handle the challenges. Fortunately, the Purdue Writing Lab has a rich history of overlapping, dynamic programs to assist in this project: Writing Lab staff, Professional Writing (graduate and undergraduate), Rhetoric and Composition (graduate), junior and senior faculty in all these disciplines. Although we recognize that members of our audience may not be able to pool the same resources, we would like to outline the multidisciplinary cooperation that makes this project a success. We hope this section acts as a model for future work. Importantly, we base our cooperation in theory.

Stuart Blythe's "Wiring a Usable Center: Usability Research and Writing Center Practice" (1998) is instructive, providing guidance not just to Purdue's process of OWL redesign but advice for all those concerned with maintaining electronic writing resources. Blythe advocates local research that analyzes writers and technology.

Specifically, Blythe asserts, "We need ways to gather meaningful data that will yield insights into how people interact with sophisticated technologies. Moreover, we need to develop productive research strategies that bring about change" (105). Blythe sees usability testing as an effective vehicle for this type of research and a way to bring stakeholders together to build knowledge, learn about human-technology relationships, and to help users (106). Blythe stresses usability testing as a means of developing students' professionalization:

> Usability research offers several promising methods not only because they engage students at various points in a design and decision-making process, but also because they can empower participants; they are theoretically informed; and they can yield data that is not only locally useful but potentially publishable. (111)

The OWL usability project fulfills many of these goals. The project provides data on how users find Web-based writing resources. The tests provide information OWL designers can use to improve the usability of the interface and the efficiency of the content management system. And, the research builds knowledge collaboratively as a focused activity where students, staff, and faculty work together outside a traditional classroom. So at one time, we are testing the usability of the OWL, but we are also fulfilling many other needs: users' needs, the needs of the undergraduate and graduate professional writing programs, the needs of faculty, and the needs of the Writing Lab staff. Figure 1 illustrates how these stakeholders negotiate the usability testing space and interact to build knowledge.
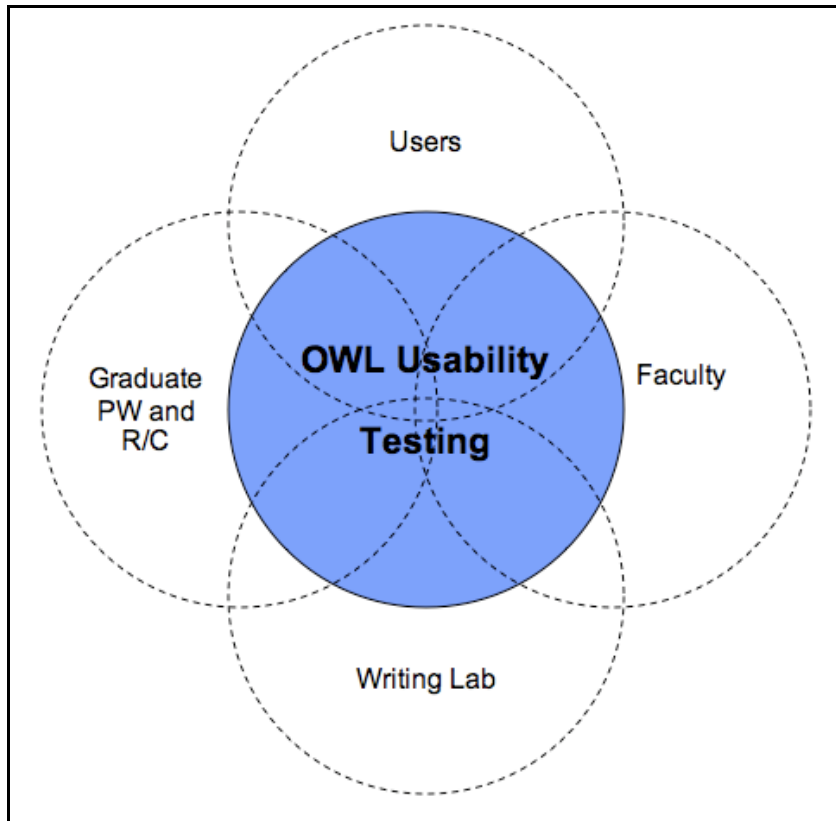

Figure 1, Usability Testing Relationships within the University

While figure 1 is static, the relationships between users, faculty, the Writing Lab, and the graduate programs in professional writing and rhetoric/composition are overlapping and fluid. We present the diagram in order to clarify the interaction in areas of collaboration. Once again, we recognize that not all programs may be able to collaborate as we have. But by outlining the theory and multidisciplinary organization framing our work, we hope to provide a guide for those interested in adapting this information to create similar projects situated in different contexts. We believe this framework is scalable for other such contexts.

Theories Informing our Research
Our work in usability and participatory design is informed by a number of theories. And while direct links to the following sources may be difficult to trace, we thought it useful to list them for reference and to show how these resources translate to design and testing methods. See the Annotated Bibliography that appears on page 53 for descriptions of the resources we have found most helpful in designing and implementing usability testing and research materials.

We have had the unique opportunity to participate with the OWL redesign in its various stages, and we have grown in our expertise as the redesign progresses. We hope these resources shed some light on our participation with the OWL and help others in their work.

Methods of Research and Analysis
Because of our mixed methods approach that collected both qualitative and quantitative information from participants, we employed several different data analysis methods. This section describes the analysis techniques used to provide an interpretation of our raw data.

Demographic data was used to both learn more about participants and also break participants into categories for analysis. Most of the demographic data was collected quantitatively, which allowed for descriptive statistical comparisons (means, medians, ranges, etc) and inferential statistical comparisons (correlations and t-tests).

For our paper prototyping tasks (Tasks 1a and 1b) we recorded a series of qualitative responses to prompts given by researchers and recorded each choice participants made. For G1 and G2 tests, we recorded 87 typed pages of notes on participant responses. For the qualitative responses, three researchers independently coded responses into categories (likes, dislikes, and suggestions) and separated meaningful responses (i.e. "the search bar should be in the upper right") from non-meaningful responses (i.e. "this page stinks"). The researchers met and developed a final interpretation based on consensus. For the recorded choices from the paper prototyping task, we calculated descriptive statistics on preferences.

Our create-your-own prototype task images (Task 1b) were coded and analyzed by two researchers. Each researcher recorded the placement of elements (such as where the search bar was placed) and noted additional important details. This process allowed us to quantify create-your-own task elements and perform descriptive statistical calculations (means, percentages).

Our on-site testing and after on-site testing questionnaire were both quantitative. We performed descriptive and inferential statistical calculations on each group, comparing both groups overall and then breaking the groups into sub-categories (new and previous users; males and females) for comparisons.

A Note on Statistical Significance
We recognize that statistical significance does not, and should not, always equal usability significance, and that quantitative data is only piece of a larger picture of user experiences and feedback. We have approached statistical significance tests as interpretive tools and analytical guides for our recommendations. While descriptive statistics have helped us understand the relationships among groups of numbers, significance tests helped discern which (if any) differences in the groups of information were more than the result of chance. We see significance testing as a valuable tool that can help researchers interpret the information generated by usability testing. We believe this because we used significance testing to help us determine which differences were the most pronounced. Hence, significance testing results showed us the areas we needed to interpret, and the results helped us create useful research tools to further develop user testing protocol.

We stress that significance tests alone are not an indicator of usability significance, and only when triangulated with qualitative feedback from participants can statistical significance be used to interpret findings. As a group, we see statistics as one among many research tools we are using to assess our research practices and incrementally deploy a plan of action for site-wide usability improvement.

OWL Usability Testing Material
In spring 2005, Dr. Salvo's English 505B mentor class began developing elements of the Purdue OWL pilot usability test. The mentor group, made up of graduate students in professional writing, worked with Dr. Salvo and the Writing Lab to compose three test elements: two paper prototype activities and one demographic questionnaire.

Pilot Test
On January 12, 2006, Dr. Salvo administered a pilot usability test in his English 515 course. The pilot usability test was designed to provide data-driven information on various usability aspects of the OWL redesign and to inform and guide the full usability tests that followed. The pilot usability test showed participants did not answer consistently when asked about the resources available at OWL.

In addition, participants did not answer consistently when asked how the redesigned OWL differed from the original OWL. For example, question 2 of the pilot test includes the following two questions:

- "What is available at this website?"
- "How does this website differ from the "original" OWL website?"

Specifically, these questions helped measure the OWL's ability to provide materials and to make clear the purpose of those materials. In addition, the questions helped measure the OWL's effectiveness in presenting library-like features and maintaining a flexible design so users can navigate and read information in their preferred way, two goals of the redesigned OWL.

The pilot usability test revealed that all participants did not list all the resources outlined on the OWL homepage. In addition, all participants did not list all of the new options of the redesigned site outlined on the OWL homepage. Participants did not realize just how many resources the OWL contained. The pilot test revealed shortcomings that called into question the usability of the OWL Family of Sites homepage and the OWL.

Based on the results from the pilot test, it was not unreasonable to conclude that users may be receiving mixed messages regarding the availability of resources on the new OWL. The pilot test, and its results, helped guide the subsequent G1 test occurring in late February and early March 2006. The following section explains the G1 OWL usability test.

The First Generation (G1) OWL Usability Test

This section details the G1 OWL usability test. Discussed in this section are the test methods and setting, usage scenarios, tasks, participant demographic information, results, and conclusions of G1. To overview, the results of G1 show that test participants liked and found useful a number of elements in the redesigned OWL. Even with these results, all three tasks of the test reveal alarming trends that could jeopardize the goals of the redesigned OWL.

Methods and Setting
We designed the methods for the G1 usability test to collect a combination of quantitative and qualitative data. We implemented this mixed-methods approach because a mixture of replicable, aggregable, data-supported (RAD) research, recorder observations, and participant responses yields the most productive data and usable information for refining the OWL. In addition, a mixed-methods approach provides the most productive data and usable information for an audience interested in usability and Writing Lab studies.

To augment time and mouse click data, we incorporated an onsite usability test developed during the spring 2006 semester. The tasks participants accomplished are proven usability procedures:

- Demographic survey (always proceeded the following tasks)
- The paper prototype activity (administered in two parts: the 'choose a paper prototype' and the 'create a paper prototype' tasks)
- The site usability test or scenario-based test (measured time and mouse clicks)
- The OWL feedback survey (always followed the site usability test).

We randomly altered the order of the paper prototyping and site usability tasks to decrease the chance that participants were influenced by the tasks they completed during the test.

We ran testing from February 27, 2006 to March 3, 2006 between 9:30 am and 8:00 pm. We conducted all tests onsite in the Purdue University Writing Lab located in West Lafayette. Participants used their choice of PCs running Microsoft Windows XP or Macintosh OS X for the OWL site usability test.

Leaders for the usability test were Tammy Conard-Salvo and Dr. Salvo. Recorders for the usability test included undergraduate and graduate students in English 515 as well as writing lab personnel who had completed CITI training[1]. For test sessions, leaders described to participants tasks they would be asked to complete and led them through the tasks. Test leaders followed a script but often adlibbed questions based on participants' responses and actions. Test leaders explained to participants that test recorders could not answer any questions and that interaction must only occur between test leaders and participants. Test leaders took digital pictures of participants' work to record the results of the paper prototype tasks. Test recorders monitored participants and typed observations on laptop computers.

---

[1] The Collaborative Institutional Training Initiative (CITI) Course in The Protection of Human Research Subjects.

Usage Scenario

The purpose of G1 was to measure the usability of only a small selection of the redesigned OWL Family of Sites:

1. The OWL Family of Sites homepage
2. The OWL homepage
3. The links from these pages
4. The resource pages and specific handouts participants were asked to find.

We did not construct the test to measure and track the usability of the entire OWL Family of Sites. By recruiting participants from the Purdue campus, we knew we would assemble primarily undergraduates, graduates, faculty, and staff from Purdue rather than the full range of OWL users worldwide. However, we believe that we tested a diverse enough range of participants to develop meaningful information on the usability of the OWL (see our discussion of demographics below).

Finally, we assumed that our participants would have a decent working knowledge of computers and the Internet since the population of Purdue is considered to be technologically savvy. To test this theory, we asked a number of computer-related questions in our demographic survey (reference demographic information below).

Tasks

In addition to filling out a demographic questionnaire, participants were asked to complete the following tasks:

1. Paper prototype activities, in two parts:
   a. choose a paper prototype
   b. create a paper prototype
2. Site usability test
3. OWL feedback survey.

Testing materials are attached in Appendix 1. Tasks are described in the sections below.

Task 1a: Choose a Paper Prototype, Design and Rationale

This test is referred to as Task 1a., though the sequence of tasks was randomized throughout testing to ensure minimal influence from the order to testing. Task 1a consisted of 12 paper prototypes, each of which differed to accentuate a particular type of layout change in potential redesign. Laying out the designs in sequence allowed participants to consider a type of major visual change, and then subsequent designs allowed the participants to select for secondary characteristics (see Appendix 1 for images of the paper prototypes).

Testing was conducted by showing participants four prototypes with different visual navigation characteristics. Prototypes were grouped by consistency with the website prior to testing (prototypes 1, 2, 3, or Group A), resizing and realigning elements of the existing website (prototypes 4, 5, 6, or Group B), redesign consistent with targeted examples—see Appendix 1 for models for redesign—(prototypes 7, 8, 9, or Group C), and hybrid variations melding elements of target websites with existing design elements (prototypes 10, 11, 12, or Group D).

