Improving Independent Student Navigation of Complex Educational Web Sites: An Analysis of Two Navigation Design Changes in LibGuides

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ABSTRACT

Can the navigation of complex research websites be improved so that users more often find their way without intermediation or instruction? Librarians at Eastern Michigan University discovered both anecdotally and by looking at patterns in usage statistics that some students were not recognizing navigational elements on web-based research guides, and so were not always accessing secondary pages of the guides. In this study, two types of navigation improvements were applied to separate sets of online guides. Usage patterns from before and after the changes were analyzed. Both sets of experimental guides showed an increase in use of secondary guide pages after the changes were applied whereas a comparison group with no navigation changes showed no significant change in usage patterns. In this case, both duplicate menu links and improvements to tab design appeared to improve independent student navigation of complex research sites.

INTRODUCTION

Anecdotal evidence led librarians at Eastern Michigan University (EMU) to investigate possible navigation issues related to the LibGuides platform. Anecdotal evidence included (1) incidents of EMU librarians not immediately recognizing the tab navigation when looking at implementations of the LibGuides platform on other university sites during the initial purchase evaluation, (2) multiple encounters with students at the reference desk who did not notice the tab navigation, and (3) a specific case involving use of a guide with an online course.

The case investigation started with a complaint from a professor that graduate students in her online course were suddenly using far fewer resources than students in the same course during previous semesters. The students in that semester's section relied heavily—often solely— on one database, while most students during previous semesters had used multiple research sources.

This course has always relied on a research guide prepared by the liaison librarian, the selection of resources provided had not changed significantly between the semesters, and the assignment had not changed. Furthermore, the same professor taught the course and did not alter her recommendation to the students to use the resources on the research guide.

What had changed between the semesters was the platform used to present research guides. The library had just migrated from a simple one-page format for research guides to the more flexible multipage format offered by the LibGuides platform. Only a few resources were listed on the first

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LibGuides page of the guide used for the course. Only one of these resources was a subscription database, and that database was the one that current students were using to the exclusion of many other useful sources.

After speaking with the professor, the liaison librarian also worked one-on-one with a student in the course. The student confirmed that she had not noticed the tab navigation and so was unaware of the numerous resources offered on subsequent pages. The professor then sent a message to all students in the course explaining the tab navigation. Subsequently the professor reported that students in the course used a much wider range of sources in assignments.

Statistical Evidence of the Problem

A look at statistics on guide use for fall 2010 showed that on almost all guides the first pages of guides were the most heavily used. As the usual entry point, it wasn't surprising that the first pages would receive the most use; however, on many multipage guides, the difference in use between the first page and all secondary pages was dramatic. That users missed the tab navigation and so did not realize additional guide pages existed seemed like a possible explanation for this usage pattern.

Librarians felt strongly that most users should be able to navigate guides without direct instruction in their use, and they were concerned by the evidence that indicated problems with the guide navigation. Was there something that could be done to improve independent student navigation in LibGuides? Two types of design changes to navigation were considered. To test the changes, each navigation change was applied to separate sets of guides. Usage patterns were then compared for those guides before and after changes were made. The investigators also looked at usage patterns over the same period for a comparison group to which no navigation changes had been made.

LITERATURE REVIEW

Navigation in LibGuides and Pathfinders

The authors reviewed numerous articles related to LibGuides or pathfinders generally, but found few that mention navigation issues. They then turned to studies of website navigation in general.

