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Writing Centers and Students with Disabilities: the User-Centered Approach, Participatory Design, and Empirical Research as Collaborative Methodologies

(9,297 words)

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Abstract

This article discusses issues of accessibility and how user-centered and participatory approaches can inform empirical research to guide the Universal Design of virtual spaces and influence writing center efforts for students with disabilities. Because this article describes how to integrate usability/accessibility testing for online and in-person services, it can work as a model for writing centers struggling with the challenges of serving students with disabilities. Toward this end, the article discusses two generations of usability testing on a large, well-established online writing lab (the Purdue OWL), as well as the collaborative projects that emerged between the usability team and campus disabilities services as a result of this testing. The article concludes with heuristics and generative questions that may assist readers in developing similar projects tailored to their own contexts.

Keywords: Online Writing Lab (OWL); Writing center; Writing lab; User-centered design; Students with disabilities; Accessibility; Usability; User-testing; Participatory design; Collaboration; Universal design; Empirical research

“I was actually looking forward to it [the usability testing] on the very first day because I knew that . . . it [the Purdue OWL] is an important resource and I’d like to get it made more accessible for me. I like the experience [and] . . . wanted to have my views heard.”

—Participant Interview from Usability/Accessibility Testing on the Purdue OWL

Introduction

Each year, thousands of students with disabilities attend institutions of higher education (Gardner, 2000, Lauffer, 2000). Some of these students disclose their needs, while others navigate college with little or no support. Writing centers and other campus services often struggle to help these students, but specific methods of assistance continue to fuel administrative and pedagogical debates. For a number of years, writing center administrators and tutors have discussed these challenges, as evidenced by the large amount of anecdotal scholarship published on this issue¹. In her recent chapter from *Disability and the Teaching of Writing*, Rebecca Day Babcock (2008) states, however, that more empirical work is needed in writing center studies to fulfill the needs of students with disabilities (p. 28); she offers her own study as an example of how researchers might conduct similar work and begin forming a set of best practices. Other scholars in the field, namely Paula Gillespie (2002), Neal Lerner (2009), and Isabelle Thompson (2009), have echoed Babcock’s call for more empirical research on all practices relating to writing centers.

This article responds to these calls for more empirical work in writing centers, and specifically it answers Babcock’s call for more research in “technological options” for assisting students with disabilities (p. 38). This piece also follows up on the *Computers and Composition* article, “Usability research in the writing lab: Sustaining discourse and pedagogy” (2009), which describes the rhetorical theories underpinning the most recent Purdue OWL² redesign from 2005-2010. Furthermore, this article builds on the book chapter, “Usability research and user-centered theory for 21st century OWLs” (2008), which explains the first two generations of usability testing on the Purdue OWL.

This article describes the final two generations of usability research on the Purdue OWL, during which researchers worked with blind and low-vision participants to test the accessibility of the Purdue OWL and learn about these participants’ literacy practices. The article demonstrates how the rhetorical theories outlined in “Usability research in the writing lab” helped guide the Purdue OWL usability testing. It also describes the collaboration that occurred between our writing center and two programs established to assist students with disabilities at Purdue University. The article interweaves rhetorical theories and user-centered and participatory design with empirical

¹ See David Brainard (1993), Shoshana Konstant (1992), Anne E. Mullin (1994), Julie Neff (1994), Leone Scanlan (1985), Steve Sherwood (1996).

² The URL of the Purdue OWL is <http://owl.english.purdue.edu/owl/>.

research to demonstrate how discursive invention can help writing center staff collaborate and use technology to assist students with disabilities. In doing so, we echo an argument made by Jean Kiedaisch and Sue Dinitz (2007) in their article on Universal Design (UD): writing center staff can develop services that benefit all students by composing programs and materials that are universally accessible.

We suggest that rhetorically informed user-centered and participatory design can help writing center staff conduct smarter research, build bridges between institutional organizations, and pedagogies that better serve all students who use writing centers. We believe that these methods may help writing center staff “listen” to and help students empower themselves. Our hope is that readers interested in computers and composition, writing centers, disability studies, and accessibility will use this information to develop similar approaches within their own programs.

The User-Centered Approach, Participatory Design, and Issues of Accessibility

Writing centers often struggle to provide assistance for the large number of students coming through their doors. They also struggle to provide adequate training for tutors who work with students with disabilities, especially as funding decreases and campus populations increase. The Purdue University Writing Lab is no exception. Rather than drastically scaling back services, however, administrators and staff took a different approach.

To better focus our efforts on the specific needs of our students and to build bridges with other organizations within the university, we integrated two methodologies into our work: the user-centered approach and participatory design. By integrating the user-centered approach, we were able to better understand what lab visitors in our physical space and Purdue OWL users in our virtual space wanted most. By integrating participatory design, we were able to develop resources for the lab and the Purdue OWL with users so that designers’ efforts were not misdirected. In this case, the Purdue Writing Lab administrators found value in strategies that also address tutor training issues while building bridges between institutional organizations and contributing to pedagogy.

Writing centers can play a valuable role in students’ transitions from their high school writing experiences to the different expectations of college writing—from first-year composition courses, to advanced undergraduate lab reports, to graduate-level CVs or research articles for refereed journals. While many students struggle through writing challenges alone, students with disabilities—physical, learning, or both—face additional challenges that often require assistance from writing centers (Wong, 1996, p. 15). Furthermore, feedback obtained during the third generation of usability tests on the Purdue OWL shows that users with disabilities, in larger numbers than we anticipated, access the OWL to help them write. To help address these needs, we looked to Jay W. Rojewski (1992) who describes seven components that “model” programs maintain to help students with disabilities transition from high school to college-level settings. Three of these approaches directly relate to writing center work: academic support systems, individualized planning, and follow-up services.

Given the important role that writing centers play in the education of all students, but especially students with disabilities, administrators must be able to understand users' needs so that they can build comprehensive programs with other campus organizations. The user-centered approach and participatory design discussed here will assist administrators in working with campus organizations to develop the academic support systems, individualized planning, and follow-up services described by Rojewski.

What is the User-Centered Approach and Participatory Design?

The term *user-centered* has existed in our computer-technology vocabulary for about twenty years and has begun permeating other fields, perhaps most notably, writing, design, and writing program administration. Researchers such as Stephen Draper, Robert Johnson, Jakob Nielsen, and Donald Norman have helped to define and clarify this term and others related to it.

In brief, the user-centered approach holds that regardless of the technology being developed (websites or even writing centers), designers must investigate users' needs and expectations. In *User-Centered System Design*, Norman and Draper (1986) identify the emphasis of their book as "people, rather than technology," though the limits of machines "are considered in order to know how to take that next step from today's limited machines toward more user-centered ones" (p. 2). Additionally, they use the word "pluralistic" to describe the interdisciplinary nature of user-centered design (p. 2). Johnson, in *User-centered Technology*, uses Norman and Draper's definition as a starting point and argues for the expertise of the user, over and above the expertise of the designer or engineer. Johnson originates user-centered design in classical rhetoric, arguing that the Greeks "treated technology as an *art* whose *end* was the *use* of a product, not in the design or making of the product itself" and that "the user is contextualized, recognized as residing in a situation of use where a special knowledge—the knowledge that users bring to interactions with technological artifacts—is championed" (p. 13).

Participatory design, on the other hand, is a term that refers to a design methodology involving users and their feedback in the production process. Expanding on the Scandinavian manufacturing and computer design methods developed by Pelle Ehn (1992), Johnson (1998) states that the aim of participatory design researchers "is to broaden the perspective we have of what computers are and how they are used . . . participatory designers are interested in the social, political, cognitive, and practical facets of computer usage" (p. 83). And according to *Computer Professionals for Social Responsibility* (2008), participatory design is an approach to the assessment, design, and development of technological and organizational systems that places a premium on the active involvement of practitioners in design and decision-making processes.

Based on these descriptions, it is probably clear why a close connection exists between the user-centered approach, participatory design, and writing center work because students, as part of the "user" base, heavily influence programmatic efforts. Consequently, user-centered and participatory methods have guided usability research on the Purdue OWL.

What is Accessibility and Universal Design?

The word accessibility invokes different connotations across different disciplines. For our work, the requirements of accessibility have included a variety of considerations because the Purdue OWL staff helps design the user interface and content for our OWL, an online literacy resource accessed by millions of people around the globe³. Therefore, it was critical for the Purdue OWL usability team to investigate the numbers of blind and low-vision users as we worked to improve online resources. Some of our more important findings include the following from Theofanos and Redish (2005):

- “Worldwide, 180 million people are blind or visually impaired” (World Health Organization, 2001)
- “7.7 million individuals who have blindness or low-vision live in America” (U.S. Department of the Census, 1997)
- “About half [of this population] (3.4 million) are aged 40 and over—one million blind people and 2.4 million visually impaired people . . . the National Eye Institute expects the 2.4 million number to double within the next three decades as the baby boomer generation ages” (National Eye Institute, 2002)

Scholars’ recognition of the expanding blind and low-vision Internet user base indicated that improvements to the Purdue OWL involving blind and low vision users would help all our users, as indicated by scholarship in UD.

The principles of UD are closely linked to those of accessibility: UD theory holds that any improvements made to an OWL or a writing center to accommodate persons with disabilities are likely to increase the usability and accessibility of resources for all users. The Center for Universal Design (2008) describes the theory in this way: “The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities” (para 1). Importantly, usability experts have noted that website revisions addressing accessibility positively affect other users’ experience with the sites, falling in line with UD: “Increasingly, technical communicators are providing ‘curb cuts’ on the Information Highway by incorporating a variety of existing design/accessibility initiatives. Universal design and human factors engineering, which is intended to accommodate all users, show great promise for assisting elderly users” (O’Hara). Moreover, Kiedaisch and Dinitz (2007) make the connection between UD and writing centers, arguing that applying the principles of UD to writing center spaces and pedagogy ensures an equitable, accommodating environment.

