

Metrics and the Success of a Higher Education Non-transactional Website

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Abstract

The purpose of this study was to discover relationships between metrics and usability standards to assess the success of the University of North Carolina System Office website. Though no relationship was arguably found, the study results will be used to improve the UNC System Office website and other non-transactional websites that convey policy based information to the general public. Remote usability testing with nine users on desktop computers revealed that the site succeeds in terms of aesthetic design and top-level navigation but suffers from critical errors, poor organization, and an overuse of industry-specific terminology. The testing results demonstrate the importance of presenting the wide breadth of information to the general public in a way that is visually appealing and topical for some while direct and deeply specialized for others. Above all, the study provides a case study in conducting usability testing.

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With the deepest gratitude and appreciation, I say, "thank you" everyone else that has supported my children and me during this process. I can only hope to give back what I have been given and will work to do so.

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List of Abbreviations

KPI	Key Performance Indicator
UNC-CH	University of North Carolina at Chapel Hill
ADA	Americans with Disabilities Act

Chapter 1: Introduction

While studying media channels in 1940, Paul Lazarsfeld found that consumers will engage with media that they find useful and gratifies them in some way. In 2020, content creators are still applying this “uses and gratifications” perspective to attract an audience (Rubin, 1994). Online media is no exception. While a website for children might need to be designed with *fun* as a consideration, banking sites often need to consider factors such as *efficiency*. Therefore, while bright colors and cartoon characters may appeal to some and dollar signs to others, above all, websites must be usable or business can suffer. Poor website usability affects customer retention and repeat sales and can lead to a businesses’ failure (Becker and Moffet, 2003). Further, websites that users perceive as highly usable help users build trust in an organization (Ivory, 2000). Once that trust has been established, it must be maintained since users rate trusting a website as more important for usability than graphics and multimedia, interactivity, ease of navigation, and website download speed (Nathan and Yeow, 2010).

Steven Krug’s book, *Don’t Make Me Think*, offers a simple and widely accepted definition of usability as “the ability for a person of normal intelligence, or below-average intelligence, to use a site to complete a task without it being more trouble than it’s worth.” How does an organization know if users are gratified with the organization’s website? By studying user behavior and testing, the organization can optimize the site to best serve users and know which issues are critical to success. This study considered the usability of higher education websites to determine which metrics were most valuable for success.

Web traffic, a form of metrics, can be measured with tools such as Google Analytics, AW Stats, as well as many others, to show users’ visits or paths through the site. Depending on the business, a rise in web traffic correlates to increased revenue (Clifton, 2010). For commercial

websites, the conversion rate (ratio of website hits compared to completed transactions) is arguably the most important metric or key performance indicator (KPI) (Bekavac & Pranicovic, 2015). For example, using an established conversion rate, Amazon.com can predict how many site visitors will complete transactions. A business-to-business website may gauge user satisfaction by studying how many visitors convert to a sales lead (Clifton, 2010).

Many other metrics support the drive to increase the conversion rate. Web metrics, such as session duration and bounce rate, all support the overall success of the site and therefore, the health of the business (Clifton, 2010). Even a quick site search time can help improve the user experience, that is, help people find products faster and make them more likely to buy (Clifton, 2010). As a result, the metrics of a website ultimately indicate the success of a commercial site.

While not all transactional websites are commercial, the relationship of metrics to conversion holds true. Some U.S. higher education websites have a clear transaction, such as collecting student applications (ex. The University of California System Office, <https://admission.universityofcalifornia.edu/apply-now.html>). These transactional higher education websites can monitor metrics to identify opportunities for improvement and increase conversions from visitor to applicant. Other higher education websites have no clear transaction and only provide information. The University System of Texas, the University System of Georgia, and the University of North Carolina System's website are such non-transactional websites. As these websites are non-transactional, the metrics do not necessarily indicate website success; the higher numbers simply indicate more activity. For example, the University of North Carolina System's website does not accept student applications, does not sell products, and does not generate sales leads; therefore, the site does not have many of these classic forms of conversions from page view to completed transaction. As a result, these website metrics do not

necessarily initially indicate the user satisfaction of a site. Since there is no clear conversion for the UNC System website at NorthCarolina.edu, website success was measured by user satisfaction via usability testing and the results compared to the session metrics.