In an early article on the transition to web-based library guides, Cooper noted that "computer screens do not allow viewers to visualize as much information simultaneously as do print guides, and consequently the need for uncomplicated, easily understood design is even greater."[1]

Four university libraries' usability studies of the LibGuides platform specifically address navigation issues. University of Michigan librarians Dubicki et al. found that "tabs are recognizable and meaningful—users understood the function of the tabs."[2] The Michigan study then focused on the use of meaningful language for tab labels. However, at the LaTrobe University Library (Australia), Corbin and Karasmanis found a consistent pattern of students not recognizing the navigation tabs, and so recommended providing additional navigation links elsewhere on the page.[3] At the University of Washington, Hungerford et al. found students did not immediately recognize the tab navigation:

> During testing it was observed that users frequently did not notice a guide's tabs right away as a navigational option. Users' eyes were drawn to the top middle of the page first and would focus on content there, especially if there was actionable content, such as links to other pages or resources.[4]

The solution at the University of Washington was to require that all guides have a main page navigation area (LibGuides "box") with a menu of links to the tabbed pages. After a usability study, MIT Libraries also recommended use of a duplicate navigation menu on the first page, stating in MIT Libraries staff guidelines for creating LibGuides to "make sure to link to the tabs somewhere on the main page" as "users don't always see the tabs, so providing alternate navigation helps."[5]

Navigation

Palmer mentions navigation as one of the factors most significantly associated with website success as measured by user satisfaction, likelihood to use a site again, and use frequency.[6] However, effective navigation may be difficult to achieve. Nielsen found in numerous studies that "*users look straight at the content and ignore the navigation areas* when they scan a new page."[7] In a presentation on the top ten mistakes in web design, human–computer interaction scholar Tullis included "awkward or confusing navigation."[8] The following review of the literature on website navigation design is limited to studies of navigation models that use browsing via menus, tabs, and menu bars.

The navigation problem seen in LibGuides is far from unique. Usability studies for other information-rich websites demonstrate similar problems with users not recognizing navigation tabs or menu bars similar to those used in LibGuides. In 2001, McGillis and Toms investigated the usability of a library website with a horizontal navigation bar at the top of the page, a design similar to the single row of LibGuides tabs. This study found that users either did not see the navigation bar or did not realize it could be clicked.[9] In multiple usability studies, U.S. Census Bureau researchers found similar problems with navigation bars on government websites. In 2009, Olmsted-Hawala et al. reported that study participants did not use the top-navigation bar on the Census Bureau's Business and Industry website.[10] The next year, Chen et al. again reported problems with top-navigation bar use on the Governments Division public website, explaining that the "top-navigation bar blends into the header, leading participants to skip over the tabs and move directly to the main content. This is a recurring issue the Usability Laboratory has identified with many Web sites."[11]

One possible explanation for user neglect of tabs and navigation bars may be a phenomenon termed "banner blindness." As early as 1999, Benway provided in-depth analysis of this problem. In his thesis, he uses the word "banner" not just for banner ads, but also for banners that consist of horizontal graphic buttons similar to the LibGuides tab design. Benway's experiments show that an attempt to make important items visually prominent may have the opposite effect— that "the visual distinctiveness may actually make important items seem unimportant." Benway follows with two recommendations: (1) that "any method that is created to make something stand out should be carefully tested with users who are specifically looking for that content to ensure that it does not cause banner blindness," and (2) that "any item visually distinguished on a page should be duplicated within a collection of links or other navigation areas of the page. That way, if searchers ignore the large salient item, they can still find what they need through basic navigation."[12]

In 2005, Tullis cited multiple studies that showed that users found information faster or more effectively by using a simple table of contents than by using other navigation forms, including tab-based navigation.[13] Yet in 2011, Nicolson et al. found that "participants rarely used table of contents; and often appeared not to notice them."[14] Yelinek et al. pointed to a practical problem in using content menus on LibGuides pages: since LibGuides pages can be copied or mirrored on other guides, guide authors must be cognizant that such menus could cause problems with incorrect or confusing navigational links on copied or mirrored pages.[15]