It is important to note that the term “electronic curb cut” (used above) refers to an electronic equivalent of the U.S. curb cut mandate to assist people with physical disabilities in navigating streets and sidewalks. Although curb cuts help people with disabilities, the majority of users assisted by curb cuts are people without disabilities: mothers with strollers, bikers, in-line

³ Our Writing Lab also considers the accessibility of physical spaces, such as uncarpeted floors and tables set far enough apart to accommodate wheelchairs.

skaters, the elderly, etc. (Kinash, 2004, p. 6). Many scholars assert that if pedagogues compose truly accessible resources, they will create more usable situations that promote learning for everyone, in physical as well as in learning situations: “Easy-to-read content benefits all learners by ‘chunking’ the information into blocks of important information that can be easily read and understood by any audience” (Opitz 2002, qtd. in Kinash, 2004, p. 6). Similarly, we found that the electronic curb cut/UD approach to revising online resources helps the accessibility and usability of the OWL for all its users.

Disability and the World Wide Web

For the purposes of our research, we employed Lennard J. Davis’ (2008) definition of impairment and disability in his article “Crips strike back: The rise of disability studies.” He argues that an impairment is the decreased or full loss of vision, mobility, mental capacities, hearing; an impairment becomes a disability only when societal barriers prevent a person with impairments from fully functioning in everyday life. Barriers come in many forms, some of the more obvious being physical or architectural (no ramps, no elevators, narrow hallways that prevent wheelchair access). Essentially, a physical barrier is one that prevents physical access through its very design.

If we translate this “physical” barrier to the World Wide Web, we find that virtual barriers are pages that are inaccessible to individuals with impairments. For example, if a website uses images for the title and navigation of the site (a common practice) and fails to include text-based titles, alt-tags, and navigation in the HTML code, a person who is blind and using a screen reader will not be able to access the title and navigation of that site. Therefore, part (or all) of the site is considered inaccessible, and an impairment becomes a disability.

A good deal of scholarship exists on website accessibility/usability and users with disabilities, but some of the most important that guided our work was Jakob Nielsen’s. In “Beyond accessibility: Treating users with disabilities as people” Nielsen (2005) describes a study conducted by the Nielsen Norman Group that asked 104 users to test nineteen major websites from the U.S. and Japan. Eighty-four of those users were blind or visually impaired. Twenty users with unimpaired vision were used as a control group. The Nielsen Norman group found that Web usability for task completion is three times faster for users without disabilities. Based on these findings, Nielsen stresses the need to consider accessibility as something more than simply following regulations (as many of his tested sites did) but by eliminating discriminatory practices on the Web. This point was especially important for the OWL usability project as we moved into research and testing with participants with blindness and low vision guided by Section 508 and World Wide Web Consortium (W3C) requirements.

While the Purdue OWL is not bound by law to provide access for users who are impaired, Section 508 of the 1998 Rehabilitation Act also served as a powerful guide during the design of a

more accessible OWL. Section 508 requires that Federal agencies' websites and technology be accessible to people with disabilities. Section 508 does not specify that non-Federal sites be accessible, but because we were following a user-centered and participatory design approach, we felt strongly that we should follow these guidelines and the guidelines outlined by the W3C, the organizations that "develops interoperable technologies (specifications, guidelines, software, and tools)." The W3C guidelines for accessibility are the standard for web development today, and we tried to incorporate these standards as we moved into the final stages of testing when we emerged from test generations one and two.

Usability Test Generations One and Two (G1 and G2): A Summary

This section reviews the theories outlined in 2009 article, "Usability research in the writing lab," published in *Computers and Composition* (26.2) and the methods and results described in the 2008 book chapter, "Usability research and user-centered theory for 21st century OWLs."

Theories Driving Usability Research

From its earliest days, a user-centered and participatory approach has guided the Purdue Writing Lab and its OWL; this collaborative work model is strongly influenced by Purdue's land-grant university mission, and more recently by the work of Blythe in his 1998 article, "Wiring a usable center: Usability research and writing center practice." The Purdue Writing Lab collects students' feedback about their experiences during tutorials, and the Purdue OWL maintains a number of methods for users to communicate their needs. This user feedback plays an important role in the decision-making processes for both Purdue Writing Lab and OWL practice. Building on these discursive work flow methods, the most current Purdue OWL redesign efforts (begun in 2005 and completed in 2010) highlight how user-centered and participatory theories model strategies for rhetorical invention, collaboration, and empirical research involving stakeholders in the Writing Lab and from other programs at Purdue.

In "Usability research in the writing lab," Salvo et al. (2009) explain how collaborative usability research acted as a method of rhetorical invention for work on the Purdue OWL. The authors state that collaborative usability research "contributes both to long-term sustainability of technological artifacts as well as the discursive interactions among stakeholders whose work supports these artifacts" (p. 107). The authors, all collaborators involved with the Purdue OWL, offer narratives of their experiences through a rhetorical lens informed by Debra Hawhee's (2002) "Kairotic encounters," where "'invention-in-the-middle' constitutes a contemporary usage of kairos as an invention heuristic" (p. 108).

Considered in this way and used as a work model, usability research moves from a process that helps ensure product success to a method of collaborative, discursive interaction between stakeholders whose roles, needs, and expectations may all be different. Salvo et al. argue that usability research, or invention-in-the-middle,

supports Patricia Sullivan’s (1989) call for taking a broader view of usability as research and not mere testing by situating the OWL usability project *vis-à-vis* the landscape of a rich body of usability research (p. 257). Further, it extends and complicates her rationale for a broader conception of usability by encouraging reflective conversations among both current and previous stakeholders in the techno-rhetorical contact zone. (p. 108)

This discursive, collaborative approach provided a model for stakeholders coming from different institutional contexts (professional writing faculty, graduate students in rhetoric and composition, writing center administrators) to work together on the Purdue OWL. Ultimately, Salvo et al. argue that it is a blend of “technical know-how” and “effective dialogic relationships among stakeholders on the team” that nurtured the successful relationships necessary to ensure that the Purdue OWL fulfills users’ needs and expectations (p.108). Informed by this flexible, discursive, and collaborative model, the first two generations of usability testing began on the Purdue OWL.

Increasing Usability and Accessibility

The Purdue OWL, prior to Karl Stolley’s redesign, was not Section 508 or W3C compliant. These accessibility limitations drove Stolley’s initial Purdue OWL redesign in the summer and fall of 2005, which then culminated in the Purdue OWL Usability Project. This project encompassed four generations of usability testing, the first two testing for usability, and the last two for usability and accessibility. The screenshots below show the redesigns of the Purdue OWL’s opening page as it progressed from the OWL in 2004 to the OWL in 2005.

Figure 1: Purdue OWL 2004

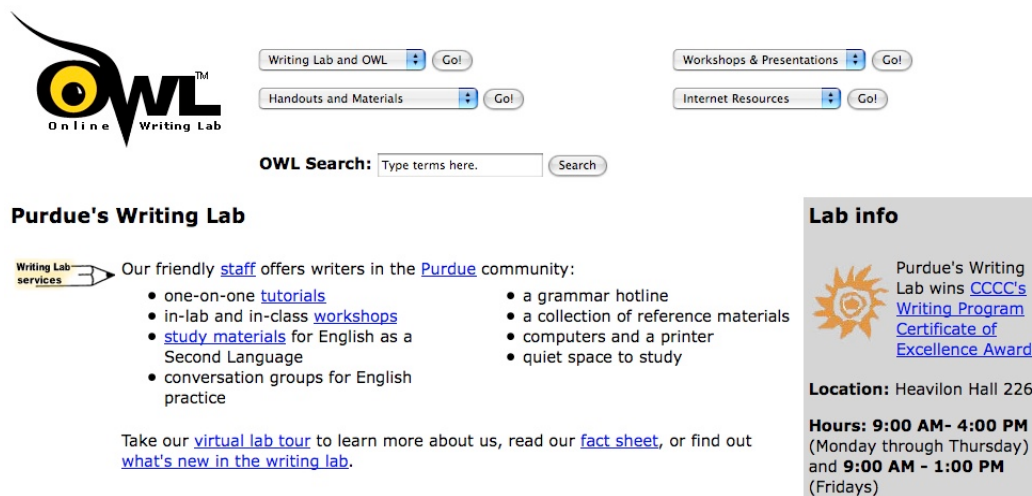
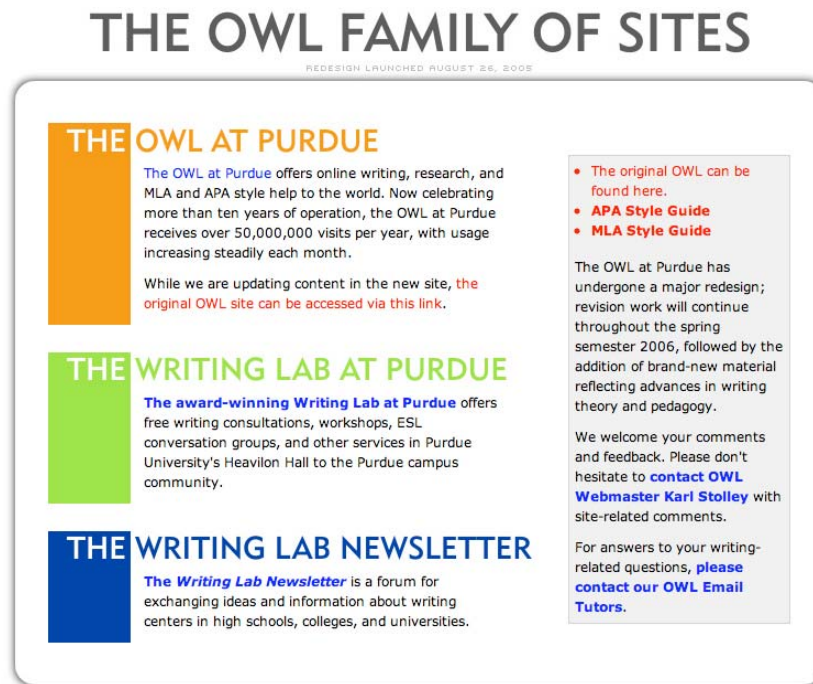


Figure 2: Purdue OWL 2005



The Purdue OWL Usability Project began in 2005 and continued through summer 2008, though changes to the OWL based were not completed until 2010.