Prototypes 1, 4, 7, and 10 were presented to each participant. Participants were asked to describe each prototype for professionalism and apparent ease of use before selecting a preferred design.

As participants selected a prototype, similar prototypes were displayed. In each grouping, each prototype differs from its family by a selected variable, e.g., prototype 4 presents small OWL icons arranged vertically across the page, prototype 5 presents these icons in larger format vertically, while p6 arranges smaller versions vertically. Each family of prototypes and its targeted variables are described below.

Each grouping of prototypes offers similarly structured redesign options. Each task asked participants to assess the professionalism and apparent ease of navigation of the prototype, and each participant first selected among prototypes 1, 4, 7, and 10. When the participant-selected prototype group (A, B, C, or D) was displayed, the participant was again asked to rate the relative professionalism and navigability of each design. The participant was then asked to select a new OWL design from the options presented.

After selecting one of the designs, all the remaining prototypes were displayed. The participant was then asked if any new design among the prototypes would replace his/her selection. At each stage of the task, recorders noted information regarding the participant's preferences and key words used to describe professionalism, navigability, and effectiveness of design.

For example, Participant 5J8 is shown prototypes1, 4, 7, and 10. This participant is asked to examine the design prototypes for one full minute, after which, the participant describes prototype 1 as professional and easy to navigate. Prototype 4 is described as less professional and less easy to navigate. Prototype 7 is described as unprofessional and difficult to navigate. Prototype 10 is rated as professional and easy to navigate. When asked to choose the new OWL design, the participant selects prototype 10.

Upon selecting prototype10, the test administrator would remove prototypes1, 4, and 7 and show the participant prototypes 10, 11, and 12. After the participant is given another minute to study each prototype design, the test administrator again asks the participant to describe the professionalism and ease of navigability of prototypes 11 and 12. At this stage, participants often compared prototypes, stating elements were more or less professional and more or less navigable than their selected prototype. Our example participant here describes both prototypes 11 and 12 as professional but not as professional or navigable as prototype 10. The participant again selects prototype 10 as the new OWL design.

At this stage of testing, all the remaining prototypes—2, 3, 5, 6, 8, and 9—are displayed for the test participant and asked after one minute if there are any designs that should replace his/her selection for the new OWL website design. This participant says no, that prototype 10 should be the new website design. This concludes Task 1a.

Groupings and Tested Variables
As described above, each testing group had specific visual elements changed in order to test variables in design. This section articulates each of these variables and offers a rationale for the structure and processes of Test 1.

Group A consists of prototypes 1, 2, and 3. This group most closely resembles the existing OWL website design. Prototype 1 is, in fact, the OWL website as it existed at the start of testing. Prototype 2 adds a search bar, resource links, and most popular resources in a right-hand navigation column. Prototype 3 offers a streamlined search bar, as well as News, Feature and Contact links in a right-hand search bar.

Group B consists of prototypes 4, 5, and 6. This group has Frequently Asked Questions (FAQ) links presented in an upper left-hand column, a search bar in the upper right-hand column, and versions of the existing OWL icons. Prototype 4 presents small icons horizontally across the middle of the page with a vertical grouping of resource links, popular resources, and News links below. Prototype 5 offers large icons arranged vertically with navigation menus on the right- and left-hand sides. Prototype 6 consists of small icons arranged vertically above News links with a navigation bar on the left-hand side.

Group C consists of prototypes 7, 8, and 9. This group offers links to answers to Frequently Asked Questions (FAQ) and a search bar, although the placement differs in each prototype. Prototype 7 has both above the title, prototype 8 offers a search bar above the title and FAQs in the lower left-hand corner, and prototype 9 offers FAQs in the top left-hand corner and search in the bottom right-hand. Each of the prototypes in Group C presents a grouping of three icons designed using the Library of Congress (LOC.gov) opening splash page as a reference. All three prototypes offer left-hand navigation.

Group D consists of prototypes 10, 11, and 12. This group offers elements of each of the three other groups of prototypes including unique combinations of left- and right-hand navigation, icons, and links.

Paper prototype comments were recorded verbatim into a text-based format. Three researchers independently categorized the results based on significant likes, dislikes, and suggestions, then met and agreed upon a final list. We defined significant likes, dislikes and suggestions as those which were relevant and meaningful to the test.

Task 1b Create a Paper Prototype, Design and Rationale
Task 1b tracked the participant's perceptions of professionalism and design and asked participants to choose among a variety of paper prototypes. Task 1b asked participants to construct their own new design out of modular elements from the paper prototypes. Again, it is important for readers to recognize that Task 1b is named only for convenience and participants completed the tasks in random order.

This task was designed to allow a maximum level of participant input and control over the design of OWL homepage paper prototypes. In evaluating Task 1b, coders have established a naming and placement system for recording: first, whether participants included certain elements or modules of design, and second, where on the screen participants placed these elements. With that in mind, analysis of these designs presents a list of the most used elements of participant-initiated design and most frequent placement of these items on the screen.

The design of Task 1b allows for some comparison and analysis of Task 1a results. Although difficult to quantify, most participants expressed satisfaction in completing Task 1b, reporting that they felt more control and a greater level of input while completing the test. Ironically, this task will result in fewer concrete changes because the results are harder to tabulate and report, revealing a limit to the effectiveness of open-ended questions for meaningful statistical results. While the results may be more difficult to analyze leading to difficulties in drawing conclusions for researchers, this is nevertheless a valuable testing regimen because it built rapport with test participants, prompted valuable conversations with participants, and opened an opportunity for participants and researchers to interact dialogically.

See the results section below for further detail regarding findings, trends, and themes that emerged from this open-ended dialogic testing. Participants and test administrators reported that the design and practice of Task 1b, create a paper prototype, allowed opportunities for communication between participants and administrators that would not have been possible through reliance on the more statistically rigorous but less dialogically oriented testing. In other words, Task 1b accomplished its goals: increasing comfort of test participants and creating opportunities for discussion with participants.

Task 2, Site Usability Test, Design and Rationale
While Tasks 1a and 1b were meant to gather open-ended preferences and suggestions from the participants, Task 2 was meant to assess the live OWL site and gather feedback on participants' experiences. Part one of Task 2 asked participants to use the OWL to answer a series of four writing-related questions (presented in a random order). Times, navigation paths, and mouse clicks to new locations were recorded for each participant. Part two of the task asked participants to rate their experiences with a short questionnaire. The questionnaire was useful both for gathering additional data from participants and for comparisons to the task itself.

Our rationale for using this task is multi-layered. On the surface, we wanted a test of the actual site included in our testing procedure. We also wanted to collect quantitative data about the site that could function as a navigational benchmark for further site testing. On a deeper layer, we wanted to compare our data from Tasks 1a and 1b to what we found in Task 2, both with the participant preferences as well as their feedback on the functionality of the test.

18

By collecting quantitative and qualitative data, we were able to further triangulate our results to present a more comprehensive picture of how participants feel about design and functionality.

Participants were asked to complete a variety of tasks relating to different information on the OWL site. These tasks simulated the types of actions OWL users complete when they visit the site. Tasks included questions about evaluating print and Internet sources, dealing with writer's block, page length of résumés, and primary research.

Part one of the test began with the participant at the OWL home page as it looked in February 2006. As each test question was read; time was recorded from the completion of the question until the participant answered the question correctly. Each navigational click and navigational path was recorded to track the flow and success of participant navigational courses.

Task 3: Feedback Survey, Design and Rationale
After Tasks 1a, 1b, and Task 2 were completed, participants were asked to fill out a feedback survey rating their experiences. A summated rating scale (Likert scale) was used to rate participants' responses on a number of areas, including how they felt while using the site, and the ease with which they found information (our complete survey can be found in Appendix 1. Two open-ended qualitative questions were also asked at the end of the survey to triangulate our quantitative results.

Demographic Information: G1 Testing
Eighteen test participants were assembled randomly from the Purdue community using a flyer distributed across campus. Though test leaders and recorders personally interacted with participants, participants' identities (name, contact information, etc.) were protected. For the purposes of data collection, participants' information was identified only by their test number. Participants were given a $10 gift certificate to a local bookstore for their time.

We had a wide variety of participants in our first generation of testing ranging in age, language ability, and in university role. Our 18 participants reported at least some computer proficiency and over half reported that they had used the Purdue OWL before. Many participants indicated that they were familiar with both writing concepts and comfortable with writing. Five of our 18 participants were ESL learners. There were not enough ESL participants to allow us to make generalizations about these participants in our first generation of testing. In the following section, we provide a detailed breakdown of our participants, including descriptive statistics about their answers. The following pie chart illustrates the breakdown of participants by category.

Figure 2, Participants by Category

General Information
We tested 18 participants with an age range of 18-46 (mean age of 24). Participant gender included 5 females (or 27.7%) and 13 males (or 72.2%). We had a wide range of class levels and majors for testing purposes. See Figure 2 for complete participant breakdowns by category/professional status.

Computer Proficiency
All participants reported spending at least six hours on a computer per week, with 66% of our participants indicated spending 16 or more hours on a computer per week. In addition, our participants reported very high comfort both with using a computer and with navigating the Internet[2] (mean of 4.722 out of 5; standard deviation 0.461). Our participants indicated that they used the Internet often to find information (4.944 out of 5; standard deviation 0.236).

---

[2] In our first generation tests, we had a perfect correlation between these two questions. In other words, our participants answered these two questions identically, which suggests that computer proficiency and Internet navigation could be very similar to participants.

OWL Usage
Eleven of our participants reported using the Purdue OWL—of those, 8 visited it yearly and 3 visited it monthly. Nine of our 11 participants had visited both the old and new OWL sites. Because we randomized the order of our three tests, participants received experience with the OWL (via Task 3) at various times during the testing process.

Writing Proficiency and Confidence
We asked participants about their writing proficiency in several ways. We first asked them if they took first-year composition at Purdue or elsewhere, and we asked them about their perceived writing fluency. Sixteen of our 18 participants reported taking first-year composition; the two participants who indicated they did not take first year composition were both graduate students. Seventeen of our 18 participants reported that they were fluent writers. These findings triangulate with those in the second part of our demographic survey. Participants reported a mean of 3.944 out of 5 in their confidence in their writing ability and 3.777 in familiarity with concepts in writing. These two questions highly correlated[3], indicating that, for our participants, familiarity with writing concepts is comparable to confidence in writing. Our participants reported a mean of 3.167 out of 5 for the statement "I do not enjoy talking about my writing" and a 2.44 for "Talking about my writing embarrasses me." These questions, however, were not significantly correlated[4].

We realize these are indirect, self-reported measures of writing proficiency and that reporting fluency in writing does not necessarily equate with rhetorical knowledge. Any additional means of measuring writing fluency would have been outside the scope of our research.

ESL Participants
First generation testing had only 5 participants who self-identified as English language learners. As such, we did not have enough individuals in this test to generalize about these participants. One reason for conducting the second generation (G2) testing (see Second Generation Usability Test below) was to recruit a more equitable sample of ESL participants.

Behaviors, Preferences, and Feelings about Technology and Writing
In the second part of the demographic survey, participants were asked to self-report behaviors, preferences, and feelings about technology and writing. Our participants reported high levels of technological comfort: in computer operations (Mean 4.722), in navigating the Internet (Mean 4.722), in finding information on the Internet (Mean 4.944), in using the web for communication (Mean 4.722), and using the computer on a daily basis (Mean 4.50). Our participants were not as comfortable with building and maintaining websites (Mean 2.556) and only marginally considered themselves expert computer users (3.278).

---

[3] Correlation of 0.815
[4] About 30% of our variation in responses can be explained through a correlation of these two questions. In other words, 30% of our subjects may link embarrassment and not liking to talk about writing, but not the rest of them. (Correlation of 0.566)

Participants reported a fairly high level of confidence in writing (Mean 3.944) and familiarity with concepts in the study of writing (Mean 3.777). Participants were generally neutral about how much they enjoyed talking about their writing (Mean 3.167). Familiarization with concepts of writing is covered in more detail in our discussion section. When asked where participants would go for information, participants were most likely to consult a website (Mean 3.722) or ask another person (Mean 3.833) over using a book (Mean 2.833). Many participants indicated that they would not give up the search for answers immediately (2.278). Participants also indicated that they or someone they knew would benefit from online writing help (Mean 4.111).

Results of G1

The G1 usability test showed that participants liked and found a number of elements useful in the redesigned OWL. Participants were fond of the new design of the OWL Family of Sites homepage. Participants also liked the drop-down menus for the navigation bar on the OWL homepage. However, all three task areas of the test reveal disturbing trends that may undermine the goals of the redesigned OWL. For example, while some tasks took participants a short time to complete, one minute or less, some tasks took participants up to two minutes or more to complete. Ten tasks took five-plus minutes to complete, and four participants could not finish their tasks. While some tasks required three clicks or fewer to complete (the industry standard), many tasks took participants more than three clicks to complete. Some tasks even took participants six or more clicks to complete, with the highest being 29.