In “2019 E-Expectations[®] Trend Report,” Ruffalo Levitz found university websites are rated as the most important research tool for parents and students when considering higher education. Research conducted by Montero and Fernández (2004) indicates that websites which violate usability conventions confuse and frustrate users. If university sites have poor usability, users could become frustrated, abandon their search for information and ultimately prevent them from attending. According to the U.S. Bureau of Labor Statistics, individuals without a college degree will earn much less (2017). Not only will the frustrated would-be student suffer financially, but according to The University System of North Carolina, the state economy will suffer since college degrees generated 63.5 billions dollars in added state income (2015).

This research study identified which metrics, if any, indicate a satisfying user experience for a higher education website that lacks a clearly identified conversion rate. To accomplish this, the study administered a usability test to determine user satisfaction, compared that data with the recorded metrics, and determined which metrics are most important to user satisfaction. The result generated a list of metrics most important to higher education websites.

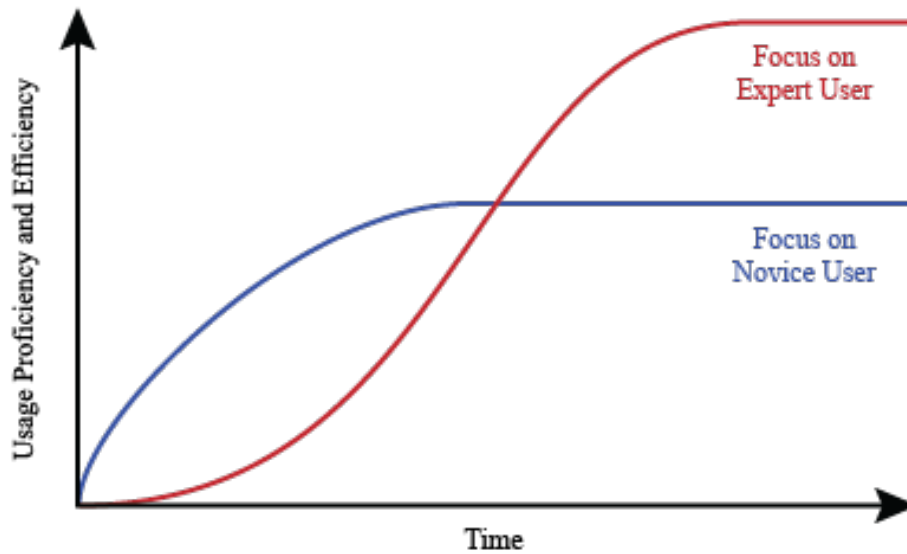
Chapter 2: Literature review

Website Usability Measurement

Website usability became an integral part of web design during the internet boom of the early 1990's (Barnum, 2010). Once formal, clinical, expensive, and time consuming (Barnum, 2010), testing was forever changed when Jakob Nielsen of Nielsen Norman Group demystified, simplified, and streamlined the process of usability testing and established many of the standards still in use today (Nielsen Norman Group, 2014). Nielsen states that website usability is based on five components: learnability, efficiency, memorability, errors, and satisfaction (Nielsen Norman Group, 2012). As noted in the following paragraphs, each of the five components are equally important and often build upon and/or affirm each other

Learnability

In his 1993 book Usability Engineering, Jakob Nielsen defines learnability as “ease of learning.” Many types of learnability exist and depend on the complexity or intended use of the system. For example, a system that users may walk up and use once (a museum map) should be easy to use. In contrast, experienced users getting a complex software package's latest release, the system can be more complex since the users have learned the basics (Telles, 1990). To illustrate this concept, Nielsen saw the learning curve gradual for novice users and steeper for more experienced users (see Figure 1).