Success can also depend on the location of navigational elements, although researchers disagree on effects of location. In addition, user expectations of where to look for navigation elements may change over time along with changes in web conventions. In 2001, Bernard studied user expectations as to where common web functions would be located on the screen layout. He found that "most participants expected the links to web pages within a website to be almost exclusively located in the upper-left side of a web page, which conforms to the current convention of placing links on [the] left side."[16] In 2004, Pratt et al. found that users were equally effective using horizontal or vertical navigation menus, but when given a choice more users chose to use vertical navigation.[17] Also in 2004, McCarthy et al. performed an eye-tracking study, which showed faster search times when sites conformed to the expected left navigation menu and a user bias toward searching the middle of the screen; but it also found that the initial effect of menu position diminished with repeated use of a site.[18] Nonetheless, Jones found that by 2006 most corporate webpages used "horizontally aligned primary navigation using buttons, tabs, or other formatted text."[19] In 2008, Cooke found that users looked equally at left, top, and center menus; however, when "a visually prominent navigation menu populated the center of the Web page, participants were more likely to direct their search in this location."[20]

Wroblewski describes how tab navigation was first popularized by Amazon.[21] Burrell and Sodan investigated user preferences for six navigation styles and found that users clearly preferred tab navigation "because it is most easily understood and learned."[22] In the often-cited web design manual *Don't Make Me Think*, Krug also recommends tabs: "Tabs are one of the very few cases where using a physical metaphor in a user interface actually works."[23]

Krug recommends that tabs be carefully designed to resemble file folder tabs. They should "create the visual illusion that the active tab is in front of the other tabs . . . the active tab needs to be a different color or contrasting shade [than the other tabs] and it has to physically connect with the space below it. This is what makes the active tab 'pop' to the front."[24] An often-cited U.S. Department of Health and Human Services manual on research-based web design addresses principles of good tab design, stating that tabs should be located near the top of the page and should "look like clickable versions of real-world tabs. Real-world tabs are those that resemble the ones found in a file drawer."[25] Nielsen provides similar guidelines for tab design, which include that the selected tab should be highlighted, the current tab should be connected to the content area (just like a physical tab), and that one should use only one row of tabs.[26] More recently, Cronin highlighted examples of good tab design that effectively use elements such as rounded tab corners, space between tabs, and an obvious design for the active tab that visually connects the tab to the area beneath it.[27] Christie also provides best practices for tab design that include consistent use of only one row of tabs, use of a prominent color for the active tab and a single

background color for unselected tabs, changing the font color on the active tab, and use of rounded corners to enhance the file-folder-tab metaphor.[28]

Two articles mention that the complexity of a site can be a factor in navigation success. McCarthy et al. found that search times are significantly affected by site complexity and recommended finding ways to balance the provision of numerous user options with simplifying the site so that users can find their way.[29] Little specifically suggests reducing the amount of extraneous information on LibGuides pages in her article, which applies cognitive load theory to use of library research guides.[30]

In sum, effective navigation is difficult to achieve. However, navigation design can be improved by considering the purpose of the site, user expectations, common conventions, best practices, the possibility that intuitive ideas for design may not perform as expected (e.g., banner blindness), the site's complexity, and more.

RESEARCH QUESTION AND METHOD

Could design changes improve independent student use of LibGuides tab navigation? The literature reviewed above suggested two likely design changes to test: adding additional navigation links in the body of the page and improving the tab design. Testing these design changes on selected guides would allow the EMU library to assess the impact before implement changes on all library research guides. For this experiment, each type of navigation change was applied to separate subsets of guides; a subset of similar guides was selected as a comparison group; and usage patterns were analyzed for similar periods before and after changes were made.

Navigation design changes were made to fourteen subject guides related to business. The business subject guides were divided into two experimental groups of seven guides. In group A, a table of contents box with navigation links was added to the front page of each guide, and in group B, the navigation tabs were altered in appearance. No navigation changes were made to comparison group C. Class specific guides were excluded from the experiment, as in many cases the business librarian would have instructed students in the use of tabs on class guides. Changes were made at the beginning of the winter 2011 semester so that an entire semester's data could be collected and compared to the previous semester's usage patterns.