Participants' responses on the OWL feedback survey revealed interesting information regarding test participants impression of the site design and navigation. When asked about the accessibility of information, the usability of the site, and how they felt while using the OWL, the responses revealed mixed feelings as well as some confusion among participants:

- Participants provided neutral to neutral-easy responses (3.6) when asked about the ease of finding information on the OWL
- Participants thought the OWL site was easy (4.0) to navigate
- Participants responded neutrally (3.44) when asked if they knew where they were while using the OWL
- Participants provided neutral-comfortable responses (3.69) when asked if they were confused while using the OWL
- Participants who used the OWL before usability testing rated the site significantly higher than non-previous users. Measured by times and clicks, there was little differentiating the two groups' performance on the tasks. Yet participants who previously used the OWL responded more positively.

When asked about what features could be improved or included in the OWL, participants noted that moving the navigation bar to the left side of pages and adding a search function would help. Participants preferred to see more helpful information on the homepage such as links for different types of visitors (teachers, students, ESL learners) and most popular resources. Also, participants wanted fewer steps involved in finding what they needed.

Analysis of Task 1a

Task 1a and Task 1b were designed to discover participants' preferences about different site features. We found several running themes in the data that provided us specific feedback about the site and more general feedback about participant preferences of browsing the web. We calculated specific preferences based on the Task 1a data, and used those preferences to help analyze the Task 1b data. For a description of Tasks 1a and 1b, see the Methods and Setting section above, which details test procedures. For complete results, see Appendix 2. The following presents the findings as collected during testing.

Out of our 63 total suggestions, 20 (or 31.75%) involved a search bar (see Appendix 2 for a breakdown of responses). Although our paper prototype does not present conclusive findings about search bar location, the create-your-own task (1b) reveals more decisive conclusions. Six participants suggested that we use left-hand navigation in various pages, while five other "like" comments were directed toward left-screen placement of elements and navigation.

Participant Preferences

Out of our 47 recorded choices, prototype 10 (Figure 3 below) was chosen 19 times, or 40.43%. Prototype 1 was chosen a total of 7 times out of 47 recorded choices, or 14.89%. Number 1 was the active design of the OWL homepage at the time and was used as a control. Although chosen 15% of the time, test administrators expected #1, the active design, to be the overwhelming preference of participants. However, with participants selecting prototype 10 over 40% of the time, test participants demonstrated a dissatisfaction with the existing design. In addition, participants indicated they preferred a more information-dense navigation page that contains frequently accessed resources, search capability, as well as resources arranged by audience.
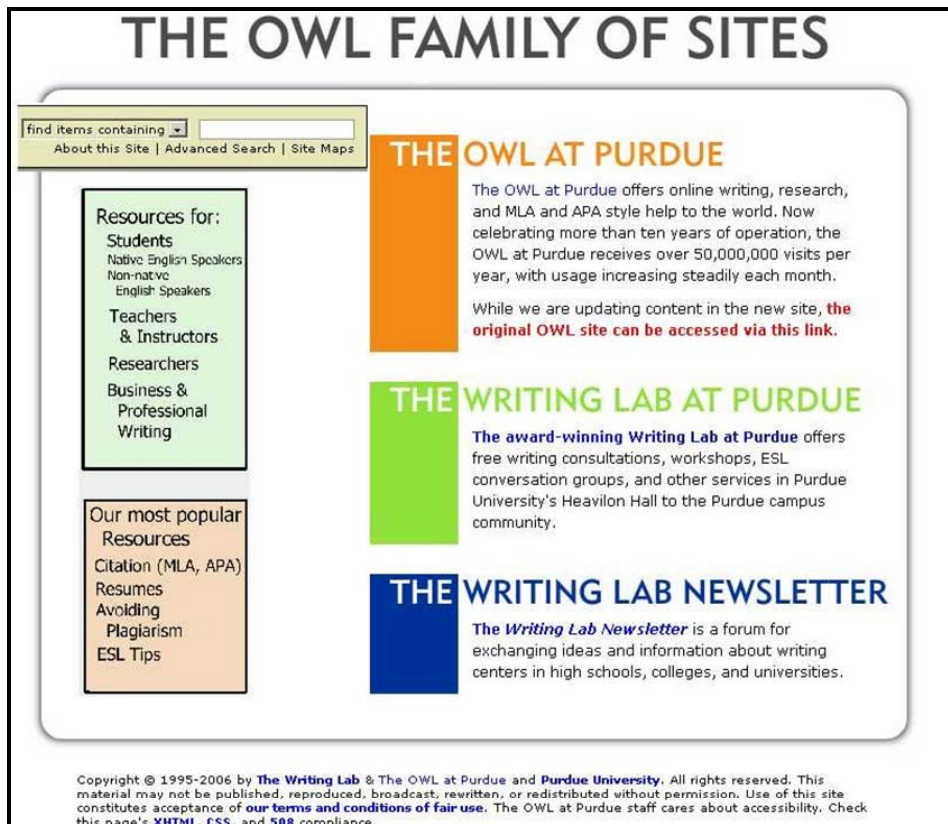
Figure 3, Template of OWL Redesign

Many of the preferences participants reported were answers to our prompts, answers relating to ease of use, professional, writing-related links. However, a number of likes, dislikes, and suggestions occurred outside of our prompts throughout the testing. These included preferences about search bar existence and location, and the amount and organization of page content. We also had many participants comment on the inclusion of specific content areas: resources for various users, most popular links, a search function, contact information, and a link to frequently asked questions. Participants were more likely to want these additional resources on their pages and based many of their choices on the absence or presence of these resources. As prototype 10 included many of the aforementioned resources, it was chosen most frequently (a total of 19 times as a first or second choice) and by 11 out of 18 participants as a first choice. A complete breakdown of choices and preferences can be found in Appendix 2

Gendered Preference
During initial testing, interesting trends emerged in relationship to the paper prototype choices (especially second choices) based on the gender of participants. Although both males and females preferred prototype 10 over all others, males showed a much stronger preference for prototype 1 over 7 as a second choice, while females preferred prototype 7 (not a single female chose prototype 1 as a second choice). Males and females also had differing opinions about prototypes 7 and 8. Females chose prototype 7 in 13.33% of all their choices while males chose it only 6.25% of the time. Males chose prototype 8 3.13% of the time, compared to females choosing it 20%.

24

Preference Based on Web Design Expertise
Another interesting difference emerged when comparing the choices of participants who had indicated that they were comfortable with developing websites to those who had not. Web design expertise was broken into three groups: those who answered 4 or 5 on our "web design expertise" demographic question (called "web designers"; 5 participants), those who answered 3 on Q5 (called "Web dabblers"; 3 participants) and those who answered 1-2 on Q5 (called Non Web Designers; 10 participants).

While prototype 10 is again the top choice for all three groups, preference for the second choice is split. For the web designers, 40% chose prototype 1 and none chose prototype 7, while 40% of the non-designers chose 7 and only 10% chose prototype 1. Differences in the total number of choices also repeat this finding—none of the web designers or web dabblers chose prototype 7, yet prototype 7 was chosen 16% of the time (prototype 7 was chosen as a first choice by non-designers).

Preference based on Past OWL Usage
We also found differences in participant choices based on whether they indicated past OWL use. It appears that the past users want to see different elements on the homepage that non-users do not want to see. All three of the participants who chose prototype 1 (our "cleanest" design with the fewest amount of additional features) were previous users. There is almost a 20% difference between previous visitors and new visitors in their preference of prototype 10 as their first choice for the new home page over 25% between the two groups in overall choices. Previous OWL users also had a wider variety of designs they preferred (9 designs) compared with non-users (5 designs).

Preference based on Writing Familiarity
We did not find any significant differences in paper prototype choices and writing familiarity.

Analysis of Task 1b
All participants but one expressed an interest in having a search bar available. Among those expressing preference, participants were split evenly as to whether the search bar or buttons should be on the right or left side: 50% expressed a preference for placement on the right-hand top and 50% expressed a preference for placement on the left-hand top of the page. While participants demonstrated no clear preference for which side of the page search should appear, participants expressed an overwhelming preference (over 95%) for placing the search at the top of *each* page. Only one participant preferred no search capability as a navigation option. Below are two representative samples of the results of Test 1b, the "create your own paper prototype" with commentary from the test administrator.
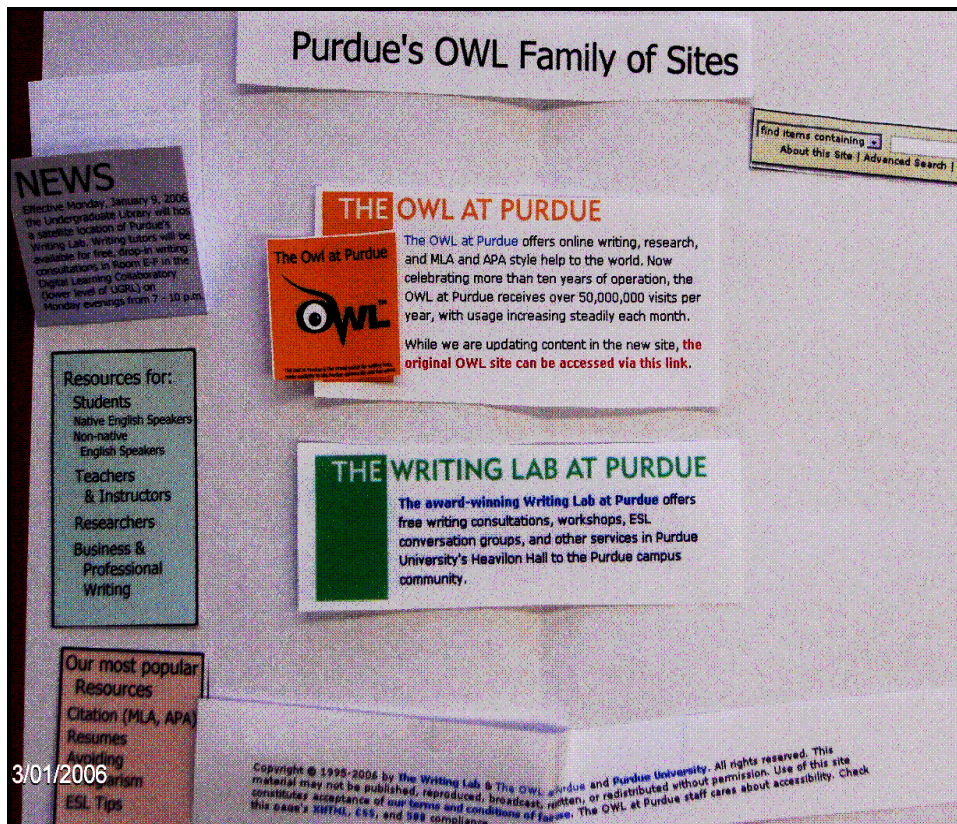
Figure 4, Create-Your-Own Participant Design

Note the ways in which participants altered the stock prototype elements: first, this participant edited the "News" box by folding the image in half and, second, the participant created a compound icon by placing the OWL Icon on top of the text-only icon.

First, by editing (folding) the News text box, the participant expressed an interest in having timely data presented but also felt the size of the text box should be limited. This action allowed the test administrator to engage the participant in discussion of the change, its purpose, and the role of timely presentation of data. Note also the way that the News box displaces the left-hand navigation column. This participant, engaged in conversation with the test administrator, revealed much about the ways in which participants used the site as well as what expectations users bring with them when visiting different kinds of sites. This data, important to understanding not just the immediate circumstance of news box placement, also allowed for depth of understanding of user expectations.

Second, by creating a compound icon (placing the image on top of the text-only icon), the participant broke what is often considered a choice between iconographic and textual navigation. The participant offered design innovation that had been overlooked both by the designers and the Usability Research Team. As is evident in the redesign offered below in the Recommendations section, this participant offered an interesting and innovative solution to a challenge that had stalled design improvement.

While the participant offering the prototype of Figure 4 above offered innovation, another participant abandoned the stock elements of the paper prototype and offered another vision of the site design below in Figure 5.

Figure 5, Create-Your-Own Participant Design

The participant abandoned stock prototype elements and offered a unique set of design elements.

No member of the usability research team could have foreseen the participant's interest or willingness to strike out on her/his own. While many research methods would have been unable to process the kind of innovation and difficulty in recording the data presented in this participant prototype, it would be a shame to lose the innovation and expression of good will this prototype draft represents. The participant clearly described how the different design elements could be used and how the design presents a new but coherent structure to the site's complex contents. It also represents a new and interesting possibility for utilizing usability testing in difficult situations where designers have run out of ideas—usability for invention, one might call it, in which the right participants can help move a design team's prototype design forward.

However, the usability research team has been unable to locate any reliable attributes that would set this participant apart for open-ended testing. The research team was fortunate to encounter this participant at this moment, and while there may be ways of predicting and locating participants likely to innovate, there seems no likely statistical means of determining who might contribute such innovations during any given usability session.

Therefore, it seems unlikely that testing can be redesigned to attract such participants. Rather, test administrators can be prepared to take advantage of opportunities when (and if) they arise.

Left-Hand Navigation and Importance
Many participants indicated that the left of the screen was more important and/or that the left hand should be used for navigation in our testing. Ten out of 18 participants placed the main navigation (links to OWL, Writing Lab and Writing Lab Newsletter) on the left side of the page. Seven of the remaining 8 placed at least some links on the left, most frequently "most popular resources" (7 instances) "news/features/contact" (3 instances) and "resources for" (6 instances).