Figure 1: Learnability Curves

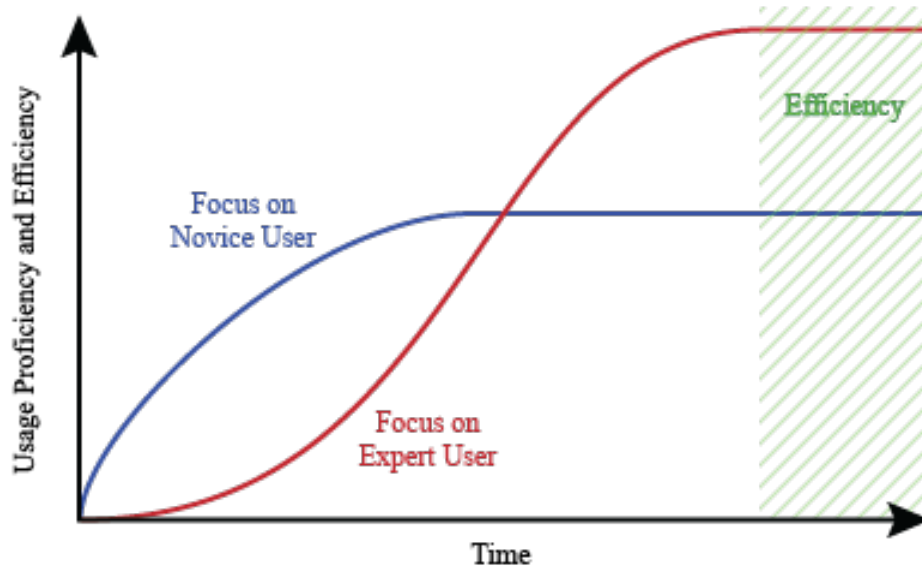
According to Nielsen, learnability is the easiest to measure (1993). The test administrator asks the participant to complete a task and the time to completion is measured. Later, the administrator assigns a nearly identical task for the participant and compares the result. If the website has good learnability, the time it takes to complete the task should be shorter the second time since the user learned the task the first time.

Testing learnability is especially valuable for complex applications and systems that users access frequently, though knowing how quickly users can acclimate to your interface is valuable for even objectively simple systems (Nielsen Norman Group, 2019). High learnability results in a quick system onboarding which translates to user's quickly becoming familiar with the site (Nielsen Norman Group, 2019). Additionally, good learnability can result in high satisfaction because users will feel confident in their abilities (Nielsen Norman Group, 2019). To measure learnability, users with prior knowledge of the website will be excluded from participation.

Efficiency of Use

After ascending the system learning curve and becoming proficient in the system, the user will reach a plateau where learning has slowed to almost nil (Carrol, 1987). This plateau noted in Figure 2 illustrates the efficiency of novice users compared to the efficiency of expert users.

Figure 2: Efficiency Plateau



Efficiency is defined as “how quickly users can perform tasks after they are familiar with the design and is based on giving users the flexibility to complete tasks based on that familiarity” (Nielsen Norman Group, 2019). Accommodating new users with time-consuming yet simple and obvious features to help accomplish routine tasks can frustrate expert users that might know shorter, less obvious methods (Carrol, 1987). The result is lower novice user efficiency while allowing for higher expert efficiency (Carrol, 1987). For example, a novice user may reload a web page by moving the mouse and clicking the reload arrow; whereas a more experienced user may just press the F5 key; both tasks accomplish the same outcome while one is more efficient.

In his 1993 book Usability Engineering, Jakob Nielsen defines learnability as “ease of learning.” Many types of learnability exist and depend on the complexity or intended use of the system. For example, a system that users may walk up and use once (a museum map) should be easy to use. In contrast, experienced users getting a complex software package’s latest release, the system can be more complex since the users have learned the basics (Telles, 1990). To illustrate this concept, Nielsen saw the learning curve gradual for novice users and steeper for more experienced users (see Figure 1).

Memorability

According to Nielsen, website memorability is defined as a system that a user can learn, leave, and return to later without having to relearn everything (1993). We encounter many forms of memorability in everyday life through two primary learning methods: emotional and metaphorical (Louise, 2003). The first type, emotion, is usually based on whether a user has a good experience (satisfaction of accomplishing a goal) or a bad experience (receiving an error) (Louise, 2003). For example, a form of negative association can be made when a user is surprised by an unexpected result (Louise, 2003). The second type of memorability, metaphorical, relies more on universal conventions (Louise, 2003, Carroll, 1982). For example, very few of us might live in a house shaped like a typical house icon, but most of us recognize clicking the symbol will return us to the home screen.