The design for group A was similar to the University of Washington implementation of a "What's in the Guide" box on guide homepages that repeated the tab navigation links.[31] For guides in group A, a table of contents box was placed on the guide homepages. It contained a simple list of links to the secondary pages of the guides, using the same labels as on the navigation tabs. The table of contents box used a larger font size than other body text and was given an outline color that contrasted with the outline color used on other boxes and matched the navigation tab color to create visual cues that this box had a different function from the other boxes on the page (navigation). The table of contents box was placed alongside other content on the guide homepages so users could still see the most relevant resources immediately. Figure 1 shows a guide containing a table of contents box.

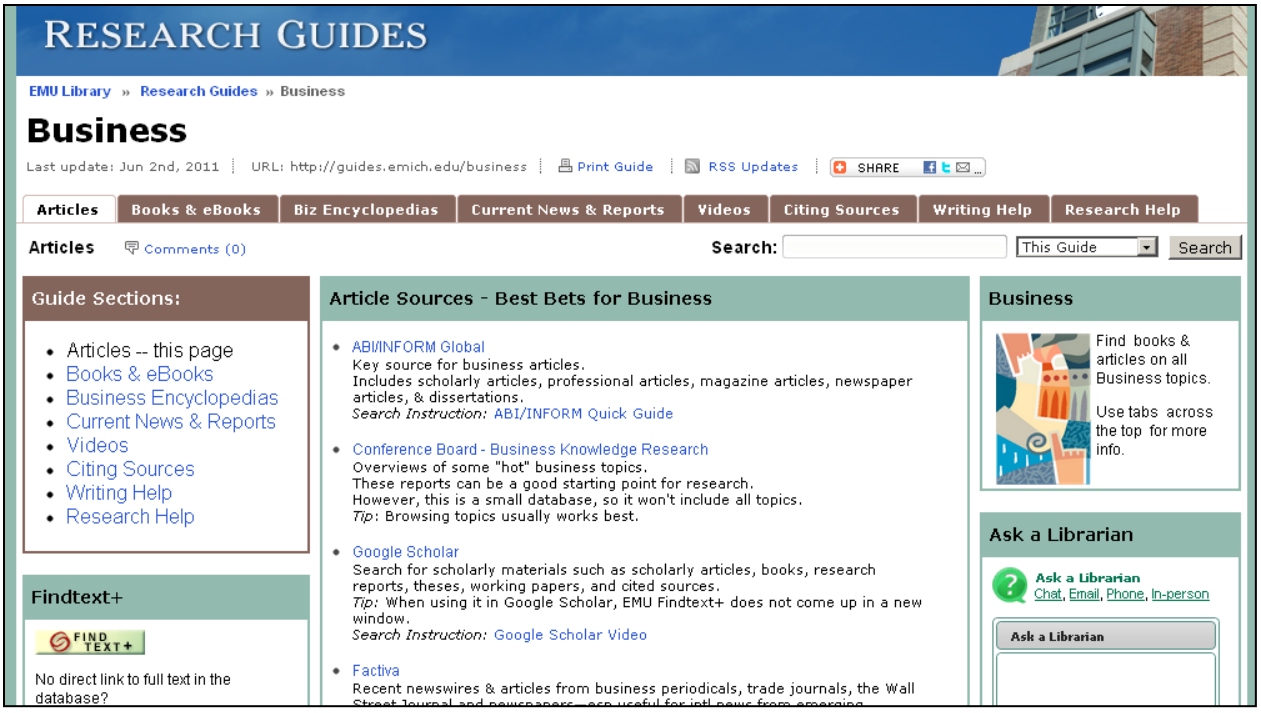

Figure 1. Group A Guide with Content Menu Box Labeled "Guide Sections"

The design change for group B focused on the navigation tabs. LibGuides tabs exhibit some of the properties of good tab design, such as allowing for rounded corners and contrasting colors for the selected tabs. Other aspects are not ideal, such as the line that separates the active tab from the page body.[32] In the EMU Library's initial LibGuides implementation, the option for tabs with rounded corners was used to resemble the design of manila file folders and increase the association with the file-folder metaphor. Possibilities for further design adaptation on the experimental guides were somewhat limited because these changes needed to be applied to the tabs of just a selected set of guides. The investigators theorized that increasing the height of the tabs might make them more closely resemble paper file folder tabs. Increasing the height would also increase the area of the tabs, and the larger size might also make the tabs more noticeable.