Search Bar
Participants overwhelmingly chose the upper right for a search a bar. Eight (44.44%) of our participants chose the upper right corner for the search bar, while a total of 11 (61.11%) chose right placement on either the top or bottom. Only two participants (11.11%) choose not to include a search bar, meaning that 88.89% included a search bar somewhere on their task 1b page. The search bar was a topic that came up frequently throughout usability testing. From the preferences task, it seems clear that most participants want a search bar, but little agreement exists on where participants would prefer it.

Of the search bars that were included, 4 participants chose the drop-down complex search bar, while 11 included the simple search bar (12 if we include the participant who hand-drew her page and included a simple search bar). Participants overwhelmingly preferred the existence of a search bar, and many preferred a search bar located on the right of the page.

Additional Content
The question of what content to include on a front page or splash page is always a problematic one for developers. Participants indicated that they prefer additional content over a cleaner-looking page. This additional content included most popular resources, resources by user, and links to specific citation guides. This finding was triangulated with both the 'choose a paper prototype' and 'create a paper prototype' data.

Task 1a and 1b Conclusions
Overall, our participants preferred pages with a search function, pages with more graphically based content, and pages that contained resources not currently found on the OWL Family of Sites homepage. These resources included "featured links," "most popular resources," "resources based on audience types," and "news." Participants chose and built pages that contained a larger amount of resources more frequently than the current OWL homepage design that includes many fewer features. It is unclear from our research whether participants would have chosen the additional resources presented during usability testing over other types of resources not presented during usability testing, or if the preference for resources in the "create a paper prototype" task was due to participants wanting to fill up their pages.

Task 1a, Choose a Paper Prototype; Task 1b, Create a Paper Prototype
Tasks 1a and 1b showed that the majority of participants preferred navigation bars on the left and wanted a search function. The redesigned OWL in February 2006 contained a right-aligned navigation bar and did not have a search function. Also, the paper prototype activities revealed that the majority of participants preferred designs that incorporate logos associated with the separate areas of the OWL Family of Sites. The redesigned OWL did not use logos for the different areas. Further, the paper prototype activities demonstrated that participants prefer more information on the front page—clearly visible contact information, resources based on type of user, and featured links were all frequent possibilities.

Analysis of Task 2
Task 2 consisted of a series of four randomized tasks that participants completed. A total of 71 tests were run with our 18 participants (approximately 4 tasks per participant). The mean number of clicks per task was 5.56 and the mean number of clicks per participant for all tasks was 23.34. Participants took an average of 117.16 seconds to complete each task and spent approximately 452.67 seconds in the completion of all four tasks. We had a click range of 1 to 24 clicks per participant per task and a range of 45 to 600 seconds per task. All participants received the same set of tasks but each participant received the tasks in a randomized order.

The first task completed by participants required the most time to complete, taking an average of 195.66 seconds per participant and 9.18 clicks. The second task took an average of 78.33 seconds per participant and 5.06 clicks. Our third task took an average of 65.22 seconds per participant and 4.47 clicks. In the final task, participants averaged 4.81 clicks and 120.12 seconds per participant. Finally, we did not find a significant difference between clicks or time based on whether participants had previously visited the OWL. Our 7 new visitors had a mean of 5.91 clicks per task and 127.15 seconds per task compared to our 11 previous visitors with 5.88 clicks per task and 107.16 seconds per task. Significant differences were also not found between participants based on gender or web expertise.

Analysis of Task 3
Some of our most interesting results came from our after-test questionnaire of the participants' experience while navigating the site. This section covers the range of answers presented and average answers to questions relating to the site. Each of the questions below asked the participants to rate their experiences on a scale of 1-5, with one being very lost or confused and 5 being very easy to navigate, very comfortable, etc, depending on the question. Overall, participants had a large range of answers, demonstrating that different participants viewed the site much differently. Participants rated their experiences as slightly above average in most cases. To the question asking participants to rate their experiences finding specific information, participant scores ranged from 1-5.

1. When calculating the mean (average) of participant responses, participants indicated that finding information on the site was between "neutral" and "easy" for them (mean 3.6 out of 5). Participants also indicated that the information was not buried in pages (mean 3.61 out of 5).
2. The wide range of our responses demonstrates to us that not all participants were comfortable finding information on the OWL site, although on average, participants indicated that the site was slightly above neutral in the ease of finding information. Participants also had a 1-5 range of answers relating to the overall organization of the homepage and a 3-5 on overall site organization.
3. Again, the wide range of answers demonstrates that not all participants were having positive experiences with the OWL homepage organization. The clustering of answers in the 3-5 range on site navigation is positive because no participants rated the OWL site navigation in the confusing or very confusing categories.
4. The average answers for these two questions were rated at a mean of 3.8 out of 5 for homepage organization and 4 out of 5 for site organization and navigation. In fact, our highest rating was in the area of site navigation, which was surprising considering the comments from Tasks 1a and 1b. The lowest mean score was 3.44 out of five (more positive than neutral) in the area of how participants felt when looking for information.

Overall, our participants rated the site slightly above average in most areas. The range of scores in the overall organization area is troubling because at least some users are experiencing great difficulty in understanding the site organization.

In addition to the averages and ranges described above, we found moderate correlations for many of the questions—especially surrounding ease of use of the site relating to participants' feelings about the experience. These findings demonstrate to us that the rating of a site element has a strong connection to the feelings of comfort a participant has while viewing our site.

- We found a correlation of .734 for finding specific information and feelings when using the site; a correlation of .708 for the accessibility of information and feelings; and a correlation of .655 for feelings and site navigation.
- We also found correlations for finding specific information and the organization of the homepage (.639) and finding specific information and the accessibility of information (0.682).
- The ability to find specific information and how a participant felt seemed to be impacted by their overall experiences on the site.

These findings are particularly helpful to us because they allow us to understand the direct link between the perceived user opinion of a site and how comfortable a user feels. As our data in the next section indicate, user feelings about our website vary widely based on gender and previous site experience. As in Tasks 1a and 1b, we again compared participants based on gender, previous OWL usage, computer expertise, and writing familiarity. We found significant differences between answers based on gender and previous OWL usage, but no significant differences based on computer expertise or writing familiarity.

Task 3, Feedback Survey (Gender)
When comparing the answers by gender, a pattern of response emerges. If questions are classified based on whether they are "evaluative" (i.e. finding specific information or site navigation—questions 1-5) or "feeling" (questions 6 and 7, which inquire about participants' feelings), an interesting pattern emerges.

1. Females had equal or higher responses based on evaluative questions (mean of .16 higher), but lower responses based in the feeling questions (mean of .7 lower).
2. Overall, males had a much larger range of answers to questions (for example, the finding specific information question had a female range of 4-5 and a male range of 1-5; the question about site navigation had a female range from 3-5 and a male range of 1-5).
3. We found a significant difference ($p<0.05$) in the scores relating to the information accessibility question (prototype 3) and a score approaching significance on finding specific information (prototype 1).
4. Female participants reported that information was much more accessible than male participants and evaluated the site as more usable than males. However, females evaluated their response to the experience using the site lower than male participants.

However, after further testing, these results were not as clearly indicative of gender-based differences in web surfing styles. See the Conclusion below (esp. page 32) for more about the combined G1 and G2 data relating to gender.

Task 3, Feedback Survey (Answers Based on Previous OWL Use)
We found highly significant differences in how participants rated their feelings and how they viewed site organization while using the Purdue OWL. In our G1 testing, we found significant differences between the answers of our previous and new OWL users. Specifically, we found differences in participant feelings when using the site and perceptions of the organization of the homepage and overall site.

When we combine the participant responses for G1 and G2 (the testing conditions were similar, but not exact for Task 3), we find that some of the differences hold and some are decreased. We again found a strong significant difference ($p<0.01$) for the question "How did you feel when using the site?". Previous users felt more comfortable (mean 3.79) than new users (mean 3.1). We found two differences approaching significance in the questions about the ease of finding specific information and the organization of the homepage (with previous users rating the site overall higher than new users). No other significant differences were found, although previous users have overall higher means than new users. Table 6 provides a detailed breakdown of the means for the two groups and their responses to the after-test questionnaire:

Questions	Previous Users	New Users
Overall difficulty of finding specific information	3.73	3
Effectiveness of the organization of the home page	4.05	3.3
Accessibility of information	3.64	3.3
Effectiveness of site organization	3.73	3.6
Accessibility of site navigation	4.05	3.5
How participants felt when looking for information (lost – oriented)	3.55	3.2
How participants felt when using the site (confused – comfortable)	3.8	3.1

Figure 6, G2 Feedback Survey Means: Previous and New Users

The list below represents some findings based on our participant responses to the feedback survey:

- Of our 18 participants, 11 (61.1%) indicated that they had visited the Purdue OWL.
- Seven (63.6%) of the 11 participants indicated that they have visited both the old and new OWL sites.
- Of those 11 participants who had visited the OWL, 8 or 72.7% indicated that they only visit it yearly; the other three indicated that they visit it monthly.
- Previous visitors as a whole rated their experiences (both evaluative and intuitive questions) as significantly higher than the participants who had reported previous OWL visits, even if these visits only occurred once a year or once a month (as most of our previous OWL users indicated).
- We found a highly significant difference in the question "How did you feel while using the site" between our new and experienced users ($p<0.001$). Experienced users rated their experiences above average (mean of 4.14) while new users rated their experiences as neutral (mean of 3).
- Furthermore, we found significant differences ($p<0.05$ level) for our user experiences in their perceptions of the organization of the home page (new users rated it at a mean of 3.14, previous users rated it at a mean of 4.36) and overall site organization (new users rated it at a mean of 3.57, previous users at a mean of 4.27).
- 72.7% of our previous users only visit the site once a year and yet their experiences are still significantly different from previous users.

The two organization questions indicate that exposure, even infrequent exposure, strongly impacts how comfortable users are with site organization. We also found differences approaching significance in locating specific information, buried/accessible information, and buried/accessible site navigation. The findings about previous and new users demonstrate to us not only the importance of usability and the frequency of repeat visitors, but also the importance of making our site more usable and accessible to first-time visitors. It also raises the interesting question of how frequency of use impacts site usability.

- 72.7% of our previous users only visit the site once a year and yet their experiences are still significantly different from previous users.

Additional research is needed in this area to discover more detail about our new users and their needs and experiences—and how these experiences are different from those who have previously used our site. User histories, in other words, are incredibly important to usability.

As the graphic below illustrates, participants who reported using the OWL previously expressed positive response to the redesign. This is perhaps the most important finding of usability testing: that, basically, participants who used both the old OWL design and the new OWL design feel better about the redesign than participants who have not used the old OWL. We interpret this data to mean that the OWL redesign is a success. However, new OWL users, defined as those who report never visiting the OWL website prior to participating in the testing, reported feeling either neutral or somewhat positive about the OWL website design. Through further refinement and clarity in taxonomy, organization, and navigation, the research group aims to improve these initial impressions to positive responses rather than user indifference.

Although statistically there was no clear significance in this data regarding our previous and new OWL users, we did find highly significant differences in how participants rated their experiences Figure 7 below shows a complete breakdown of impressions.
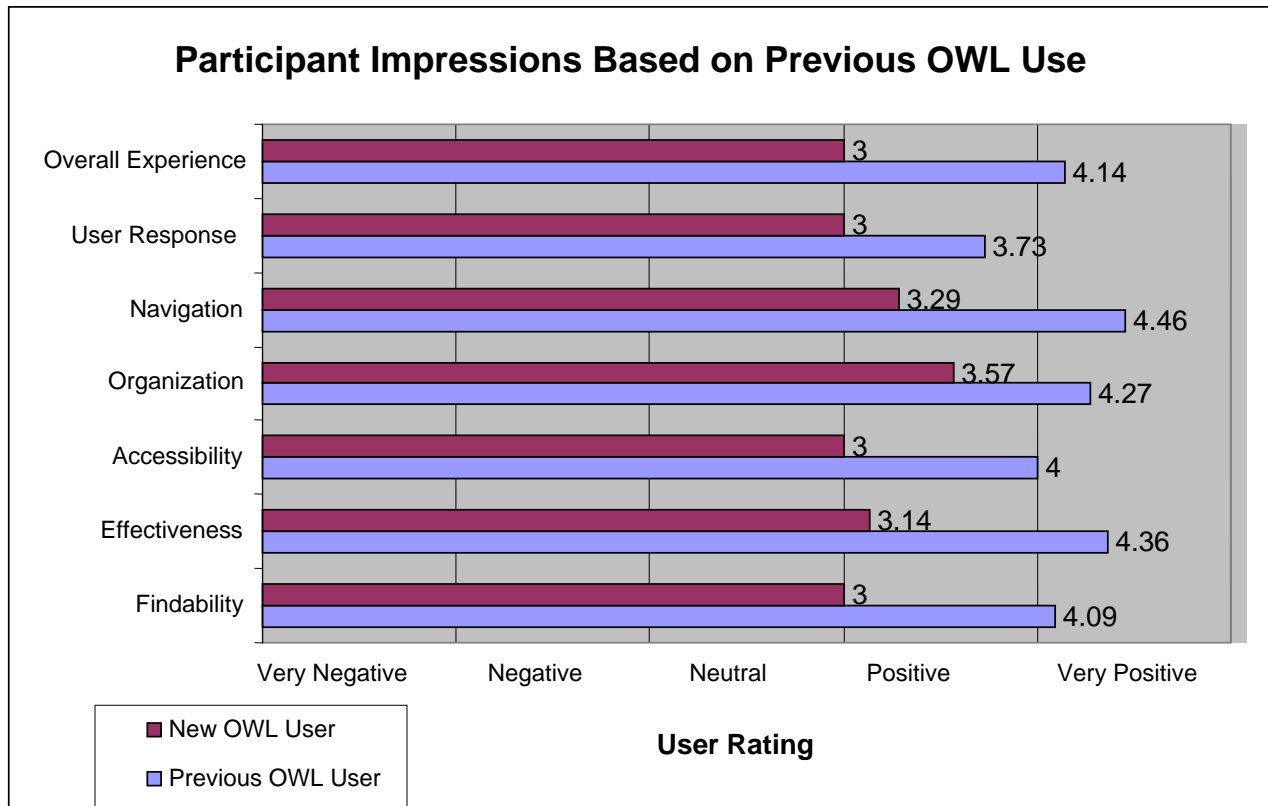

Figure 7, Previous vs. New OWL User Opinions

Conclusions for First-Generation Testing (G1)
Based on the results of G1, we conclude that the redesigned OWL successfully improves many aspects of the original OWL site design, including organization, navigation, and overall look and feel. In addition, test participants found many elements of the new OWL useful. However, results from our testing show that, not surprisingly, the new OWL contains usability problems. Finally, our results indicate that further research is necessary to build more data to further refine conclusions and recommendations. The following list outlines our conclusions broken down into each task area:

Task 2, Site Usability Test
The site usability test showed that most tasks took participants one minute or less to complete. However, the test also revealed that some participants required one minute or more to complete an alarming number of tasks. The test showed that ten tasks took five or more minutes to complete, and four tasks could not be completed at all. The shortest period necessary for participants to complete a task was thirty seconds. The longest period required for participants to complete a task was ten minutes.