Since short-term memory famously holds only about seven chunks of information and can only hold them for approximately 20 seconds (Nielsen Norman Group, 2009), having easily memorable steps on a website is imperative for users to be able to quickly learn repeat steps, lest they be required to relearn use with each action or visit. Memorability can be measured by

comparing the time it takes to complete a task with no prior knowledge and then repeating the same or similar task (Louise, 2003).

Errors and Error Recovery

Experts agree that systems should be free from errors and if a user does encounter an error, how easily can the user recover (Nielsen, 1993, Dingli and Cassar, 2014). Errors refers to how many mistakes users make and how forgiving the site is after a mistake is made. Simply, encountering errors can frustrate users and erode trust in an organization (Ivory, 2000).

Designers and developers use techniques such as form auto-complete and form validations to limit user input errors, but must rely on user reports, error logs, and testing to discover technical errors (Ogata, Goto, Okano, 2016). Further, errors can lower the users efficiency (Ogata, et al., 2016). To test for errors and error recovery, users will be observed and errors will be noted by the administrator or by the participant using the post-test questionnaire (Wang, 2014).

Satisfaction

Finally, Nielsen states that all systems must be subjectively pleasant to use, lest the user abandon the system (1993). User satisfaction with a website is important to consider since user satisfaction affects perceived website usability (Belanche, Casaló, and Guinalú, 2012). User satisfaction levels are also cyclical: studies have proven that when a satisfied user leaves a website and returns, the user will feel more satisfied with each successful website visit (Cohen, 2006; Belanche, et al., 2012). To measure satisfaction, users will be asked to self-identify satisfaction levels in a post-test questionnaire.

Deviations

Deviations from Nielsen's components exist and have been met with varying degrees of acceptance. Researcher Booth (1989) and Kengeri, Seals, Harley, Reddy, and Fox (1999), found usefulness important. Brinck, Gergle, and Wood (2002) defined the components of usability as functionally correct (similar to whether the users' expectations were met after completing an action), and subjectively pleasing (similar to Nielsen's satisfaction component). Other researchers included first impressions (Hix & Hartson, 1993, Kengeri et al., 1999). Initial and long-term performance (defined slightly differently than Nielsen's error component) was included by Hix & Hartson's study in 1993. Unique components included likeability (Kengeri et al., 1999), interface effectiveness (Kim, 2002), and user attitude (Shackel, 1986 and 1991). On the fringe of industry acceptance are Oulanov & Pajarillo's (2002) concepts of affect (basically the user's stated opinion), control (could the user control his or her interactions), helpfulness, adaptability (a reverse of Nielsen's concept of learnability in that the user must adapt to the interface).

Testing Methods

Depending on the goals of the website, testing methods can vary greatly. Simply, website usability testing consists of observing users using various methods to complete tasks (Barnum, 2010). Testing procedures fell into five basic categories: questionnaires, observation and questionnaires, simple observation, technology based, and other. The most common data collection methods include questionnaires, observation, a combination of the two, heuristic evaluation, A/B testing, eye tracking, mouse tracking, and others. As of 2020, testing can occur with a single participant or, as Lenovo's test lead Leah Kaufman detailed at 2019 UX Y'all Conference in her presentation "Two heads Are Better Than One: Usability Testing with Duos and Groups = More Fun & Richer Info," using dyads or small groups.

Many researchers have administered usability tests with in-person questionnaires that vary in length and rigor with observation, remote questionnaire with no observation, and simple observation (Pant, 2015, Peker, Kucukozer-Cavdar, and Cagiltay, 2015, Babich, 2019). By using a combination of observation and questionnaires, researchers studied the usability of 5 university websites with accurate results (Peker, et al., 2015). For test participants that may be limited by geographic location, some researchers offer remote questionnaires without observation (Babich, 2019). In contrast, in the 2015 study "An Assessment of the Usability of the University of the West Indies (Mona, Jamaica) Main Library's Website," researchers Adrian St. Patrick Duncan and Fay Durrant assessed the usability of the UWI's main library website only using observation (2015).

Technology based data gathering tools can be utilized to provide more quantitative data. Eye tracking, tracking and recording where the study participant is looking (Nielsen & Pernice, 2010), was used by Kvasnicová and Kremeňová to monitor the eye movements of 15 volunteers.