Our usability testing involved users answering questions about the redesigned 2005 Purdue OWL and included task-based procedures completed on the 2005 OWL. To assess user impressions of 2005 Purdue OWL and to investigate how users complete tasks, we recruited 32 participants: 18 for generation one and 14 for generation two. We tracked participants' times and mouse clicks as they completed tasks on the Purdue OWL. We also asked participants to choose Purdue OWL page designs they preferred out of different layouts, and we asked participants to design their own pages using paper prototypes. Lastly, we gathered feedback during testing and through after-test questionnaires using quantitative (Likert scale) and qualitative (open-ended questions) methods.

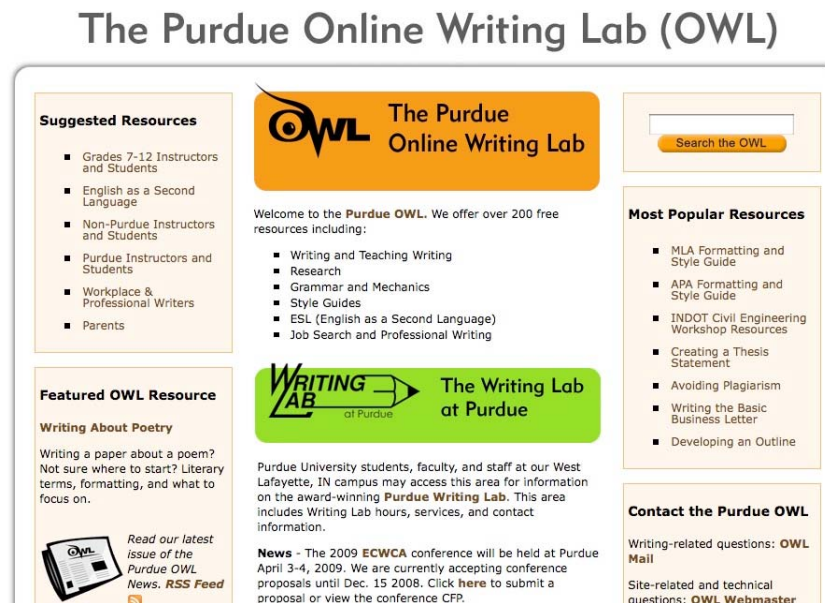
Work with participants during generations one and two generated valuable data for the Purdue OWL, which brought about significant changes to the site's design. It is beyond the scope of this article to detail these findings⁵, but results from these first two generations prompted us to recommend that the Purdue Writing Lab:

⁵ For a detailed discussion of the first two generations of OWL usability research, see Driscoll et al. (2008). For research protocols and raw data, see The OWL Usability Report and Appendices: <http://owl.english.purdue.edu/research/>.

1. Design links and 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 internal pages
3. Add a search engine function
4. Incorporate graphical logos in the OWL homepage
5. Continue testing to measure usability and to generate new ideas for design and content.

This screenshot shows many of the changes that came from the first two generations of testing:

Figure 3: Purdue OWL 2009 and Current Design

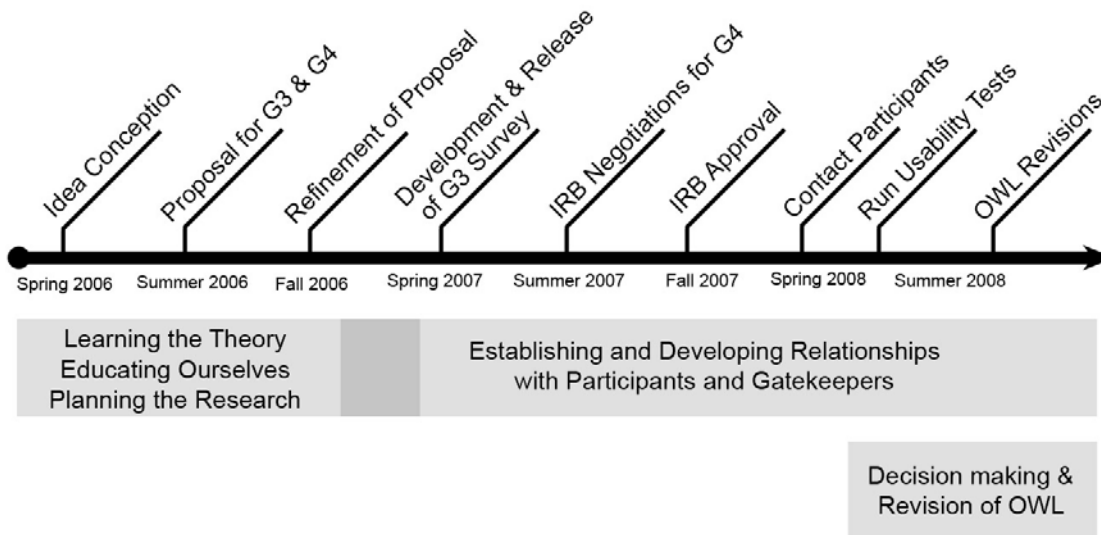


Guided by the findings of generations one and two, we conducted generations three and four, which gathered data about how visitors who use adaptive technologies navigate the Purdue OWL.

Usability Test Generations Three and Four: Focusing on Usability and Accessibility

To continue usability research and address issues of accessibility, we developed and conducted generations three and four of our usability testing between 2006 and 2008. Research for generation three consisted of a web-based, self-selected survey housed on the Purdue OWL that asked all OWL visitors to provide demographic data and information on their assistive technologies. Research for the fourth generation of testing consisted of usability tests and in-depth interviews with two male blind/low vision participants from Purdue University. Figure 4 shows the lifecycle for generations three and four (G3 and G4):

Figure 4: Testing Generations Three and Four (G3 and G4)



Listening and Responding to Global Users—Generation Three: The OWL Survey

The Purdue OWL serves millions of global users every year; in 2009, the OWL served 111,038,482 pages to users from 125 different countries (Purdue Writing Lab Annual Report, p. 26). So in order to better address the needs of all Purdue OWL users and improve accessibility, the usability team⁶ developed the OWL survey⁷ to be administered via the Web. The primary goal of the survey was to acquire additional knowledge about the broad base of Purdue OWL users. This data also allowed us to triangulate findings between the different generations of testing: because the first two generations of testing allowed us to work with small numbers of participants in depth, a major goal for generation three was to complement our in-person usability research by drawing from a much larger user base.

The Purdue OWL survey ran from May 1, 2007 to May 1, 2008. The web-based survey was available to all OWL visitors via a link at the top of each OWL page on the main OWL site (owl.english.purdue.edu/owl/) but not sister sites, like the (in person) Writing Lab pages. The survey had 4,384 participants from across the world who self-selected to click the link and participated in the survey. After the initial survey questions (asked of all participants), participants who identified themselves as having a disability were asked additional questions.

The questions driving our survey included:

⁶ Michael J. Salvo, Tammy Conard-Salvo, Dana Driscoll, Reuben Ternes, Allen Brizee, and Morgan Sousa.

⁷ We drew upon a number of sources to help us design our survey, but particularly useful were Ronald Czaja and Johnny Blair (2005), and Earl R. Babble (2006).

- Who are Purdue OWL users?
- Where are they from?
- What technologies do they use to access the OWL?
- How important is Section 508 compliance to them?*
- How important is accessibility to them?*
- What are their impressions of OWL navigability and accessibility?

*Asked only of participants who self-identified as having a disability.

Please see Appendix 1 for a screen shot of a page from the OWL survey.

Results and Implications—Generation Three: The OWL Survey

Of the 4,384 respondents, 249 (5.68%) used assistive technologies. The following information is taken from these 249 respondents.

Females using assistive technologies numbered 146 (58.6% of the 249), and males using assistive technologies numbered 103 (41.4%). Participants using assistive technologies who were also English as-a-Second-language learners numbered 137 (55%). Also of great interest to us were the types of assistive technologies participants used:

Type of assistive technology	Participants who used technology	Participants who used technology
Screen reader for blindness	56	22.5%
Screen reader for cognitive disabilities	51	20.5%
Screen magnifier	61	24.5%
Adapted keyboard	141	56.6%
Adapted mouse	131	54.4%
Adapted software	97	39%
Voice recognition or recording	68	27.3%

This data indicates that many of our respondents used multiple forms of assistive technology to browse the web. Our research for generation three indicated that:

- More Purdue OWL visitors than we expected are using assistive technologies
- The Purdue OWL 2005 redesign focusing on W3C standards and 508 compliance was effective and appreciated; however...