The site usability test showed that many tasks required three or fewer mouse clicks to complete. Three clicks to destination is currently considered the *commercial* standard for navigation, although no such standards have been determined for informational resources like the OWL. The test also revealed that an alarming number of tasks required four or more clicks to accomplish and that fourteen tasks took ten or more clicks to finish. The lowest number of clicks for a task was two. The highest number of clicks was 29.

Task 3, OWL Feedback Survey
The OWL feedback survey showed that participants liked and found useful content and design elements of the redesigned OWL. However, the survey also revealed that participants did not respond in the positive manner expected of the redesigned OWL. While we did not receive negative responses from participants on the feedback survey, we were concerned about the number of neutral responses that indicate the necessity for more work on usability. Based on the goals of the redesigned OWL—positive feedback from participants—the number of neutral responses on the feedback survey justified a second generation of testing (see below).

Gender-based Conclusions
The site usability test suggested that males and females possess very different searching styles. Specifically, at the start of the site usability test, females required much more time but many fewer mouse clicks than males to locate pieces of information. Males, on the other hand, completed tasks more quickly but needed far more mouse clicks to do so. However, as the test progressed, the differences in male-female searching styles became less pronounced. Both males and females required similar time durations and numbers of mouse clicks to locate information.

In order to refine our data and test our hypotheses developed during the first generation of testing, we revised test materials and procedures and conducted the G2 tests. The following section details the G2 usability test.

Second Generation (G2) OWL Usability Test

This section provides discussion of the need for a second generation test and outlines the methods, setting, participants, usage scenario, and tasks of G2. The section then details the results of G1 and G2 separated into three areas: 1) the OWL redesign; 2) audience-based research (visual, gender, and ESL); 3) the user-centered OWL prototype developed to test G1 hypotheses. Lastly, this section presents our conclusions and recommendations based on G1 and G2. We find that the OWL redesign improves on the original OWL, but that usability problems still exist and should be addressed if the new OWL is to meet Writing Lab goals. We also find that usability testing can work as a method of invention to develop new ideas. Lastly, we find a difference in impression between previous OWL users and new OWL users.

Based on results of G1 and G2 tests, we recommend the following:

- Design OWL links and pages for the types of visitors using the OWL (user-based taxonomy),
- Move the OWL navigation bar from the right side to the left side of the OWL pages,
- Add an OWL search function,
- Incorporate logos in the OWL Family of Sites homepage, and
- Continue usability testing to measure success and stimulate new ideas.

After G1 testing, the OWL Usability Group concluded that more data was needed to provide detailed suggestions for improving the OWL's usability. In addition, the group concluded that minor adjustments to methods and setting would have to be made in order to collect additional data. Therefore, to collect more data on OWL usability, and to help refine our methods, we proposed the G2 usability test. Second-generation testing allowed us to expand our knowledge of OWL usability by adding to our participant pool, and it helped collect data on our initial recommendations: the user-based links, user-based pages, the left-aligned navigation bar, the search function, and the OWL logos. We collected this data using the user-centered OWL prototype, a simple html mock up of the OWL Family of Sites splash page and the OWL. Please note that G2 was not conducted as a second complete and discrete test. Rather, G2 was a continuation of the overall usability testing conducted to provide the OWL with the most accurate and usable information possible.

Methods and Setting
The test methods for G2 mirrored the test methods in G1 with two exceptions: testing the user-centered OWL prototype and test setting. For G2, we used the same demographic collection method and tasks used in G1:

- The demographic survey (always proceeded the following tasks)
- The paper prototype activity (administered in two parts: 1a, 'choose a paper prototype' and 1b, 'create a paper prototype')
- The site usability test (measured time and mouse clicks)
- The OWL feedback survey (always followed the site usability test).

As in G1, we randomly altered the order of the tasks to decrease the chance that participants were influenced by the tasks they completed during the test. For example, some participants completed the paper prototype activities first, while others completed the site usability test first.

For G2, we added four tasks to the site usability test to measure the user-centered OWL prototype. Based on the types of activities participants carried out in G1, each task required participants to find information on the OWL prototype, such as punctuation handouts for K-12 teachers and information on APA format rules. To test the effectiveness of the user-centered changes we proposed based on the G1 test, we asked participants to navigate the OWL prototype. Mirroring the site usability test from G1, we measured the amount and type of information participants found and used on the OWL prototype, and we measured the amount of time and number of mouse clicks it took to access this information. Finally, we asked participants to reflect on their experience in a feedback survey. These procedures are unchanged from first generation testing.

Two key differences distinguish G1 from G2 testing:

1. The first key difference between the G1 site usability test and the G2 test is that participants were asked to assume a fictitious role (the part of a K-12 teacher, parent of a student, or a student from a university other than Purdue) to match the categories of users upon which we based our link taxonomy in the OWL prototype. The second difference was the test setting. For G2, we tested from Monday, July 10, 2006 to Monday July 17, 2006 between 11:00 am and 4:45 pm in Heavilon Hall, room 402. Because we switched test settings, we could not offer participants the choice between a Macintosh and a PC. We randomly assigned participants one or the other.

2. The second key difference between G1 and G2 testing was the creation of new use scenarios with a new user-centered OWL prototype test design. The purpose of G2 was to measure the usability of only a small section of the redesigned OWL Family of Sites: the OWL Family of Sites homepage, the OWL homepage, the links from these pages, and the resource pages and specific handouts participants were asked to find. We did not construct the test to measure and track the usability of the entire OWL Family of Sites.

The participant tasks we used for G2 mirrored the G1 tasks: Task 1a and Task 1b (the paper prototype activities), Task 2 (the site usability test), and Task 3 (the OWL feedback survey). See G1 Methods and Setting above for details. A notable exception to the combined data is, of course, the user-centered OWL prototype. Data collected from this prototype is unique to G2 because it was developed to test recommendations we made based on data from the pilot test and from G1.

Leaders for the usability test were Ph.D. students H. Allen Brizee, Jo Doran, Dana Lynn Driscoll, and Morgan Sousa. Recorders for the usability test included the Ph.D. students listed above as well as Dr. Michael Salvo. For test sessions, leaders described the tasks and led participants through the tasks.

Test leaders followed a script but often added questions based on participants' responses and actions during the tasks. Test leaders explained to participants that test recorders could not answer any questions and that interaction must only occur between test leaders and participants. Test leaders took digital pictures of participants' work to record the results of the paper prototype task.

Demographic Information: G2 Testing
Fourteen test participants were assembled randomly from the Purdue community using a study flyer distributed across campus. Though test leaders and recorders personally interacted with participants, participants' identities (name, contact information, etc.) were protected. For the purposes of data collection, participants' information was identified only by their test number. Participants were given a $10 gift certificate to a local bookstore for their work with the test. In addition, G2 was not constructed to measure and track the behavior of every type of user visiting the OWL. By soliciting for participants on the Purdue campus in the summer months, we knew we would assemble primarily upper level undergraduate or graduate students and staff from Purdue rather than the full range of OWL users.

Age
A total of 14 participants (8 females, 6 males) were tested during G2. Participants had a mean age of 25, with an age range of 19 to 33 (this is comparable to G1 testing, which had a mean age of 24 and an age range of 18 to 46 years old).

Categories
Nine (or 64.3%) of our participants were graduate students, 4 (or 28.6%) were seniors, and 1 (or 7.14%) was a sophomore. This group was much different from our G1 testing demographic, which included 3 freshmen (16.67%). 2 sophomores (11.11%), 3 juniors (16.67%), 5 seniors (27.78%), 3 graduate students (16.67%), and 1 faculty/staff member (5.56%). We attribute the difference in participant educational standing to the differences in testing during the summer months versus testing during the regular school year.

Majors
G2 participants came from a variety of majors, with the largest group coming from the social sciences (5 participants or 36.71%) and technology fields (4 participants or 28.57%). Additional participants came from the sciences (2 participants or 14.29%), education (1 participant or 7.14%), business, and the liberal arts (1 participant or 7.14%).

Computer Proficiency
Fifty-seven percent (57%) of participants reported that they spent 20+ hours on a computer per week. Two (2) participants reported 16 to 20 hours, 1 participant 10 to 15 hours, and 3 participants reported 6 to 10 hours of weekly computer use. Reported computer usage in G2 was higher than that in G1 testing—38.89% of participants (or 7) reported 20+ hours on the computer. Out of 14 G2 participants, 9 (64.29%) "agreed" or "strongly agreed" to being an expert computer user (compared to 50% in G1 testing). Three G2 participants were neutral about being an expert, while an additional 2 self-identified as "non-expert."

Since one purpose of our demographic data collection was to measure total computer knowledge with several overlapping questions, we ran correlations between questions relating to Web design and expert computer usage. A correlation between G2 participants of Web design and expert status reveals only a 58% correlation (compared to G1 testing, which had a 72% correlation). This means that participants in G2 were a bit less likely to consider Web design tied with expert computer use. This could be attributed to the difference in the testing population between G1 and G2 participants.

Primary Hand
Two participants were left-handed; 12 participants reported being right-handed. Right and left handedness did not have a bearing on the results of G2 tests, which mirrored results from G1, where handedness did not have a bearing on results.

Owl Use
Participants were asked to report their knowledge and use of the OWL. Half (7 or 50%) reported that they use OWL yearly. Four participants (28.57%) reported that they use OWL monthly while 2 (14.28%) have never used OWL. One (1) participant (7.14%) did not respond. Comparing this to G1 data, we have a decrease in the number of participants who have never used OWL (7 or 38.89% of G1 participants reported never using OWL). This data highlights differences between the two pools of participants, highlighting distinctions between G2, composed of mostly graduate students, versus a more widely distributed participant pool for G1.

Language and Knowledge About Writing
The G2 participant pool provided a wider range of second language (ESL and L2) participants. Six participants (42.86%) were non-native English speakers while 8 (57.14%) participants spoke English as a first language. G1 testing had only 2 (11.11%) non-native speakers. Increasing the number of ESL students among participants has allowed us to make some comparisons between L1 and L2 capabilities on tasks that we were not able to make with our original G1 data set. More G2 participants as a whole did not consider themselves fluent writers than the pool of test participants for G1. Of our G2 participants, 3 (or 21.43%) responded they were not fluent writers. Only one (1) participant (5.56%) responded s/he was not a fluent writer in G1 testing.

Results of G2
The participant tasks we used for G2 mirrored the G1 tasks: Task 1a and Task 1b (the paper prototype activities), Task 2 (the site usability test), and Task 3 (the OWL feedback survey). See G1 Methods and Setting above for details.

In order to present the Writing Lab with the most complete data and usable information, the sections that follow *combine* our data from G1 with the data from G2, thus providing a clearer picture of the redesigned OWL's usability. A notable exception to the combined data is the user-centered OWL prototype. Data collected from this prototype is unique to G2 because it was developed to test the recommendations we made based on data from the pilot test and from G1.

- The results of the G1 and G2 usability test showed that, for the most part, participants expressed similar suggestions and preferences in the paper prototyping tasks.

As such, most of this section focuses on the additional data gathered for comparison from our new user-based OWL prototype and results based on other important findings from G1.

General Findings: Task 1a, Choose a Paper Prototype and Task 1b, Create a Paper Prototype
Our findings for the paper prototype tests mirror results from G1. These include the following:

- All (100%) G2 participants want a search bar included in the site. In the create-a-paper-prototype task, all fourteen participants included a search bar in their site. Many participants preferred pages that had search bars over those that did not.
- All (100%) G2 participants want a "most popular resources" box on the main page. In the create-a-paper-prototype task, all participants included "most popular resources" somewhere on their page.
- Most of the G2 participants want to see resources broken down by audience. Twelve out of 14 (85.71%) G2 participants included these in their create-a-paper-prototype site.
- A preference for icons combined with text was also prevalent in the G2 testing. In the create-a-paper-prototype task, 50% of our participants (7) included icons with text navigation and descriptions on their pages. The other 50% included text navigation (what the OWL employs currently).
- Participants were also interested in seeing a Frequently Asked Questions box on the main page. Ten of our 14 participants included an FAQ box in their create-a-paper-prototype designs.