This option was simple to implement on the guides in group B by adding html break tags, *
*, to the tab text. Taller tabs also provided more room for text on the tabs. Tabs in LibGuides will expand in width to fit the text label used, and if the tabs on a guide require more space on the page, they will be displayed in multiple rows. Multiple rows of tabs are visually confusing and break the tabs metaphor, decreasing their usefulness for navigation.[33] The EMU Library's best practices for research guides already encouraged limiting tabs to one row. Adding height to tabs allowed for clearer text labels on some guides without expanding the tab display beyond a single row. Figure 2 shows a guide containing the altered taller tabs.

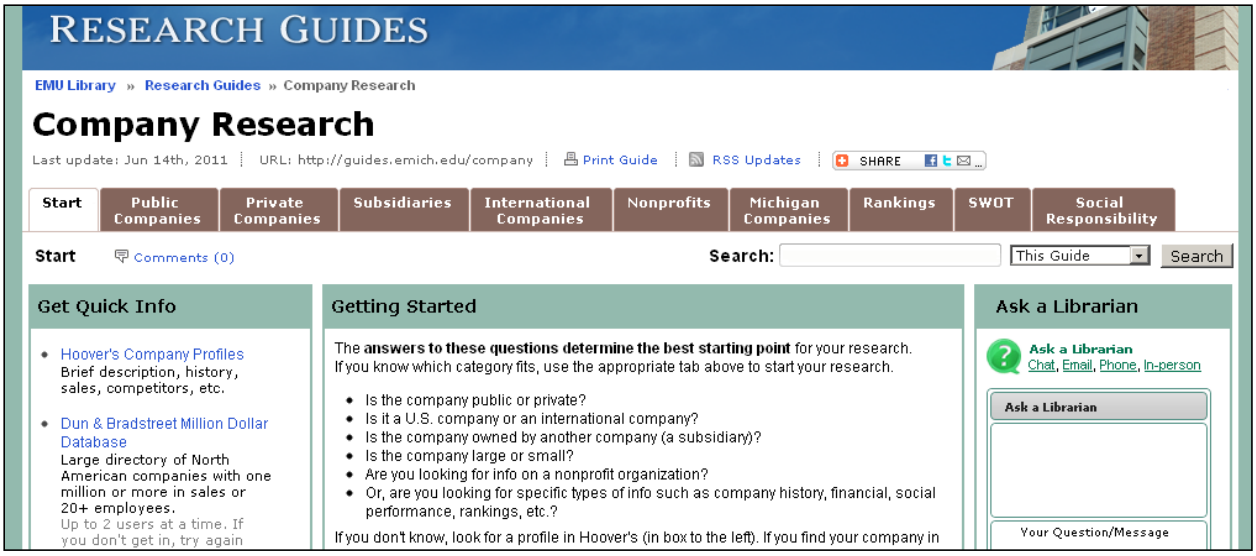

Figure 2. Group B Guide with Tabs Redesigned to Look More Like File Folder Tabs

While variations in content and usage of library guides did not allow for a true control group, other social science subject guides were selected as a comparison group. Social science subject guides were excluded from the comparison group if they had very low guide usage during the fall 2010 semester (fewer than thirty uses), or if they had fewer than three tabs, making them structurally dissimilar to the business guides. This left a group of sixteen comparison guides. No changes were made to the navigation design of these guides during the test period.