Our results also showed that users often face multiple, simultaneous barriers to information—multiple assistive technologies, low bandwidth, and language. Therefore, designers of online literacy resources need to consider the one or more barriers that exist between users and the information they need when they are designing websites. Lastly, while our participants were generally pleased with Purdue OWL accessibility, they expressed a need for improvement. The tables in Figure 5 illustrate participants' opinions on the accessibility of Purdue OWL navigation and OWL content. Respondents' feedback on accessibility was positive: over three-quarters of

participants assessed both the Purdue OWL navigation and the OWL content as *somewhat* or *very accessible*.

However, we also recognize that almost one-quarter of participants did *not* respond favorably to the accessibility of Purdue OWL content: they reported *neutral*, *inaccessible*, or *very inaccessible* opinions about their experience (see the data highlighted by the red boxes below). Similar to the findings from generations one and two, this feedback indicated that the Purdue OWL required more improvements to accessibility and usability.

Figure 5: G3 OWL Navigation and Accessibility

Accessibility of OWL navigation:

	Frequency	Percent
Very inaccessible	13	5.2
Somewhat inaccessible	14	5.6
Neither accessible or inaccessible	14	5.6
Somewhat Accessible	55	22.1
Very Accessible	153	61.4
Total	249	100.0

Accessibility of OWL content:

	Frequency	Percent
Very inaccessible	20	8.0
Somewhat inaccessible	19	7.6
Neither accessible or inaccessible	17	6.8
Somewhat accessible	47	18.9
Very Accessible	146	58.6
Total	249	100.0

This information is crucial for the user-centered approach and participatory design, and it helps designers focus on what users want and need. Though we had already planned generation four, findings from generation three reinforced the need to conduct more testing and to collect in-depth data from our in-person participants.

Listening and Responding to Students—Generation Four: Research with Blind/Low Vision Participants

Conducting research with participants with disabilities requires very careful planning. To initiate this process, we performed an extensive literature review⁸, after which we chose to follow

⁸ See <http://www.danadriscoll.com/accessibility/workscited.php> to review our complete source list.

guidelines for conducting research with blind and low-vision participants developed by the following organizations:

- DO-IT (University of Washington)
- Jacob Nielsen's Useit.com
- Information Technology Technical Assistance and Training Center (ITTATC.org)
- World Wide Web Consortium (W3.org).

These organizations have developed valuable resources to aid individuals with disabilities and those who work with these individuals. One of these resources, ITTATC, proved particularly useful because its website discusses three phases for considering accessibility in overall design: 1) accessibility in the analysis phase; 2) accessibility in the design phase; 3) accessibility in the testing phase.

Phase one calls for designers to collaborate with persons with disabilities during the early planning stages of a product. The ITTATC suggests asking the following questions:

- What populations or groups should a designer consult?
- What are their basic needs?
- What goals should the project fulfill in relationship to accessibility?

Phase two focuses on involving disabled users in the design phase itself—receiving and incorporating their input as a product, website, or service area is designed (“Accessibility in the user-centered design process”).

Phase three discusses accessibility testing of a prototype or an existing product/website. This process includes usability testing, short informal assessments, a standards review, heuristic evaluations, and design walkthroughs (“Evaluating for accessibility”).

The W3C states that standards compliance alone does not equate with 100% accessibility—a lesson learned first-hand in generation four of the Purdue OWL Usability Project. The W3C recommends that web designers use preliminary reviews and usability tests during all phases of development while adhering to accessibility standards. These resources were vital to our design methods, and they raised our awareness of accessibility issues in virtual and physical spaces, which would affect later work in the Purdue Writing Lab.

Mirroring the first two generations of in-person usability testing, we used a mixed-methods research approach⁹ for generation four. We chose this methodology because we believed

⁹ Mixed Methods Research Design: “When...the nature of the of the research problem makes it necessary to use both qualitative and quantitative data in developing a more thorough answer, when each kind of data is subjected to standards of quality that are appropriate within its paradigm of origin...when interpretation links data types together in a genuine synthesis—that represents something that...deserves being called a distinct type of inquiry [mixed methods]” (Locke, Silverman, Spirduso 167).

replicable, aggregable, data-supported (RAD¹⁰) research using mixed methods would provide the most valuable information for the Purdue Writing Lab. To help develop our tests, we consulted “Accessibility evaluation methodology” by W. Bradley Fain and Dennis Folds (2001). This source provided a series of steps for accessibility testing. Selected steps pertinent to Web accessibility are as follows:

1. Define Objectives
2. Perform Task Analysis
3. Develop Test Method
4. Prepare the Evaluation Checklist
5. Prepare the User-in-the-loop Evaluation
6. Document the Results.

Guided by these steps, generation four testing consisted of the following components:

- Participant screening questionnaire
- Demographic questionnaire
- Quantitative usability tests (which included modified speak-aloud protocols) and after-test surveys
- Ethnographic interviews and video taping of test sessions
- After-test questionnaire on the test process itself.

We believe that collecting information using empirical methods validates our process, and we found that it helped us more carefully listen to our users by including their opinions in writing center policy and OWL design. Therefore, we provide the following information to illustrate further how we listened to and helped empower our users.

Participants: Access to participants, especially when working with disabled populations, is a challenge in this kind of research because persons with disabilities are a protected population. We chose to work with participants with low vision and blindness for two reasons: first, our web survey (G3) results indicated that large number of participants with disabilities used screen readers, screen magnifiers, and other vision-based technologies; and second, members of the Purdue University Adaptive Services office suggested two participants who had low vision/blindness and would be interested in helping us improve the Purdue OWL.

Test Setting: Initially, the usability team spent substantial amounts of time discussing the potential location of the usability tests. In our first two generations of testing, we set up the testing site in the Writing Lab and in a computer lab in Purdue’s English Department, respectively. In working with blind and low-vision populations, however, we did not want to introduce unnecessary barriers, such as asking participants with blindness to navigate new buildings on campus. We initially considered traveling to participants’ homes for convenience sake, but in the end, we conducted our testing in Purdue’s Adaptive Technologies Center because

¹⁰ See Richard Haswell’s “NCTE/CCCC’s Recent War on Scholarship” where he calls for more replicable, aggregable, and data supported (RAD) research in composition studies.

both participants were familiar with the center. Moreover, JAWS, the screen reader our participants use to surf the Web, was on the computers in the Assistive Technology Center.

Participant Pre-Test Screener: Before testing began, we emailed participants a pre-test screener¹¹, and an open-ended survey in .doc, .rtf, and .pdf formats to ensure that they would have an accessible file format. This screener allowed us to learn about participants' familiarity with types of assistive technologies, meet the accessibility requirements of our participants during the testing process, and prepare test materials in each user's preferred format (digital, Braille, or read aloud). The screener was not intended to collect demographic data; rather, it provided information about participants' needs so that we could adapt our usability research to their requirement as much as possible.

Demographic and Pre-Test Questionnaires: At the start of each usability session, we read aloud to each participant a demographic questionnaire and pre-test questionnaire (similar to the questionnaires used for generations one and two)¹². The goal of collecting this information was to learn more about our participants. At participants' requests, we read aloud (and recorded) the pre-test survey during the testing.

Usability Tests: Tests¹³ were similar in method to G1 and G2, during which participants were asked to complete a series of tasks to answer specific questions and find information on the Purdue OWL. We measured time to complete tasks and recorded the pages visited. For test generations one and two, we counted mouse clicks. But, for test generation four, we did not do this because mouse *clicks* has a different meaning on a screen reader: blind/low vision participants using JAWS do not surf the Web with a mouse; they toggle through pages using the direction arrows on the keyboard or use hot key combinations to open lists of hyperlinks. This type of information was important to us because, as Nielsen (2005) notes, accessibility is not simply about persons with disabilities being able to access a site; it is more about persons with disabilities being able to easily and comparably access a site (para. 15).

We compared¹⁴ information from these usability tests to our previous tests to see if the OWL was accessible for our blind/visually-impaired population. We also used modified speak-aloud testing protocols to help us understand why participants chose certain navigation patterns and participants' processes for finding information on the site, including their navigational strategies and any problems they encountered. These usability tests were focused on the navigation and accessibility of the site itself as well as writing information located within the website. However, since the Purdue OWL contains over 250 multi-page resources on writing, our ability to test users' perceptions of the OWL content was substantially limited. Instead, we chose a set of

¹¹ See the Appendix to read the pre-test screener used in the generation test four.

¹² See the Appendix to read the questionnaires.

¹³ See the Appendix to read the usability test.

¹⁴ When we say "compared," we do not mean comparing precise data points, such as the time to complete protocol tasks, since OWL organization and content changed between testing generations. When we use the term "compare," we mean this in a more holistic sense: we looked at the overall results from the first two test generations and noted differences and similarities in test generation four.

representative questions that would test the navigability and organizational structure of the site within limited pages of content.

After-test Questionnaire: We measured participants' impressions of the OWL using an after-test questionnaire¹⁵. In generations one and two, the data we received from this questionnaire proved more useful than the actual testing data (time-to-complete-task, mouse clicks). For example, even after creating a user-centered Purdue OWL prototype for generation two, the task completion time and mouse click count did not improve significantly. However, participants' impressions and reactions to the revised Purdue OWL prototype improved. Moreover, the open-ended questions from the after-test questionnaire allowed participants from generations one, two, and four to provide suggestions—another venue for participatory design—to improve the Purdue OWL. The after-test questionnaire also showed that despite what we considered to be a long period of time to locate information using JAWS, our participants found the Purdue OWL fairly usable and accessible

Interview Questions: We used a series of interview questions¹⁶ to help us learn about blind and low-vision participants and their use of computers for writing-related and social activities. Based on information from our literature review about the increase in blind and low-vision Internet users, we formulated interview questions to obtain information about why and how our participants use the Web. Furthermore, we wanted to know about participants' impressions of the Internet regarding website accessibility and usability. Lastly, we asked participants about resources they would like to see on the Purdue OWL to help them, specifically as blind/low-vision users.