In addition to the general findings, several interesting individual preferences arose during testing: 1) participants as visual learners; 2) audience-based information (gender, ESL).

Visual Learning
One female participant, who indicated that she was a visual learner throughout the test, repeatedly mentioned how she only wanted "pictures" and not text descriptions. This participant's preference is interesting because she read the text on the icons when she perceived that text to be an image, and not strictly text alone.

Audience-Based Prototypes
One male participant in Task 1b created new titles for the "resources for…" and "most popular resources" images. He wanted them transformed into search functions—one to search "by category" and one to search "by user title." This request mirrored the recent discussions of the OWL staff about expanding our navigation system to include multiple taxonomies. Figure 8 below is a picture of this participant's Task 1b test result.
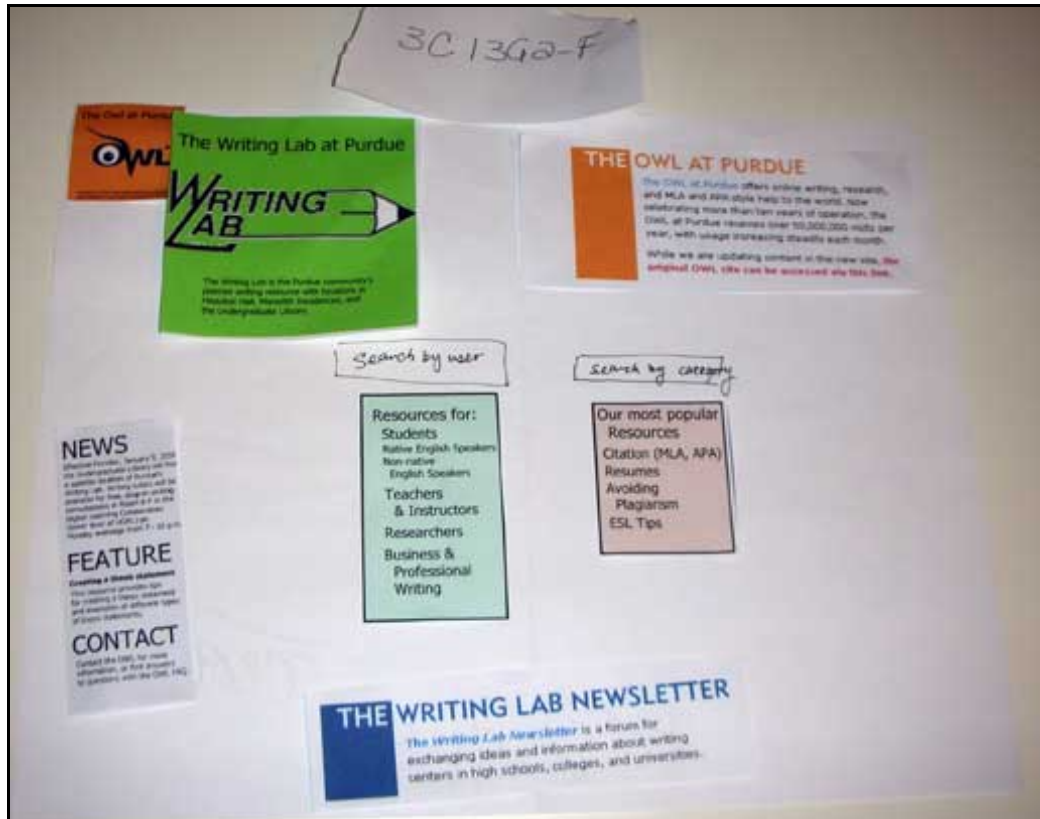
Figure 8, G2 Search by Category, Search by Participant Task 1b

We discuss more on multiple navigation taxonomies in the "OWL Prototype Findings" section below.

Gender-Based Data
Eighteen males and thirteen females (for a total of 31 participants) were enrolled in the G1 and G2 studies. Seventeen males and 13 females had clicks recorded; 15 males and 12 females had times recorded for the task-based analysis.

We find no statistically significant differences between male and female clicks or times. However, descriptive statistics still show some interesting patterns between our male and female participants. The overall click average for male participants was 5.68 clicks per task. Female participants had a click average of 6.37. Females were also higher in their total time on task—118 seconds compared to 109 seconds.

When we break down the data by task, we find males and females had a relatively equal distribution of clicks and times after the first task (see Figures 9 and 10 below). So while females had higher clicks and times on the first task, males had slightly higher clicks and times for the remaining three tasks.

Task Clicks

	Males	Females
Task 1 clicks	7.88	12.62
Task 2 clicks	6	3.46
Task 3 clicks	4.18	3.77
Task 4 clicks	4.89	5.07

Figure 9, G2 Gender-Based Task Mouse Clicks

Task Times

	Males	Females
Task 1 time	178	218
Task 2 time	83	75
Task 3 time	67	61
Task 4 time	120	118

Figure 10, G2 Gender-Based Task Times

User-Centered OWL Prototype
The user-centered OWL prototype usability assessments were designed to test whether the user-based navigation taxonomy would be more beneficial for participants over the redesigned OWL navigation system. We ran two comparison tests (please see Appendix 2, Tests 3a and 3b). Each participant was asked to perform both tests. Ordering was reversed randomly for participants, and participants all completed the same number of questions.

Clicks
Participants had a lower average number of clicks using the user-centered OWL (4.89) than the redesigned OWL (6.09 clicks). We compared groupings or significant differences as a whole and on a per-question basis. No overall significant differences were found for participants. A comparison of the order of questions (comparing question 1-1; 2-2; etc.) produced two results approaching a significant difference (questions 1 and 4). Figure 111 below provides a detailed breakdown of mouse clicks per question (averaged for all participants).

Tasks	Redesigned OWL	OWL Prototype
Task 1	10.15	4
Task 2	4.79	5.43
Task 3	3.5	6.07
Task 4	5.71	4.07

Figure 11, G2 Mouse Clicks Per Person, Redesigned OWL and OWL Prototype

Question three of the prototype test seemed to be difficult for participants. During the prototype task, one participant had clicks that were nearly four standard deviations from the mean. If we remove this participant, the mean prototype clicks for question three becomes 4.15. A second participant had clicks that were two standard deviations from the mean.

If we remove this participant, the clicks become 3.58. While we do not suggest that these two participants' scores are invalid, removing these two outliers allows us to see that even for a question that caused two participants significant difficulty, the prototype performed well for the remaining 12 participants. When we compared the average number of clicks for each participant, we found that out of our 14 participants, 42.86% (6 participants) had fewer clicks with the user-based prototype. Three participants (or 21.46%) had higher amounts of clicks, while 5 participants (37.14%) were within two clicks of each other, and hence, had negligible results either way.

Time
Participants took less time to complete tasks with the user-centered OWL than with the redesigned OWL site. We recorded times for nine of the fourteen participants.

- Time per task for the user-centered OWL averaged 97 seconds.
- Time per task on the redesigned OWL averaged 105.5.

As we mentioned above in the Clicks section, because we have a small number of participants, individual idiosyncrasies can severely distort the data. If we remove participants who have scores four or more standard deviations away from the mean (one score from test a; three scores from test b), the average times become 75.19 seconds for the user-centered OWL and 94.86 seconds for the redesigned OWL. Again, while we are not disregarding the four outlier scores, removing these scores offers us a better understanding of where the 'average' users fall. We compared scores for each individual task.

- We found a significant difference in scores in comparing task 1 results ($p < 0.002$).

The remainder of the tasks did not approach significance. Because of the idiosyncrasies in the data, task 3 and task 4 participants had higher times on the overall tasks. See Figure 12 below:

	Redesigned OWL	**OWL Prototype**
Task 1	176.87	75.14*
Task 2	73.33	71.25
Task 3	56.67	100.56
Task 4	105	123.7

_____
Figure 12, G2 Task Time Scores, Current OWL and OWL Prototype
* Significant at the p <0.002 level

When we compare average times for individual participants, we find that participants overall located information in less time using the user-centered OWL prototype.

- Out of our nine participants who were timed, four (44%) found information in less time.
- Two participants (22%) took longer to find information.
- Three participants' average times on tasks were within 10 seconds of each other, and hence, had negligible results either way.

Feedback Survey

The amount of time and number of clicks represents only part of the participants' experience in navigating the redesigned OWL and the OWL prototype. Participants were also asked to rate each site at the end of their given set of tasks. The following figure provides a list of means based on participants' feedback from the redesigned OWL and OWL prototype tests:

Test	Redesigned OWL	OWL Prototype
Ease of Finding Information	3.31	3.64
Effectiveness of Homepage	3.71	3.93
Accessibility of Information	3.43	3.57
Effectiveness of Organization*	3.29*	4.07*
Effectiveness of Site Navigation	3.71	3.86
Feelings When Finding Information	3.43	3.57
Feelings When Using Site**	3.43**	3.86**

_____

Figure 13, G2 Feedback Survey, Redesigned OWL and OWL Prototype
* Significant at the p < 0.02 level
** Approaching significance

Even though the test data is not entirely favorable for the user-centered OWL prototype, participants still rated their experiences using the prototype more positively as a whole. Organization (which the OWL prototype targeted) was significantly rated higher by participants when it was user-based.

Feedback on the User-Centered OWL Prototype Taxonomy

Much G2 participant feedback mirrored earlier feedback from G1 testing (requests for search bars, visual issues, etc.), although some feedback was specific to the organization and navigation of the site. In general, participants seemed very interested in the hierarchical relationship and organization of the site as well as how site information is described.

Of a total of 8 comments, 27 for the OWL prototype were related to the taxonomy of the navigation system or its naming practices. This list outlines participant feedback on taxonomy:

- "More obvious headings and hierarchies within individual pages."
- "Avoiding Acronyms like EFL/ESL. The navigation links a bit more prominent + organized."
- "Concise design on the main page. Category clarity."
- "User's menu or just "how to use the website" / "help." Online helper."
- "I thought that the organization of the columns and boxes was not very professional looking, but the information was well organized."
- "Adding icons like paper writing help/thesis writing etc…"
- "Highlight the direction. For example. When I looked for: when use words or numbers. I skipped the first sentence (the answer) and looked at the subtitles."

And finally, this comment has a bearing on the redesigned OWL navigational system:

- I like that the info is broken down at the right side of the page but there is so much info put there maybe that could be done differently some how.

User-Centered OWL Prototype
We designed the OWL prototype based on data-driven hypotheses drawn from the pilot test, G1, and user-centered theory. While some participants' time and mouse click scores did not improve, we believe these outliers were anomalies. Overall, the changes we recommended proved effective in reducing the amount of time and the number of mouse clicks participants required to complete tasks. In addition, even though some participants did not respond positively to every question in the OWL prototype feedback survey, we believe negative comments were also anomalies. In fact, most participants reflected favorably on the user-centered OWL prototype. The majority of participants reported that they:
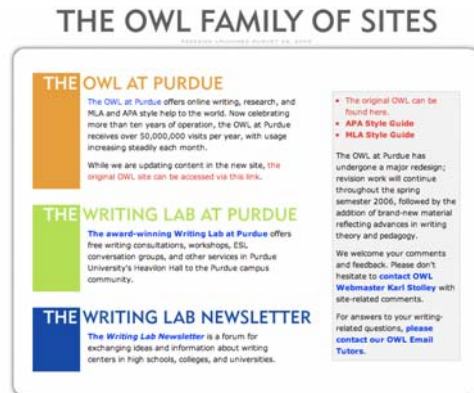
- Found it easy or very easy to find specific information
- Thought the organization of the home page was either effective or very effective
- Thought information was either accessible or very accessible
- Thought the site organization was either effective or very effective
- Thought the site navigation was either accessible or very accessible
- Either knew where they were or knew exactly where they were when looking for information
- Felt either comfortable or very comfortable using the OWL prototype.

User-Centered OWL Design
To test our recommendations (user-based taxonomy, left justified navigation bar, search function, and OWL graphics), we designed the OWL prototype for use during G2. The user-centered OWL prototype incorporated our suggestions and allowed us to collect data that would determine the validity of our recommendations toward improvement of OWL's usability.

Based on combined data from the pilot test, G1, and G2, we believe the user-centered prototype should guide—and form the basis of—future OWL redesigns and improvements. The graphic below shows screenshots of the OWL Family of Sites homepage as it looked during G1 and G2 testing. The graphic also illustrates the changes we made for the OWL Family of Sites prototype.