The business guides—which the authors had permission to experiment with—tend to be longer and have more pages than other guides. On average, the experimental guides had more pages per guide than the comparison guides; guides in groups A and B averaged nine pages per guide, and comparison guides averaged five pages per guide. Guides with more pages will tend to have a higher percentage of hits on secondary pages because there are more pages available to users. However, the authors intended to measure the *change* in usage patterns with each guide measured against itself in different periods, and the number of pages in each guide did not change from semester to semester.

DATA COLLECTION AND RESULTS

LibGuides provides monthly usage statistics that include the total hits on each guide and the number of hits on each page of a guide. Use of secondary pages of the guides was measured by calculating the proportion of hits to each guide that occurred on secondary pages. Data for the fall 2010 semester (September through December 2010) was used to measure usage patterns before navigation changes were made to the experimental guides. Data for the winter 2011 semester (January through April 2011) was used to measure usage patterns after navigation changes were made. Each would represent a full semester's use at similar enrollment levels with many of the same courses and assignments. Usage patterns for the comparison guides were also examined for these periods.

As shown in figures 3 and 4, in both group A and group B, the percentage of hits on secondary pages increased in five guides and decreased in two guides.

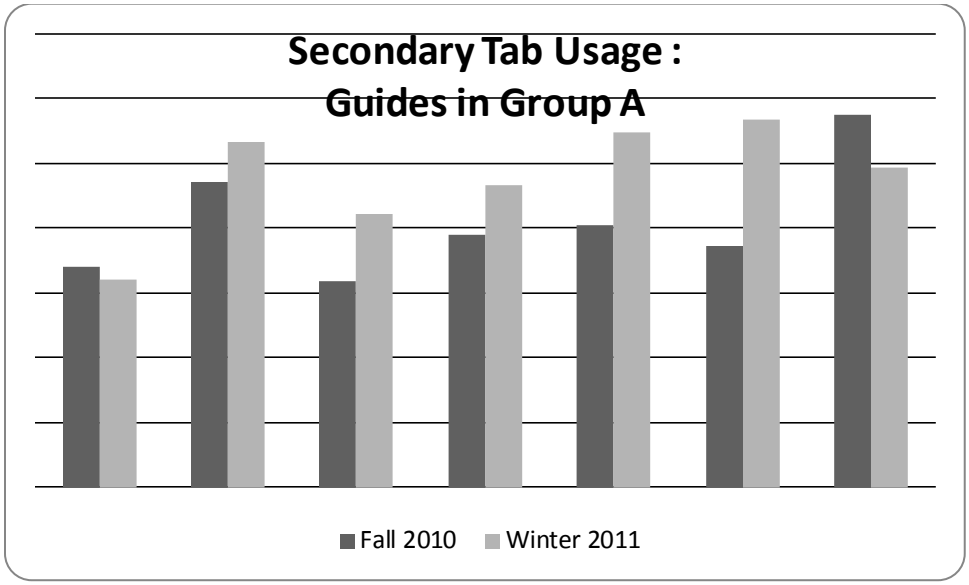

Figure 3. Group A: Change in Secondary Page Usage with Content Menus Added for Winter 2011