After-Test Interview Questions: Lastly, to integrate participants' feedback, improve the test, and learn more about *how* we conducted the research, we asked¹⁷ participants about the testing process itself. We wanted to determine whether we had conducted an accessible and usable test. We felt that these questions would help researchers complete work with disabled participants more effectively. We wanted to know participants' impressions of the test materials, protocols, questions, and even the researchers themselves.

Results and Implications—Generation Four: Research with Participants with Blindness/Low Vision

Working closely with the two blind /low-vision participants allowed us to collect important data. With this data, we made important changes to the Purdue OWL, and we developed relationships with the participants that enabled us begin projects with the Purdue Disability Resource Center and Assistive Technologies Center. To begin, we found that the time to complete tasks mirrored generations one and two:

¹⁵ See the Appendix to read the after-test questionnaire.

¹⁶ See the Appendix to read interview questions.

¹⁷ See the Appendix to read the after-test interview questions.

- Participant two, who had only rarely used the Purdue OWL, found the first information location task difficult, and, in fact, did not finish the first task. Both participants' navigation skills improved with Purdue OWL use as the test progressed.
- Participant one, who had visited the Purdue OWL fairly often, completed tasks quickly, but our overall testing findings proved that our blind/low-vision participants took *substantially* longer to find information than did our sighted participants from the first two generations of testing.

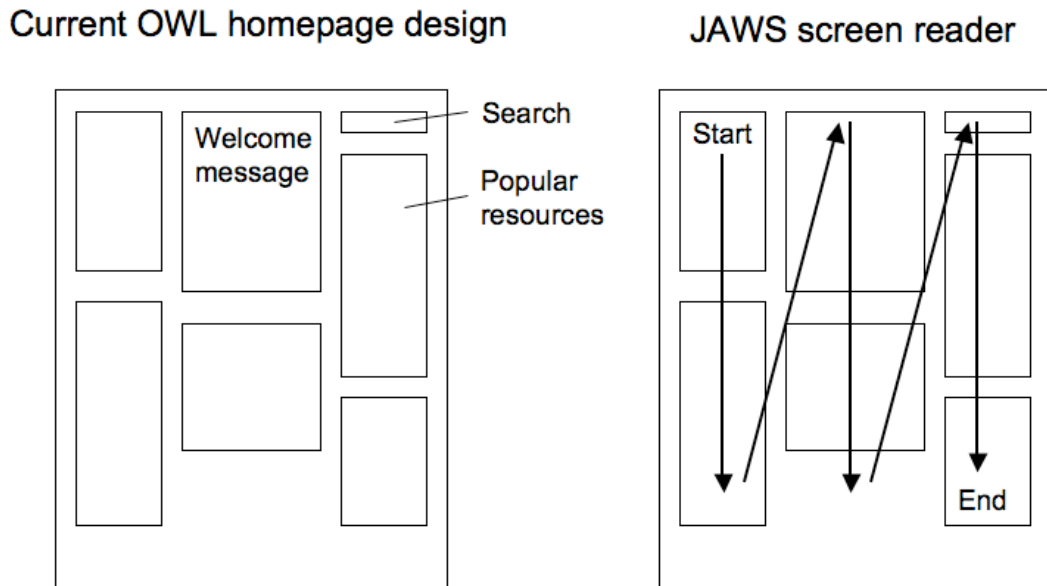
While time to complete tasks in generations one and two was an important measure of Purdue OWL usability, we did not have enough participants in generation four to compare times with other users with blindness and/or low vision. Therefore, qualitative data, participant speak-aloud feedback, and after-test questionnaire data proved more useful than the task-based protocol data.

Participants in generation four provided insightful data regarding Purdue OWL usability and accessibility. When asked to rate Purdue OWL accessibility on a scale of 1-10, both participants ranked it at 7. They also indicated that for a site to be rated at a 9 or 10, it would have to contain only text and no images (images can be difficult for screen readers to decipher, especially in page navigation elements). We found that just because the Purdue OWL was technically *accessible*—it complies to W3C and Section 508 guidelines—participants did not find the OWL particularly *usable*, as our data shows from the after-test (Likert scale) questionnaire:

- Finding information was *neutral* to *easy*
- Organization of the home page was *ineffective*
- Information was *neutral* to *accessible*
- Site organization was *ineffective* to *neutral*
- Site navigation was *accessible*
- When looking for information, users felt *neutral*
- While using the site, users felt *neutral* to *comfortable*.

Through our modified speak-aloud protocols and after-test open-ended inquiries, we also learned that users with blindness/low vision search for information differently than sighted users. This information is important for computer and composition specialists because designers should realize that screen readers like JAWS read in columns beginning at the top left side of the page. Therefore, important navigation tools like search boxes and navigation bars on Web pages should be positioned in the code so that they are the first or second navigation feature accessed by screen readers. Figure 6 shows the current Purdue OWL homepage design and the process by which JAWS moves through the design elements. Important to note is that a user with a screen reader who wants to search the site would need to scroll through two columns to reach the search box in the top right-hand corner.

Figure 6: JAWS Screen Reader Process

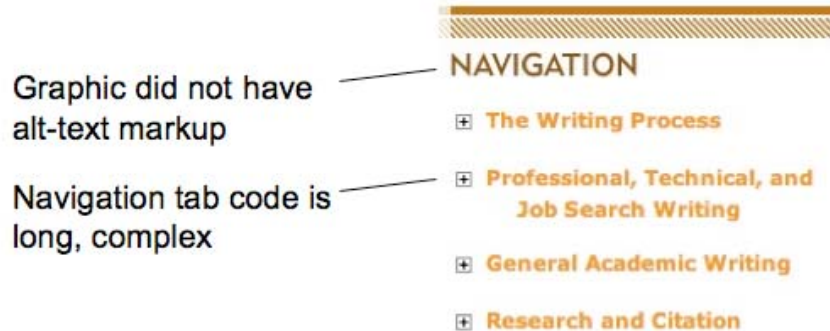


Additionally, we learned that important features of the Purdue OWL were still not accessible—thus affecting the site’s usability—despite the validation process Cynthia Says¹⁸ used for every OWL page at the time. For example, navigation elements that we assumed would be readable with JAWS were actually images lacking alt-text markup¹⁹. Moreover, some graphical elements require long, complex code to display in browsers, which is confusing to JAWS users. Figure 7 illustrates this accessibility roadblock.

¹⁸ All Purdue OWL pages underwent W3C and Section 508 standards through the Cynthia Says Web validation. Cynthia Says can be found here: <http://www.contentquality.com/>.

¹⁹ Alt-text markup is a textual explanation of visual elements that is included in standards-based HTML code. For example, the alt text for the image describing the preposition “into” on the Purdue OWL states “This image shows a glass sitting on a table and milk is being poured into it.”

Figure 7: Accessibility Roadblocks 1



Furthermore, we learned that the most popular resources on the Purdue OWL—MLA and APA formatting materials—were not as usable for users with blindness/low vision as they could be. Because HTML and CSS code, when read in JAWS, does not indicate formatting, JAWS users are not able to hear and follow the tricky spacing and indentation requirements outlined by APA and MLA rules²⁰. Instead, participants would only hear the content of the citation, but not the formatting information, such as hanging indentation (see Figure 8).

Figure 8: Accessibility Roadblocks 2

Cite the Purdue OWL in MLA:

Entire Website

```
The Purdue OWL. 26 Aug. 2008. The Writing Lab and OWL at  
Purdue and Purdue University. 23 April 2008  
<http://owl.english.purdue.edu>.
```

Also, both generation four participants stressed the need for a site map, which Purdue OWL 2004 had but Purdue OWL 2005 lacked. This information was the driving force behind the development of the current Purdue OWL site map found at <http://owl.english.purdue.edu/sitemap/>. Also, our decision to locate the hyperlink to the site map in the upper left corner of the Purdue OWL front page was based upon data from test generation four.

If experts in computers, composition and writing centers wish to integrate user-centered and participatory design into their work and into the design process of online resources, this type of data is indispensable. Moreover, it would have been impossible to obtain user feedback and

²⁰ Please note that these examples reflect the pre-2009 MLA and APA citation rules.

integrate their suggestions into the Purdue OWL design processes without the usability testing we conducted. Based on our experiences during test generation four, we developed the following plans (these may be applied to other OWLs and online literacy resources):

- Reorganize OWL homepage so important navigation elements are higher on the page
- Link to a site map from the top left side of OWL homepage
- Add alt text tags to *all* graphics, even minor ones such as design elements
- Remove all graphics from navigation bars
- Add descriptions in text for citation pages that describe formatting
- Add document downloads (.doc, .pdf for screen readers)
- Verify that HTML heading levels are used properly (h1, h2, h3; JAWS users tab through heading levels to find information quickly because they cannot visually scan a page)
- Develop OWL research and writing resources *with* (not just for) users
- Design OWL while using JAWS (this led to the installation of JAWS in the OWL office where OWL design work takes place)
- Continue testing with users to continually improve OWL usability and accessibility.