OWL Family of Sites Screenshot   *User-Centered OWL Family of Sites Screenshot*
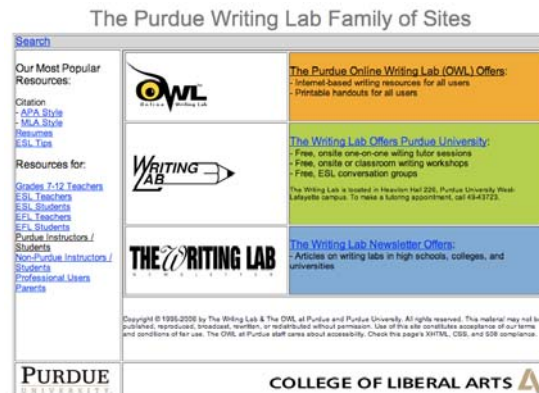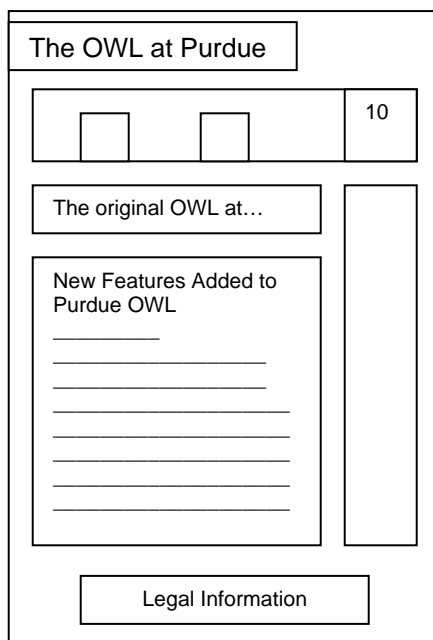

Figure 14, Screenshots: OWL Family of Sites During Testing and OWL Family of Sites Prototype

The following graphic illustrates the layout changes we recommend for the OWL homepage:

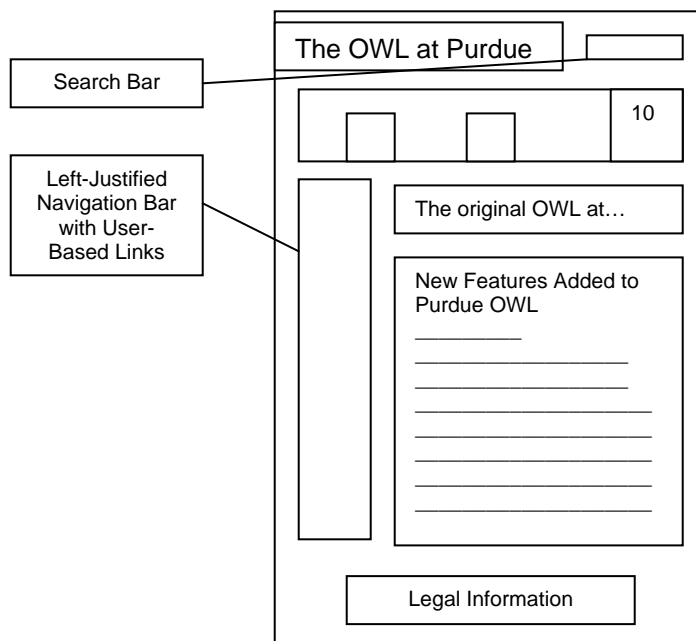*OWL Layout During Testing*   *User-Centered OWL Layout*

Figure 15, OWL Homepage Layout During Testing and Proposed OWL Homepage Layout

The graphic below shows screenshots of the OWL homepage during testing and the changes we made for the OWL homepage prototype:

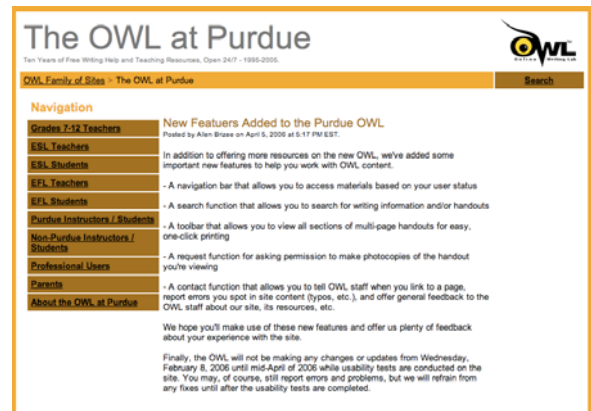*OWL Homepage Screenshot During Testing*   *User-Centered OWL Homepage Screenshot*

Figure 16, Screenshots: OWL Homepage During Testing and Proposed OWL Homepage

The screenshots and outlines above illustrate the user-centered recommendations we proposed based on data collected from the pilot test, G1, and G2. While this section has applied only to the second generation of testing, what this report refers to as G2 Testing, the following section offers conclusions applicable to all the testing that has been conducted thus far on the OWL site. Based on the results of G2, we believe the user-centered OWL prototype performed well during usability testing, and we conclude that the user-based taxonomy for links and pages, as well as the addition of text and logo graphics, was effective.

Conclusion

The results of pilot, G1, and G2 testing show that participants found many OWL updates useful and valuable. However, usability testing also showed that many participants were either indifferent or not happy with elements of the OWL redesign. Time and mouse click data supports these negative impressions. In short, some participants took too much time and too many mouse clicks to complete the tasks OWL users attempt to accomplish every day. If the OWL redesign is to fulfill the goals outlined by the Writing Lab, we recommend designers shift to a more user-centered approach. This approach includes incorporating a user-based taxonomy for links and pages, shifting the navigation bar to the left side of OWL pages, adding a search function, and using text and logos together to help users navigate the Website.

Conclusions formed after G1 testing included in *Preliminary Report to the Purdue Writing Lab* are, for the most part, supported by the additional data gathered from G2 testing. In some cases, G2 data helped expand observations, and in other cases (such as the case of our visual user and our increased ESL users), G2 data provided us new insights into the varied user base.

We concur with most of the suggestions in the preliminary report and have included some additional discussion below. Overall, we find that although the OWL redesign improves on the original OWL, usability problems still exist and should be addressed if the new OWL is to meet Writing Lab goals outlined in the Background section above.

Results of G1 and G2 show that male and female participants, overall, surfed the OWL in a similar manner. In addition, G1 and G2 results show that ESL participants took longer and used more mouse clicks to complete tasks than did native English speakers. However, even though ESL participants required more time and mouse clicks to surf the OWL than native English-speaking users, ESL participants did not reflect as many negative impressions. Also, experiences during testing indicated that usability testing can work as a user-centered method of invention to help designers work on prototypes. Previous and new user impressions of the OWL are markedly different. Participants who were familiar with the old OWL design expressed a clear preference for the new design. Overall, this report concludes that the OWL redesign is a success.

The second generation of testing, especially the results of the user-centered OWL prototype, support the recommendations made after the first generation of testing. The preliminary results after G1 hold up to further empirical inquiry. The prototypes created based on user-centered design principles will create a more accessible, usable OWL and will help fulfill the redesign goals outlined by the Purdue Writing Lab. In addition, we find that participants value information architecture, site navigation, and taxonomy. We believe participants' expressions of positive feelings for the redesign positively supports our recommendations to shift from the organization reflected in the redesigned OWL to a more user-based organization. While users would not likely use such language as *information architecture*, *user-centered design philosophy*, *ease of navigation*, or *improved organizational taxonomy*, these technical terms accurately represent the feelings participants expressed through two generations of usability testing, and offer a clear set of suggestions for the next round of OWL redesign and improvement.

Purdue's OWL is an important and valuable catalogue of writing-related information, and it deserves its devoted following and global reach. These usability conclusions are intended to improve the overall user experience and to retain the interest of returning OWL users as well as to inspire commitment from a savvy group of students, teachers, faculty, and administrators whose expectations are multiplied by use of the web. Purdue has an outstanding brand in the OWL, as demonstrated by its increasingly impressive web statistics. Therefore, this report is intended to maintain and increase the leadership of an outstanding resource.

Following the distinction made by Stuart Blythe, we call attention to the distinction between usability testing and usability research. Further research in the area of ESL and gender-based web-searching preferences is warranted and deserves further development. The sections following explore these and other areas ripe for further research.

ESL Data

Because we had a larger number of ESL participants in G2 testing, we now have enough data to compare ESL speakers with native speakers of English. When combining G1 and G2 data, we have a total of 9 self-identified ESL (L2) speakers and 23 native (L1) speakers of English.

L1 speakers, on average, require both less time and fewer clicks per task than L2 speakers (see Figure 17 below):

	L1	L2
Time	107 sec	145 sec**
Clicks	5.98	6.78

Figure 17, G2 ESL Mouse Clicks and Task Times
** Approaching significance at the $p < 0.05$ level.

When comparing the Likert after-test questionnaire, we find two questions that are approaching a significant difference between L1 and L2 participants. To the question that asked how buried information on the pages was (question #3), native English speaking participants responded with a mean of 4.0 out of 5 while non-native speakers responded with a 4.56 out of 5. Similarly, on the question about how comfortable participants felt while using the site, native English speakers gave a mean answer of 3.54 out of 5 while non-native participants gave it a 3.94 out of 5.

The findings above indicate that even though our non-native speaking participants spent much more time clicking and searching through the site than their native-speaking counterparts, they rated the site more favorably than native speakers who found information faster.

It is unclear why our non-native speakers rated the site higher than our native speakers, although we suspect that native speakers and non-native speakers both begin with different expectations in their web searching and also value their experiences differently.

Results Based on Gender

The data gathered during G1 suggests that the male and female participants possessed different searching styles. Specifically, females, at the beginning of the test, required more time and fewer mouse clicks to locate pieces of information within the OWL. Males, on the other hand, needed less time but clicked more frequently than females. As the site usability test progressed, these gender-based searching styles diminished, leaving very little variation between the ways that males and females participants searched for information. However, the data collected during G2 does not support the hypothesis formed after G1. The G2 data, coupled with the data from G1, suggests that the earlier hypothesis was simply a result of an idiosyncrasy in the first group of female participants. The G2 data, with a more balanced male-to-female ratio, reveals that no notable gender-based variations exist.

In our G1 results, we found that females and males had different responses based on the type of question we asked. Questions about evaluating the site were ranked equally or higher by female participants, while questions asking about feelings were ranked lower.

Males had a much wider range of responses for both types of questions. This finding contradicts existing research on the subject. The work of Manuel J. Sanchez-Franco (2006) acknowledges that females typically rate their computer "self-efficacy" lower than males.

Additionally, Chin-Chung Tsai and Chia-Ching Lin (2004) reveal that males expressed considerably more positive attitudes than females on the aspects of usefulness and perceived control of the Internet. Further, research in the areas of gender and communication technology by Agnetha Broos (2005) confirms that men generally have more positive attitudes toward the Internet and experience lower levels of anxiety associated with computers and the Internet than women. Moreover, while men experience decreasing levels of computer anxiety associated with computer experience, women do not.

New findings surface when combining the G1 participants with G2 participants:

- Significant difference (p<0.03) in the question, "How did you feel when using the site" with female participants feeling significantly less comfortable (mean 3.17) than our male participants (mean 3.83).
- Our second "feeling" question was approaching a significant difference between the two groups.

This confirms our earlier finding that females feel less comfortable on the site overall. The work of Justine Cassell (2003) locates the origin of this difference in comfort level to childhood usage patterns of boys and girls. Even as kindergarteners, boys and girls judge the computer to be a boy's toy. This perception amplifies as children grow. By early junior high school, heavy users of computers are boys, by a rate of 4 to 1. In addition, by the time children reach third grade, boys are using the computer for exploratory purposes—for recreation or to program (Cassell 403, Marcus 454). Girls, on the other hand, view the computer as a tool to accomplish a task.

Men, or boys, even at early ages, are much more comfortable navigating and managing unfamiliar spaces than girls, who access the computer for a very specific purpose. Similar perceptions exist in adults. Further, Sanchez-Franco (2006) reveals that female perceptions of usefulness of the computer of the Web do not increase behavioral intention toward them. Males' perceived usefulness, on the other hand, contributed more substantially than female participants. Though we originally found a significant difference between male and female participants concerning the accessibility of information, that difference is not longer statistically significant with the combined results of G1 and G2. The following figure illustrates the mean responses for questions 1-7 from G1 and G2 testing, separated by gender.

Questions	Females	Males
Overall difficulty of finding specific information	3.33	3.63
Effectiveness of the organization of the home page	3.66	3.9
Accessibility of information	3.25	3.7
Effectiveness of site organization	3.33	3.9
Accessibility of site navigation	3.58	4.05
How participants felt when looking for information (lost – oriented)	3	3.7
How participants felt when using the site (confused – comfortable)*	3.17	3.83

Figure 18, G2 Feedback Survey Means: Females and Males

Unlike the G1 testing, where there was a difference in participant evaluation and feeling, our combined results show that males rate the site higher overall, half to almost a full point higher. The differences in the range of scores are less pronounced in our G2 population than in G1's, with men and women both having larger ranges of scores. We believe this difference in the ranges of answers in the two tests is a result of the differences in population for the first- and second-generation tests.

Recommendations
After conducting three usability tests on the OWL redesign (the pilot study, G1 and G2), we recommend the following:

1. Design links and pages for the types of visitors using the OWL (user-based taxonomy)
2. Move the navigation bar from the right side to the left side of the OWL pages
3. Add a search function
4. Incorporate logos in the OWL Family of Sites homepage
5. Continue testing to measure usability and to generate new ideas for design and content.