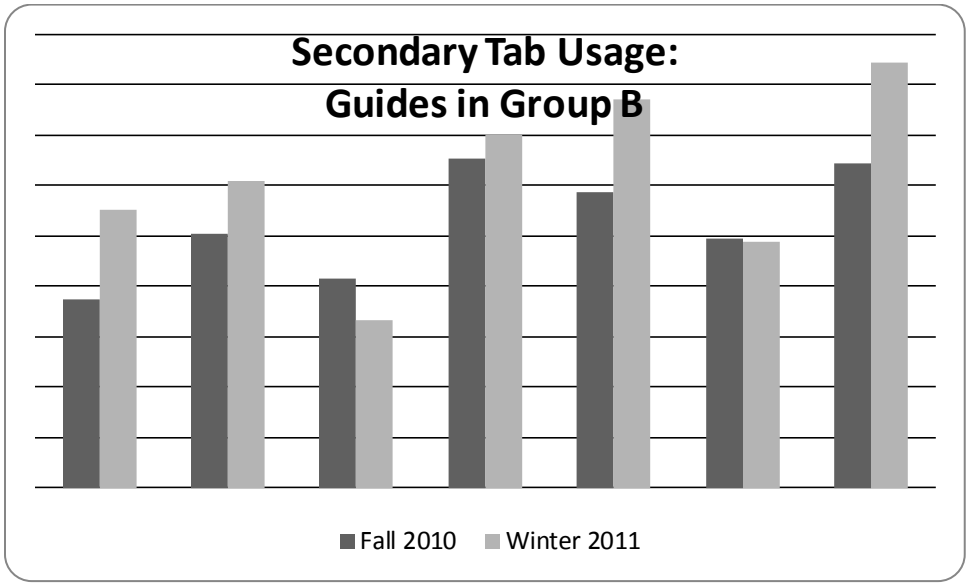

Figure 4. Group B: Change in Secondary Page Usage with New Tab Design for Winter 2011

Both groups of experimental guides showed an increase in use of secondary guide pages after the design changes were made. The median usage score was calculated for each group. Group A, with the added menu links, showed an increase of 10.3 points in the median percentage of guide hits on secondary pages. Group B, with redesigned tabs, showed an increase of 10.4 points in the median percentage of guide hits on secondary pages. Within the comparison guides, the proportion of hits

on secondary pages did not change significantly from fall 2010 to winter 2011. Table 1 shows the median percentage of guide hits on secondary pages before and after navigation design changes.

	Group A: Menu Links Added	Group B: Tabs Redesigned	Group C: Comparison Group
Fall 2010	39.1%	50.5%	37.7%
Winter 2011	49.4%	60.9%	37.4%

Table 1. Median Percentage of Guide Hits on Secondary Pages

The box plot in figure 5 graphically illustrates the range of the usage of secondary pages in each group of guides and the changes from fall 2010 to winter 2011, showing the minimum, maximum, and median scores, as well as the range of each quartile.