Lastly, we included an important step in our methods to ensure a more participatory approach to the testing, and to adhere to Fain and Folds' (2001) user-in-the-loop evaluation: we asked participants to provide feedback on the testing process itself through after-test questions. Most notable from these responses were participants' excitement and appreciation for usability/accessibility testing on the Purdue OWL. Some questions and our participants' answers follow:

- *How do you feel about this testing experience?* "I was actually looking forward to it on the very first day because I knew that being a liberal arts student and it is an important resource and I'd like to get it made more accessible for me. I like the experience. I would have wanted to have my views heard."
- *If you had any suggestions on how to improve the test itself, what would they be?* "To be honest I think you are doing a fine job with it. Those are the kinds of questions we won't be able to tell you exactly today—you've pointed out certain issues and pinpointing certain facts to look at the accessibility, you have everything covered."
- *What were your reactions to the whole testing process (contact, screening, us coming here)?* "Perfect, I don't think there were any problems with it at all. I didn't have to worry about a delayed response, within the next 12 hours I would get a response. Normally people just don't respond. No problems with that."
- *Did any parts of the test seem unimportant?* "No I think that what I took away from the test was good—what I learned the site it seemed effective."
- *What do you think about us running these tests in general?* "I think it's a really good move. I would like other departments to adopt similar approaches because it enables us . . . generally, we are reluctant. I'm hesitant to say I'm having problems with this because

there are things I wouldn't say without being asked. It gives me satisfaction that I know at least one part is being worked on.”

Neither participant mentioned problems with the testing, and both participants appreciated the multiple file formats we used for the pre-test screener and demographic survey. They both said they selected the .doc versions with JAWS to read and answer the questions. We attribute the extensive literature review and adherence to best practices to the success of our testing and the high level of satisfaction exhibited by our participants for the testing process and collaboration.

However, the benefits of these efforts did not end with data collection and the work we completed to fulfill Purdue OWL users' needs. While recruiting generation four participants and establishing the Assistive Technologies Center as a test setting, we developed fruitful relationships that sparked cooperation between the Writing Lab, the Disability Resource Center, and the Assistive Technologies Center. Because of our work, these three organizations worked with students to make our lab more accessible.

Building and Maintaining Collaborative Relationships

When working with participants with disabilities, it is helpful to investigate relevant scholarship and best practices, to build relationships with gatekeepers (institutional review boards and assistive services), and to build and maintain relationships with participants. Because our research was driven by rhetorically informed user-centered and participatory methods, we considered cooperation with our Institutional Review Board (IRB), assistive services, and participants as part of the collaborative process. We considered our stakeholders to be co-developers in our joint efforts to improve the accessibility and usability of the Purdue OWL and the Writing Lab. These experiences can serve as a model for other writing centers seeking to conduct this work, as we'll further discuss at the end of this article.

Rather than viewing our IRB as a bureaucratic roadblock, we tried to remember that the board is maintained to help and protect the same people we want to assist—Purdue Writing Lab and Purdue OWL users with disabilities. Similarly, rather than approaching Purdue's Assistive Services office as a bureaucratic roadblock, we understood the necessity for vetting researchers who work with students with disabilities. The time and patience we applied to the project paid off in the end because the cooperation we nurtured between our research team, the IRB, and assistive services blossomed into ongoing collaboration.

The IRB and Assistive Services at Purdue were interested in the potential risks to participants with disabilities. When we first designed our research, we had planned to visit participants in their homes to see how they accessed the Internet, how they used the Purdue OWL, how they conducted research, and how they wrote in their own spaces. As our IRB pointed out, this approach would have also negated the risk of securing transportation to and on Purdue's large campus. However, after communicating with the Disability Resource Center and Assistive Technologies Center, we decided that testing on campus in the Assistive Technologies Center was the best policy, leading to further negotiations with the IRB. However, because participants

were already using the Assistive Technologies Center for their daily work, no additional risks could be foreseen, and our application process was not delayed.

After IRB approval, we worked with the Disability Resource Center to connect with potential blind/low-vision participants. These ongoing face-to-face meetings preserved collaborative relationships and led to further cooperation. By the time we contacted our participants, we had developed a good working relationship with our counterparts in the Disability Resource Center and Assistive Technologies Center.

The User-Centered Approach and Participatory Design as Methods of Collaboration

Who are our users? While it may be intuitive to consider this sort of question in a writing center regarding students, this question may not always include the consideration of *all* our users—students with disabilities, other campus organizations, etc. But if administrators are willing to use this type of lens to think about who uses writing centers (and OWLs if they exist), the user-centered, participatory approaches may be constructive. And when combined with Hawhee's inventions-in-the-middle theories outlined above, the user-centered approach and participatory design also act as effective methods of collaboration. Writing center staff might begin defining their users by stating the obvious: that writing center users are students. They come to centers (in person or online) for help with writing and research, and sometimes they need emotional support.

But administrators should also recognize that other campus organizations likely comprise the user base, as do tutors in our writing center, along with college faculty and staff. However, we suggest that student services—organizations that help our end users—can and should be considered users. Moreover, since some campus organizations share the common goal of assisting students with disabilities, administrators and staff could help one another more effectively fulfill educational missions by working together. For example, in order to fulfill one of our most important agenda items from generation four testing—to integrate JAWS into the OWL design process—we had to work closely with the Assistive Technologies Center, the campus organization that maintains the JAWS application and trains people to use it.

During the summer of 2008, we worked with the director of the Assistive Technologies Center and a software/accessibility specialist from the information technology office at Purdue to obtain essential training with JAWS so that we could test the Purdue OWL during each stage of its development. In addition, we made an important discovery during the training sessions: a primary navigation feature of the OWL 3.0 design—the navigation bar—did not work with JAWS. This finding led to an immediate fix. Lessons like this one made it obvious that JAWS would need to be installed on computers where most OWL work is performed, allowing us to design and test resources iteratively during developmental stages instead of during post-testing situations. This work would not have been possible if not for the empirical research we conducted in generations three and four assisted by members of the Disability Resource Center and Assistive Technologies Center.

A second collaborative project emerged from our generation four work: we invited a specialist in learning disabilities from the Disability Resource Center to speak with Writing Lab tutors about how to work with students with learning disabilities. Based on this session, we decided to set up tutor points of contact within the lab so students working with the Disability Resource Center could meet with tutors who had experience with learning disabilities.

Through these collaborations—directly linked to our usability/accessibility research on the Purdue OWL—we were able to better serve four segments of our user base: students who come to the in-person Purdue Writing Lab, OWL visitors worldwide, the Disability Resource Center, and the Assistive Technologies Center. As a result, we believe that the user-centered and participatory design methods improved the accessibility and usability of the Purdue OWL, and they improved the accessibility of the Writing Lab itself for a population that might need it most—students with disabilities. Furthermore, we believe that the relationships we built with campus assistive services and the changes we made on the Purdue OWL will help all of our users as we apply user-centered and participatory design to our writing center “curb cuts.”

The User-Centered Approach, Participatory Design, and Your Writing Center or Online Writing Resource

To integrate user-centered and participatory methods and form collaborative strategies in your writing center or for your online resources, you might begin by answering a few questions that helped guide our work (which are strikingly similar to the questions outlined by the ITTATC):

- What is the purpose of your work, and what would you like to accomplish?

For the Purdue OWL Usability Project, we defined the purpose of our work as a commitment to improve the usability of the OWL for all our users, including users with disabilities. Since the first two generations of testing helped us make the Purdue OWL more usable, we wanted to accomplish our next goal by collecting data from OWL users (generation three) about how they access and use the OWL with assistive technologies. We also wanted to work with Purdue OWL users (generation four) in designing a more usable OWL for people using screen readers.

We identified the purpose of the Disability Resource Center’s workshop on tutoring students with disabilities as updating and improving tutors’ methods in assisting people who visit our Writing Lab who may or may not disclose their situations. We recognized that the Disability Resource Center staff members are the campus experts on disabilities, and they are a part of our Writing Lab user base that shares common goals. Furthermore, we realized that we should foster ongoing collaboration to develop workshops for tutors and to offer students from the Disability Resource Center specific tutors.

- Who are your users? How might you gain their feedback on your services?

For both projects, we used audience analysis heuristics to answer this question (adapted from Richard Johnson-Sheehan’s *Technical Communication Today*):

- Who are they?
- What do they need?
- Where will they be accessing information?
- When will they be accessing information?
- Why will they be accessing information?
- How will they be accessing information?

Studying users can be further aided with graphical heuristics, as in Table 1:

Table 1: Graphical Heuristic for Understanding Users’ Needs, Values, and Attitudes

<i>Users</i>	<i>Needs</i>	<i>Values</i>	<i>Attitudes</i>
Students with disabilities			
OWL users			
Campus disability organizations			

Lastly, studying how and where users will be applying the resources or services you help develop may assist you in making decisions, as demonstrated in Table 2.

Table 2: Graphical Heuristic for Understanding How and Where Users Apply Resources or Services

<i>Users</i>	<i>Physical Context</i>	<i>Economic Context</i>	<i>Political Context</i>	<i>Ethical Context</i>
Primary users				
User’s organization				
User’s industry or social group				

- With whom might you collaborate to achieve the goals of this project? Or, who else shares common goals so that you might work together?

For our projects, the goals of the Disability Resource Center and the Assistive Technologies Center naturally overlapped with the goals of the Purdue Writing Lab and the Purdue OWL since all three organizations are dedicated to helping students learn and succeed and all three assist students with disabilities.

Further, we found that collecting mixed methods, empirical research was an effective method to help us answer many of these questions. We suggest that the quantitative and qualitative data we collected during the Purdue OWL Usability Project helped our users empower themselves, and that this process answers the call from scholars, such as Babcock, for more empirical work in writing center best practices involving students with disabilities.

However, we also recognize that this sort of research may not be possible or applicable in other contexts. While the cost of conducting this research was minimal, the time and effort dedicated to these projects was significant. Therefore, scalable and situated options should be considered when applying rhetorically informed user-centered approach and participatory design process in your writing centers or for your online resources.