Broader Implications and Further Research
Usability testing can serve multiple purposes for writing centers and their online counterparts. First, usability testing can provide systematic and specific feedback for writing center and OWL operations, which contributes to the continuing improvement of those operations. Second, usability testing leads to exciting research opportunities and research questions while maintaining a balance of power and potential gains between participants and researchers. Finally, usability testing provides unique opportunities for collaboration with individuals in multiple disciplines and research experience for students.

Writing centers and online writing labs can benefit from usability research. Our findings have provided a clear trajectory for revision of the Purdue OWL rooted in research. Blythe (1998) states usability methods can offer writing labs avenues for critical reflection and can generate data useful for reporting to administration, for scholarly publication, and for the incorporation of student and tutor voices into decision-making processes about writing labs and OWLs. Usability is a type of research, and although it may be more practical than other types of basic research, scholarly questions can still be asked and answered throughout its duration.

Interaction with participants and findings can lead to new questions and research ideas while avoiding the ethical pitfalls that are a major concern in our discipline. For example, in their introduction to *Ethics and Representation in Qualitative Studies of Literacy* Peter Mortensen and Gesa Kirsch (1996) ask the following questions of research: "Who benefits from the research? Whose interests are at stake? What are the consequences for the participants?" (xxi). Usability studies and participatory design circumvent potential ethical issues by providing direct benefits in the form of more usable services and products for research participants.

Usability testing can also provide another type of benefit through its collaborative nature. In our own testing, writing center personnel worked with research methods specialists and professional writing experts to design and administer the test and to analyze the results. Collaboration between professional writing faculty, writing center administrators, graduate students, and undergraduate professional writing students fostered an educational atmosphere while invigorating professionalization.

Online writing labs are continually evolving with the development of new technologies and processes. Usability testing ensures that writing labs and online writing labs keep pace with these changes and continue to address the needs of users, lab staff, faculty, as well as undergraduate and graduate researchers. We hope that this project and its findings will form a framework of continuing research on Internet-based usability that will ensure premium services for the large number of visitors to online writing labs. We also hope this work will serve as a beacon for other online writing resources and a guide for research on Web-based resource usability and access.

If you have any questions, please contact us at the following email addresses: Dr. Michael Salvo (salvo@purdue.edu); H. Allen Brizee (hbrizee@purdue.edu); Dana Lynn Driscoll (adriayna@yahoo.com); Morgan Sousa (msousa@purdue.edu).

Works Cited

Blythe, Stuart. "Conceptualizing the Technologies of Writing Center Practice." Diss. Purdue University, 1997.

Blythe, Stuart. "Wiring a Usable Center: Usability Research and Writing Center Practice." *Wiring the Writing Center*. Utah: Utah UP: 1998: 103-118.

Broos, Agnetha. "Gender and Information and Communication Technologies (ICT) Anxiety: Male Self-Assurance and Female Hesitation." *Cyber Psychology & Behavior* 8.1 (2005): 21-31.

Cassell, Justine. "Genderizing Human-Computer Interaction." *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Ed. Julie A. Jacko and Andrew Sears. New Jersey: Lawrence-Erlbaum Associates, Publishers, 2003. 401-412.

Coe, Marlana. *Human Factors for Technical Communicators*. New York: John Wiley & Sons, Inc, 1996.

Dumas, Joseph S., and Janice C. Redish. *A Practical Guide to Usability Testing*. Portland: Intellect Books, 1999.

Ehn, Pelle. "Scandinavian design: On Participation and Skill." *Usability: Turning Technologies into Tools*. Ed. Paul S. Adler and Terry A. Winograd. New York: Oxford University Press, 1992: 96-132.

Harris, Muriel. "Collaboration Is Not Collaboration Is Not Collaboration: Writing Center Tutorials vs. Peer Response Groups." *College Composition and Communication* 43 (1992): 369-83.

International Writing Centers Association (IWCA). 20 July 2006. <http://writingcenters.org/>.Jeffrey, Rubin. *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests*. New York: John Wiley & Sons, 1994.

Johnson, Robert R. *User-centered Technology: A Rhetorical Theory for Computers and Other Mundane Artifacts*. Albany: State University of New York Press, 1998.

Kirsch, G and Mortensen, P., eds (1996). *Ethics and Representation in Qualitative Studies of Literacy*. NCTE. XXI.

Latour, Bruno. *Aramis or The Love of Technology*. Trans. Catherine Porter. Cambridge: Harvard University Press, 1999.

United States Congress. Library of Congress. *Library of Congress Website*. Feb. 6 , 2006. Feb. 7, 2006 <http://www.loc.gov/index.html>.

Lundsford, Andrea. "Collaboration, Control, and the Idea of a Writing Center." *The Writing Center Journal* 12.1 (1991).

Marcus, Aaron. "Global and Intercultural User-Interface Design." *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Ed. Julie A. Jacko and Andrew Sears. New Jersey: Lawrence-Erlbaum Associates, Publishers, 2003. 441-463.

North, Stephen. "The Idea of a Writing Center." *College English* 46 (1984): 433-446.

Purdue OWL Family of Sites. 26 August 2005. Department of English, Purdue University, West Lafyaette, IN. 7 February 2006 http://owl.english.purdue.edu/.

Sanchez-Franco, Manuel J. "Exploring the influence of gender on the web usage via partial least squares." Behaviour & Information technology 25.1 (Jan.-Feb. 2006): 19-36.

Spinuzzi, Clay. *Tracing Genres Through Organization: A Sociocultural Approach to Information Design*. Cambridge: The MIT Press, 2003.

Sullivan, Patricia, and James E. Porter. *Opening Spaces: Writing Technologies and Critical Research Practices*. Greenwich, CT: Ablex Publishing Corporation, 1997.

Trenner, Leslie and Joanna Bawa, ed. *The Politics of Usability: A Practical Guide to Designing Usable Systems in Industry*. Springer-Verlag, 1998.

Tsai, Chin-Chung and Chia-Ching Lin. "Taiwanese Adolescents' Perceptions and Attitudes Regarding the Internet: Exploring Gender Differences." Adolescence 39.156 (Winter 2004): 725-734.

Annotated Bibliography

Blythe, Stuart. "Conceptualizing the Technologies of Writing Center Practice." Diss. Purdue University, 1997.

The author, as a Ph.D. student in rhetoric and composition at Purdue University, offers a set of strategies and principles that propose a theoretically informed set of guidelines for the implementation of networked computer technologies in writing centers in particular, and for writing instruction in general. The dissertation includes a study of Purdue's Online Writing Lab.

Blythe, Stuart. "Wiring a Usable Center: Usability Research and Writing Center Practice." *Wiring the Writing Center*. Ed. Eric Hobson. Logan, UT: Utah State University Press, 1998. 103-118.

The author discusses usability research methods and how they reflect critically upon the interaction between users, environments, etc., by helping the reader to observe and evaluate tutorial interaction mediated by networked computers.

Broos, Agnetha. "Gender and Information and Communication Technologies (ICT) Anxiety: Male Self-Assurance and Female Hesitation." *Cyber Psychology & Behavior* 8.1 (2005): 21-31.

The article presents the results of a qualitative study examining gender differences in Information and Communication Technologies (ICT) anxiety levels. Results of the study show that females had more negative attitudes toward computers and the Internet than men. Additionally, men reported lower feelings of computer anxiety than did females. Further, while computer experience decreased computer anxiety for men, the same effect was not found in women.

Cassell, Justine. "Genderizing Human-Computer Interaction." *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Ed. Julie A. Jacko and Andrew Sears. New Jersey: Lawrence-Erlbaum Associates, Publishers, 2003. 401-412.

The author examines the differences in gendered use and perception of computers and the Internet. Cassell interviewed males and females ranging in age from kindergarten to high school. She determined that kindergarteners of both genders perceive the computer to be a boy's toy. As a result, more boys use the computer for longer periods and time and for more exploratory purposes (surfing, designing, gaming).

Coe, Marlana. *Human Factors for Technical Communicators*. New York: John Wiley & Sons, Inc, 1996.

> The author, an instructor of technical writing, technical editing, human factors and SGML at UCLA, explains human factors in easily understandable terms and shows the reader how to apply these concepts to create technical communication products. The book includes the psychology and physiology of how users access, learn, and remember information. The text also discusses the impact of colors, shapes and patterns, learning styles, and approaches and obstacles to problem solving, as well as information on action structures.

Dumas, Joseph S., and Janice C. Redish. *A Practical Guide to Usability Testing*. Portland: Intellect Books, 1999.

> The authors present a scholarly and useful how-to book based in the tradition of document design and visual rhetoric. Dumas and Redish explain usability and techniques for assessing and assuring usability; they outline steps for planning and conducting a usability test; and they explain data analysis and how testing can improve products and processes.

Ehn, Pelle. "Scandinavian design: On Participation and Skill." *Usability: Turning Technologies into Tools*. Ed. Paul S. Adler and Terry A. Winograd. New York: Oxford University Press, 1992: 96-132.

> The author, known as the grandfather of user-centered design, discusses the Scandinavian approach to systems design, also called a work-oriented design approach. This approach explains maintains that democratic participation and skill enhancement, not just productivity and product quality, are themselves objectives of design. The text includes the trade-union-oriented democracy approach to skill and participation, the role of skill and participation in design as a practical activity, and the philosophical foundation for a skill-based participatory design based on the language-game philosophy of Ludwig Wittgenstein.

Jeffrey, Rubin. *Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests*. New York: John Wiley & Sons, 1994.

> The author provides readers with easy to understand step-by-step guidelines, proven testing tools, and techniques for usability testing. The text includes sample templates, models, tables, and test plans.

Johnson, Robert R. *User-centered Technology: A Rhetorical Theory for Computers and Other Mundane Artifacts*. Albany: State University of New York Press, 1998.

> The author, a Purdue University graduate who situated usability in the history of rhetoric and writing programs, explains the rhetoric of user-centered design and presents a theoretical model for examining technology through a user perspective.

He begins with a historical overview of the problem of technological use, and he elaborates on user-centered theory by defining three focal issues of the theory: user knowledge, human-technology interaction, and technological determinism. Johnson then applies user-centered theory in both the nonacademic and academic spheres.

Latour, Bruno. *Aramis or The Love of Technology*. Trans. Catherine Porter. Cambridge: Harvard University Press, 1999.

The author, a professor at the Institute of Political Studies of Paris, explores the circumstances surrounding the development and subsequent demise of Aramis, a public transportation system developed in Paris, France, during the 1970s and 1980s. Aramis is aimed at training readers in the field of technology studies and at experimenting in new literary forms that treat technology as living things. The non-traditional narrative is told from varying points of view, including the transport system itself, Aramis.

Marcus, Aaron. "Global and Intercultural User-Interface Design." *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Ed. Julie A. Jacko and Andrew Sears. New Jersey: Lawrence-Erlbaum Associates, Publishers, 2003. 441-463.

The author examines gendered differences in computer usage patterns. The results of this study suggest that boys are much more comfortable operating computers and the Internet than women. Also, it suggests that women experience higher levels of anxiety associated with web use.

Sanchez-Franco, Manuel J. "Exploring the influence of gender on the web usage via partial least squares." Behaviour & Information technology 25.1 (Jan.-Feb. 2006): 19-36.

The author analyzes the web acceptance and usage rates of males and females. Gender differences are examined in relation to how they impact the acceptance and use of males and females. The author uses partial least-squares (PLS) to estimate the parameters of the proposed models.

Spinuzzi, Clay. *Tracing Genres Through Organization: A Sociocultural Approach to Information Design*. Cambridge: The MIT Press, 2003.

The author, Assistant Professor of Rhetoric at the University of Texas in Austin, examines the everyday improvisations by workers who write notes, jot down ideas, and read aloud from an officially designed texts. The author argues that the traditional user-centered approach to design does not take into consideration these unofficial genres appearing in the workplace. Spinuzzi asserts that when these innovations are recognized for what they are, they can be studied to develop solutions to usability issues.

Sullivan, Patricia, and James E. Porter. *Opening Spaces: Writing Technologies and Critical Research Practices*. Greenwich, CT: Ablex Publishing Corporation, 1997.

>   The authors, a Director of Rhetoric and Composition at Purdue University and a Professor of Writing, Rhetoric, and American Cultures at Michigan State University, argue for a "postcritical research methodology" and apply this frame to the study of computers and writing. The text explores postmodern research methodologies and outlines strategies and procedures for application. The authors argue for an overlapping relationship between and critical awareness of methodology, practice, and pedagogy, forming a *praxis*.

Trenner, Leslie and Joanna Bawa, ed. *The Politics of Usability: A Practical Guide to Designing Usable Systems in Industry*. Springer-Verlag, 1998.

>   The editors look at situating usability within institutional workplace cultures. Trenner and Bawa explain the process of starting and running a usability group and discuss ways to manage usability once the project is underway. The text explains how and why usability should work within an organization.

Tsai, Chin-Chung and Chia-Ching Lin. "Taiwanese Adolescents' Perceptions and Attitudes Regarding the Internet: Exploring Gender Differences." Adolescence 39.156 (Winter 2004): 725-734.

>   The authors explored adolescent male and female perceptions and attitudes regarding the Internet. They collected data from 636 high school students in Taiwan. Their data suggests that males perceive the Internet as a toy, while females perceived the Internet as a technology or tool to accomplish a task. Perhaps expectedly, men believed they could obtain enjoyment from the Internet, while women held more pragmatic views of the Internet. Additionally, males expressed significantly more positive attitudes regarding their perceived usefulness for and control over the Internet.