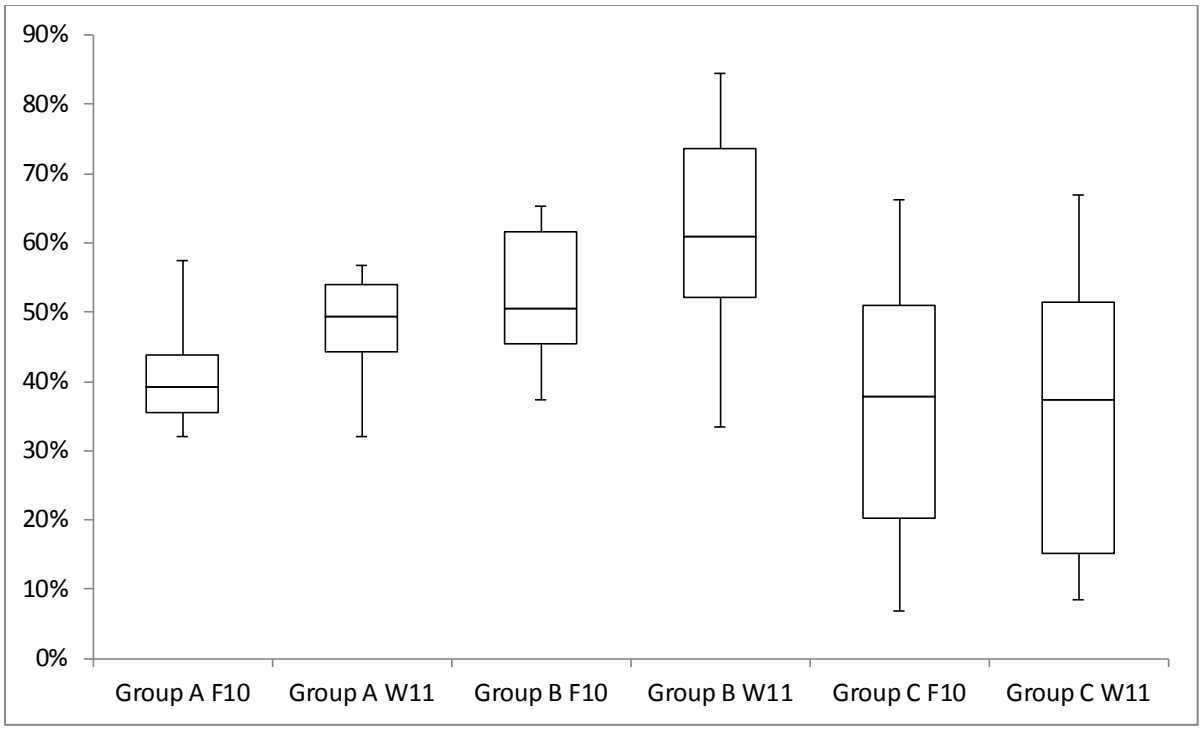

Figure 5. Distribution of Percentage of Guide Hits on Secondary Pages. This figure demonstrates the change in usage pattern for groups A and B and the lack of change in usage pattern for comparison group C.

Averages for the percentage change in secondary tab use were also computed for the combined experimental groups and the comparison group.

	Experimental or Comparison	N	Mean	Std. Deviation	Std. Error Mean
Change in secondary tab use	Experimental	14	.07871	.097840	.026149
	Comparison	16	-. 02550	.145977	.036494

Table 2. Average Change in Secondary Tab Use from Fall 2010 to Winter 2011, Comparing All Experimental Guides (Groups A & B) With All Comparison (Group C) Guides.

When comparing all experimental guides and all comparison guides, the change in use of secondary pages was found to be statistically significant. The average change in use of secondary pages for all experimental guides (groups A and B) was .07871, and the average for all comparison guides (group C) was -.02550. A *t* test showed that this difference was significant at the $p < .05$ level ($p = .032$).

STUDY LIMITATIONS

In some (possibly many) cases, the first page of the guide provides all necessary sources and advice for an assignment. We measured actual *use* of secondary pages, but were unable to measure *recognition* of navigation elements where the student did not use the secondary pages because they had no need for additional resources.

Because it wasn't possible to control use of the guides during the periods studied, it is possible that factors other than the design changes contributed to the pattern of hits. Though subject guides rather than class guides were used to limit the influence of instruction in the use of guides, it wasn't possible to determine with certainty if other faculty members instructed a significant number of students in the use of particular guides during the periods examined.

The comparison group was slightly dissimilar in that they had fewer pages than the experimental guides; however, the number of pages on a guide did not correlate with a *change* in percentage of hits on secondary pages from one semester to the next.

APPLICATION OF FINDINGS

When presented with the study results, the full library faculty at EMU expressed interest in using both design changes across all library research guides. The change to tab design—which is easiest to implement—has been made to all subject guides. Some librarians also chose to add content menus to selected guides.

Since the complexity of research guides is also a factor in successful navigation,[35] a recent LibGuides enhancement was used to move elements from the header area to the bottom of the guides. The elements moved out of the header included the date of last update, guide URL, print option, and RSS updates. The investigators hypothesize that the reduced complexity of the header may help in recognizing the tab navigation.

Although convinced that the experimental changes made a difference to independent student navigation in research guides, the authors hope to find further ways to strengthen independent navigation. Vendor design changes to enhance the tab metaphor, such as creating a more visible connection between the active tab and page, might also improve navigation.[36]

CONCLUSION

Designing navigation for complex sites, such as library research guides, is likely to be an ongoing challenge. This study suggests that thoughtful design changes can improve navigation. In this case, both duplicate menu links and improvements to tab design improved independent student navigation of complex research sites.

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