For example, posting surveys and feedback forms on writing center websites that collect qualitative and quantitative data (see the usability testing forms in the Appendix) can provide staff with important information about what resources and designs most effectively meet users' needs and expectations. Surveys need not be permanent fixtures, especially given the limited staffing resources at some writing centers to collect and track data. Even surveys posted for a short duration can yield valuable information. In-person interviews or focus groups are also a way to triangulate data collected through surveys, as shown through our work in the Purdue OWL test generation four. These in-depth discussions with small groups can be useful for redesigning physical or online spaces with users' needs in mind. In-person or online consultation feedback forms (which many writing centers already use) can be modified to include questions about the usability or accessibility of writing center physical and online spaces.

Further, distributing feedback forms or engaging in conversations with a broad range of writing center users might help administrators and tutors "listen" to a population that is normally underrepresented in staff meetings. These feedback forms might also open up avenues of cooperation with other campus organizations, like those described in this article. Even short workshops that explain one another's services can foster collaboration.

We also recommend a more empirical, user-centered, and participatory approach to developing the comprehensive services for students with disabilities and establishing Rojewski's (1992) "model" programs: academic support systems, individualized planning, and follow-up services. Feedback methods based on these three categories would be valuable measures for assessing of these best practices. We believe that even a scaled inquiry and limited collaboration with students and campus organizations will help writing centers fulfill users' expectations as administrators carve their own curb cuts in physical and virtual spaces.

Conclusion

In this article, we have demonstrated how two theories evolving from rhetoric and technical communication helped the Purdue Writing Lab and its OWL better serve users. User-centered and participatory design methods, combined with empirical research, allowed us to focus on and collaborate with users (global and local) and two different campus organizations dedicated to assisting students with disabilities. We hope that the description of our process and findings promotes more research in these areas and serves as a model for other writing centers. Used as methodologies of collaboration, the user-centered and participatory design approaches can be valuable theoretical guides for empirical research in disabilities studies and writing programs.

On a broader scale, our research has also raised questions and illustrated gaps in our understanding of disability, accessibility, and OWLs. More research is needed to understand how students with disabilities gain access to online writing-related information and engage in writing processes. We also need to better understand how students, both with and without disabilities, use online writing information, and if the content and delivery of such information facilitates or precludes successful writing processes. We may also think about other types of writing center users—faculty, staff, community members—and their need for usable, accessible online writing resources. Seeking answers to these questions through user-centered, participatory, and empirical methodologies can help us, as computer and composition specialists, better adapt our pedagogies for all students of writing.

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References

- Babcock, Rebecca Ray (2008). "Tutoring deaf college students in the writing center." In Cynthia Lewiecki-Wilson, Brenda Jo Brueggemann, & Jay Dolmage (Eds.), *Disability and the teaching of writing: A critical sourcebook* (pp. 28-39). Boston, MA: Bedford.
- Babble, Earl R. (2006). *The practice of social research*. 9th ed. Florence: Cengage Learning/Wadsworth.
- Blythe, Stuart (1998). "Wiring a usable center: Usability research and writing center practice." In Eric Hobson (Ed.), *Wiring the writing center* (pp. 103-118). Logan, UT: Utah State University Press.
- Brainard, David (1993). "Tutoring and learning disabilities." *Writing Lab Newsletter* 17, 15-16.
- Center for Universal Design (2008). "Principles of universal design." Available: http://www.design.ncsu.edu/cud/about_ud/about_ud.htm. [Accessed July, 2010].
- CPSR—*Computer Professionals for Social Responsibility*. Available: <http://cpsr.org/issues/pd/>. [Accessed November, 2008].
- Czaja, Ronald, & Blair, Johnny (2005). *Designing surveys: A guide to decisions and procedures*. Thousand Oaks, CA: SAGE Publishing/Pine Forge Press.
- Davis, Lennard (1999). "Crips strike back: The rise of disability studies." *American Literary History*, 11(3), 500-512.
- Driscoll, Dana L.; Brizee, Allen; Salvo, Michael J.; & Sousa, Morgan. "Usability research and user-centered theory for 21st century OWLs." In Kirk St. Amant & Pavel Zemplansky (Eds.), *The handbook of research on virtual workplaces and the new nature of business practices* (pp. 614-631). Hershey, PA: Idea Group Publishing.
- Ehn, Pelle (1992). "Scandinavian design: On participation and skill." In Paul S. Adler & Terry. A. Winograd (Eds.), *Usability: Turning technologies into tools* (pp. 96-132). New York, NY: Oxford University Press.
- Fain, W. Bradley, & Folds, Dennis (2001). "Conducting an accessibility evaluation." *Accessibility Evaluation Methodology*. Available: <http://accessibility.gtri.gatech.edu/aem/AEM1.html>. [Accessed November, 2008].
- Gardner, Daniel (2008). "Students with LD and the search for college financial aid: A discussion of options and resources." *LD Online*. Available: <http://www.ldonline.org/article/6199>. [Accessed October 2008].

George Institute of Technology (2006). *Information Technology Technical Assistance and Training Center (ITTATC)*. Available: <http://www.ittatc.org/>. [Accessed November 2008].

Gillespie, Paula (2001). "Beyond the house of lore: WCenter as research site." In Paula Gillespie, Alice Gillam, Lady Falls Brown, & Byron Stay (Eds.), *Writing Center Research: Extending the Conversation* (pp. 39-51). Mahwah: Routledge.

Haswell, Richard (2005). "NCTE/CCCC's recent war on scholarship." *Written Communication*, 22(2), 198-223.

Hawhee, Deborah (2002). "Kairotic encounters." In Janet M. Atwill & Janice M. Lauer (Eds.), *Perspectives on rhetorical invention* (pp. 16-35). Knoxville: University of Tennessee Press.

Ianetta, Melissa; Bergmann, Linda; Fitzgerald, Lauren; Haviland, Carol Peterson; Lebduka, Lisa; & Wilsocki, Mary (2006). "Polylog: Are writing center directors writing program administrators?" *Composition Studies*, 34(2), 11-42.

Johanek, Cindy (2000). *Composing research: A contextualist paradigm for rhetoric and composition*. Logan, UT: Utah State UP.

Johnson, Robert R. (1998). *User-centered technology: A rhetorical theory for computers and other mundane artifacts*. Albany, NY: State University of New York Press.

Kiedaisch, Jean, & Dinitz, Sue (2007). "Changing notions of difference in the writing center: The possibilities of universal design." *The Writing Center Journal*, 27(2), 39-59.

Kinash, Shelley; Crichton Susan, Kim-Rupnow; & Soon, Weol (2004). "A review of 2000-2003 literature at the intersection of online learning and disability." *The American Journal of Distance Education*, 18(1), 5-19.

Konstant, Shoshana (1992). "Multisensory tutoring." *Writing Lab Newsletter* 16, 6-8.

Lauffer, Kimberly (2000). "Accommodating students with specific writing disabilities." *Journalism & Mass Communication Educator*, January 2000, 20-46.

Lerner, Neal (2009). *The Idea of a Writing Laboratory*. Carbondale: Southern Illinois UP.

Locke, Lawrence F.; Silverman, Stephen J.; & Spirduso, Waneen Wyrick (2004). *Reading and understanding research*. 2nd ed. Thousand Oaks, CA: Sage Publications.

Mullin, Anne E. (1994). "Improving our ability to tutor students with learning disabilities." *Writing Lab Newsletter* 19, 1-4.

- Neff, Julie (1994). "Learning disabilities and the writing center." In Joan A. Mullin & Ray Wallace (Eds.), *Intersections: Theory-Practice in the Writing Center* (pp. 81-95). Urbana, IL: National Council of Teachers of English.
- Nielsen, Jakob. (2005). "Beyond accessibility: Treating users with disabilities as people." Available: <http://www.useit.com/alertbox/20011111.html>. [Accessed November, 2008].
- Nielsen, Jakob. (2010). *Useit.com: Usable information technology*. Available: <http://www.useit.com/>. [Accessed November, 2008].
- Norman, Donald A., & Draper, Stephen W. (Eds.) (1986). *User centered system design: New perspectives on human-computer interaction*. New Jersey: Lawrence Erlbaum Associates, Inc.
- O'Hara, Karen (2004). "Curb cuts on the information highway: Older adults and the Internet." *Technical Communication Quarterly*, 13(4), 423-445.
- Purdue University Writing Lab (2008). *Purdue Writing Lab Annual Report for 2007-2008*. Purdue University, West Lafayette, Indiana.
- University of Washington (2010). DO-IT: Disabilities, opportunities, internetworking, and technology. Available: <http://www.washington.edu/doi/>. [Accessed November 2008].
- Salvo, Michael J.; Ren, Jingfang; Brizee, Allen; & Conard-Salvo, Tammy (2009). "Usability research in the writing lab: Sustaining discourse and pedagogy." *Computers and Composition*, 26(2), 107-121.
- Scanlan, Leone (1985). "Learning disabled students at the writing center." *Writing Lab Newsletter* 9, 9-11.
- Sherwood, Steve (1996). "Apprenticed to failure: Learning from the students we can't help." *The Writing Center Journal*, 17(1), 49-57.
- Section 508: The Road to Accessibility*. Available: <http://www.section508.gov/>. [Accessed November, 2008].
- Rojewski, Jay, W. (1992). Key components of model transition services for students with learning disabilities. *Learning Disability Quarterly*, 15(2), 135-150.
- Theofanos, Mary Frances, & Redish, Janice (Ginny) (2005). "Helping low-vision and other users with web sites that meet their needs: Is one site for all feasible?" *Technical Communication*, 52(1), 9-20.
- Thompson, Isabel, et al. (2009). Examine our lore: A survey of students' and tutors' satisfaction with writing center conferences." *The Writing Center Journal*, 29(1), 78-101.

Vogel, Susan, & Adelman, Pamela (1993). *Success for college students with learning disabilities*. New York, NY: Springer-Verlag.

Wong, Bernice (1996). *The ABCs of learning disabilities*. San Diego, CA: Academic Press.

World Wide Web Consortium. Available: <http://www.w3.org/>. [Accessed November, 2008]

Appendix – Research Instruments

Purdue OWL Online Survey from G3

The following questions will ask you more information about yourself and your experiences browsing the site. —

What type of assistive technology do you use? (check all that apply)

- Screen reading programs for persons with blindness
- Screen reading programs for persons with cognitive disabilities
- Screen magnifier
- Adapted keyboard
- Adapted mouse
- Adaptive software
- Voice recording/recognition software

Other (please specify):

How long have you been using assistive technology to access the Internet?

How long have you been on the Internet?

How important is web accessibility and 508 compliance to you?

How accessible do you find the navigation of the Purdue OWL?

How accessible do you find the content of the Purdue OWL?

Are there any areas that have caused you difficulty? If so, which area of the site and why was it difficult?

Pre-Test Screener from G4

Participant Pre-Test Session Questions

Thank you for your interest in the Accessibility testing for the Purdue OWL. We are completing this testing to make sure the OWL is accessible and efficient for individuals with vision impairments or blindness. We also conducting this research to help us develop resources that will assist individuals with vision impairments or blindness conduct research and write at Purdue University. As such, we are interested in learning about your computer use and writing habits. The following questions help us set up the testing session and help us begin collecting information about your computer use.

- 1) We are particularly interested in including people with vision impairments or blindness in this study. Do you have a vision impairment or are you blind? *If yes, please briefly describe your disability.*
- 2) Do you use any assistive technologies (AT), specialized computer access software or hardware, or adaptive strategies? *(if needed, can provide examples: such as screen readers, voice input, alternative keyboard or pointing device)*
- 3) Which assistive technologies (AT) or adaptive strategies do you use with Web sites? Do you use a specific version?
- 4) How long have you been using this/these assistive technology/ies?
 - i. less than 3 months
 - ii. 3 months to 1 year
 - iii. more than 1 year
- 5) How would you rate your skill with each assistive technology you use? Use a scale of 1-7, where 1 is not skilled at all and 7 is very skilled. *Please respond to this question for each AT listed in number 3 above.*
- 6) Are there any accommodations or issues that we should be aware of that you will require to participate in the study (such as fatigue, communication)?
- 7) Before the testing session, we will send a confirmation letter and a consent form. In what format would you like these materials?:
 - a. Printed, any text size
 - b. Printed in large font -- *If yes, What is your preferred size and font face*
 - c. Braille -- *If yes, What type of Braille, e.g., Grade 1 or Grade 2*
 - d. Electronically (e-mailed or disk mailed) *If yes,*
 - i. Which format: accessible HTML, plain text, or other: ____
 - ii. Sent via e-mail or regular mail (on CD)
 - e. Verbally -- *If yes, What format: cassette tape mailed, electronic sound file e-mailed, or read over the phone*
- 8) Prior to and/or during the study, we will ask you to complete some tasks. How do you prefer to receive the instructions for the tasks:
 - a. Printed, any text size
 - b. Printed in large font -- *If yes, What is your preferred size and font face*
 - c. Braille -- *If yes, What type of Braille, e.g., Grade 1 or Grade 2*
 - d. Electronically -- *If yes, What format: accessible HTML, plain text, or other: ____ if yes, What type of media: CD or USB Jump Drive*
 - e. Verbally, read to me

Demographic Questionnaire from G4

Demographic Questionnaire	
Thank you for your willingness to participate in the OWL accessibility tests. We appreciate your time and value the feedback you will provide us. Please respond to the following questions by placing a check mark in the appropriate box. Fill in any information you are willing to share on the lines provided.	
1.	I am ____ years old.
2.	I am: <input type="checkbox"/> male / <input type="checkbox"/> female.
3.	Have you ever used the Purdue OWL? <input type="checkbox"/> Yes / <input type="checkbox"/> No / <input type="checkbox"/> I don't know
4.	How frequently do you use the Purdue OWL? <input type="checkbox"/> Several times a day <input type="checkbox"/> Several times each week <input type="checkbox"/> Once or twice a week <input type="checkbox"/> Rarely <input type="checkbox"/> Never / Not to my knowledge
5.	How often do you use the computer to find writing-related information? <input type="checkbox"/> Several times a day <input type="checkbox"/> Several times each week <input type="checkbox"/> Once or twice a week <input type="checkbox"/> Rarely <input type="checkbox"/> Never / Not to my knowledge
6.	Is English your first language? <input type="checkbox"/> Yes / <input type="checkbox"/> No / <input type="checkbox"/> I don't know
7.	Would you say you speak English fluently? <input type="checkbox"/> Yes / <input type="checkbox"/> No / <input type="checkbox"/> I don't know

Pre-Test Survey from G4

Please indicate the response that most closely approximates how you feel about the statement. Each statement can be answered in the following ways: strongly disagree, disagree, neutral, agree, strongly agree.					
I am comfortable operating a computer.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am comfortable navigating the Internet.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I often turn to the Web to find information.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I frequently use the Web for communication (email, instant messaging, chat, blog).	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am comfortable building and maintaining Websites.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am confident in my writing ability.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am familiar with concepts in the study of writing.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When faced with a writing question, I am likely to consult a book.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When faced with a writing question, I am likely to consult a Website.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When faced with a writing question, I am likely to ask another person.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I do not enjoy talking about my writing.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I prefer to look up information online rather than in a book.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I prefer to talk to a real person rather than search for answers online.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
When I cannot find an answer immediately, I often give up the search.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Usability Test from G4

OWL Task Protocol

Proctor: Please navigate to owl.english.purdue.edu, the Purdue OWL homepages. During this phase of the test, we would like you to use the site to find specific information, which will be given to you shortly. You are not going to be evaluated on your proficiency with navigating the Internet or using the computer, rather, this test is to see how well the site allows you to find particular information. That is, we are testing the *site* and not you.

TASK 1: *Question: According to the OWL website, how does the internet publication process differ from print-based publication?*

TASK 2: Please navigate back to owl.english.purdue.edu. Use the website to find cures to common causes of writer's block. Locate the advice for dealing with stress. How many solutions are offered?

Proctor: During this phase of the test, we would like you to continue to use the site to find specific information. However, for the next two questions we would like you to talk us through what you are doing to find the information and why you are doing it. In other words, as you navigate the site to find specific information, please explain your process.

TASK 3: Please navigate back to owl.english.purdue.edu. When would you have a 3 or more page resume?

Answers are based on applying for a senior-level management position with leadership experience or for applying for research or scientific position, particularly university faculty positions.

TASK 4: Please navigate back to owl.english.purdue.edu. Imagine that you are writing a paper for a social science class and you are asked to be exploring observation as a part of primary research. Can a researcher focus on everything happening at the observational site?

"Before you observe, you should consider how you will focus your observations--because you can't focus on everything!"

After-Test Questionnaire from G4

Directions: Please answer the following questions based on your experiences during the computer task.

Overall, finding specific information was:	Very Difficult	Difficult	Neutral	Easy	Very Easy
Organization of the home page was:	Very Ineffective	Ineffective	Neutral	Effective	Very Effective
Most of the information was:	Buried Deeply in Pages	Somewhat Buried	Neutral	Accessible	Very Accessible
The site organization was:	Very Ineffective	Ineffective	Neutral	Effective	Very Effective
The site navigation was:	Buried Deeply in Pages	Somewhat Buried	Neutral	Accessible	Very Accessible
When I was looking for information, I felt:	Very lost	Somewhat Lost	Neutral	I knew where I was	I really knew where I was
How did you feel when using the site:	Very Confused	Confused	Neutral	Comfortable	Very Comfortable

What features would have helped you find the information faster?

What other changes would you make to the site?

On a scale of 1 – 10, with 10 being the most accessible and 1 being the least accessible, how would you rate the OWL?

What is an example of a “10” site to you?

Interview Questions from G4

Interview Questions

- When did you start using a computer?
- How often do you write?
- What kinds of things do you write?
- How important is a computer to your writing? Has it changed the amount of writing that you do?
- How would your writing change if you did not have access to a computer? (assuming the participant uses a computer to write)
- Do you have services to help you write? (If so, what services?)
- It has been said that the Internet breaks down barriers between people. We're interested in your experience:
 - Please tell us how you have used the Internet to communicate with people who share your concerns.
 - Please tell us how you have used the Internet to connect with people you may not have otherwise known.
- Has your connection to the Internet changed the amount of face-to-face communication you do?
- Has having an Internet connection changed your life? If so, how?
- Does anything bother you about Websites?
- How accessible do you find the Internet to be in general? Are there specific parts that are more or less navigable?
- What resources would you like to see OWL offer:
 - On research?
 - On writing?

After-Test Interview Questions from G4

After-Test Interview Questions

- How do you feel about this testing experience?
- What were your reactions to the whole testing process (contact, screening, us coming here)?
- Was the test itself usable/accessible? If so, how? If not, why not?
- If you had any suggestions on how to improve the test itself, what would they be?
- Did any parts of the test seem unimportant?
- What part of the test was most valuable?
- What parts of the test went well? Which parts of the test did you have difficulty with?
- Are there any additional problems/issues you see with the OWL that did not come up during testing?
- Did you find any of the questions or tasks discriminatory or marginalizing?
- Did you find any of the researchers discriminatory or marginalizing?
- What do you think about us running these tests in general?
- Do you have anything else you'd like to contribute?