Neil Dawson writes that eye tracking can be used in interviews to determine problems users might not articulate. For example, if a participant does not complete a task, researchers can review the eye tracking data to determine where the users may have been looking or gotten lost (Dawson, 2019).

Similar to eye tracking, mouse tracking follows user's mouse movements and clicks. Other automated tools that scan websites and evaluate them by attempting to predict website usage or adherence to heuristic guidelines (Chi, Cousins, Rosien, Supattanasiri, Williams, Royer, ... Chen, 2003). There are also a multitude of proprietary web-based testing tools currently available (ex./ Loop11 at www.loop11.com/). Benefits of using a web-based tool include a larger sample selection pool, on-the-fly design changes, A/B testing, real time data collection, and the ability to share data via the cloud.

Automated tools that utilize the emerging field of artificial intelligence are still being developed but are becoming more widely adopted; such as website scanning software "Sirius." With the software, experts assign heuristic guidelines to elements on a website and the Sirius tool values the elements (Torrente, Prieto, Gutiérrez, and Sagastegui, 2013) and then a lookup table is used to determine the usability of the website. In Dingli and Cassar's 2014 study "An Intelligent Framework for Website Usability," the researchers set out to develop an ideal web-based software tool which would evaluate a website's usability based on adherence to W3C accessibility guidelines and allowing users to choose design preferences. After the test was complete, the software would generate a list of suggestions. The tool Infigura developed by Thomas Tiedtke, Thomas Krach, and Christian Martin uses a combined information architecture, automated usability evaluation, and user data mining, but also requires human data interpretation to study specific websites (2005). Researchers Ruili Geng and Jeff Tian developed a tool that

deals specifically with the navigation characteristic of usability by interpreting server logs (2015). While compelling, the tool simply collected data for administrators to interpret in conjunction with participant observation. Less frequently used testing methods include automated software scanners, unsupervised traditional observation, and unsupervised surveys to varying degrees of success; though, many are used in niche applications or lack of supporting empirical evidence. For example, Hasan's study "Using university ranking systems to predict usability of University websites" attempts to discover a relationship between an educational website ranking tool, Eduroute, and the usability of the website (2013). Researchers Randolph G. Bias, Brian M. Moon and Robert R. Hoffman studied whether a user's mental model of a website matches the actual model of a site (2015).

Considering the types of testing discussed in the preceding literature review, the most commonly used method was contextual inquiry consisting of two complementary components: observation of the user completing preassigned tasks and a questionnaire to assess the demeanor of the user.

Chapter 3: Research Question(s)

1. What website metrics are most indicative of a successful higher education non-transactional website?
2. How do users feel about the website, and what improvements can be made following a usability test? What insights can be gained about metrics and website design from this process?

Chapter 4: Methods

In studying website usability, little research has been done on U.S. higher education non-transactional websites; particularly, in finding which metrics are indicative of user overall satisfaction. NorthCarolina.edu is a typical American higher education non-transactional website. In the past 8 years, the state-owned website www.NorthCarolina.edu, has undergone three major redesigns without regular usability testing creating problems for visitors and users. To find what metrics are indicative of a successful website, I conducted remote guided inquiry sessions with users. To begin, I developed a script based on Nielsen's usability standards where users were asked for opinions and to complete various tasks on the website such as locating information, submitting assistance requests, and navigation. I recruited participants via Facebook advertisements (Appendix B) and the UNC-Chapel Hill research pool. After initial contact, each participant completed a pre screening survey. With 9 respondents, I conducted individual video interviews. During the interviews, I video recorded users' faces and screen activity, recorded task success/failure, and made notes of user's comments. At the conclusion of the testing sessions, participants were given a survey and, upon completion, presented with a \$25 Amazon gift card.

Research Setting and Equipment

My guided inquiry sessions were originally scheduled to take place in the testing facilities on the UNC-CH campus. Due to the outbreak of the Coronavirus, or COVID-19 pandemic, campus was shuttered and testing was taken online and conducted remotely using the video conferencing software Zoom (<https://www.zoom.us/>). Since participants were in the natural environment of their own home using their own equipment, the environments proved adequate to provide valuable feedback. Of the nine participants, all used their own personal

laptop and desktop computers, either Windows or Apple operating systems, and either Google's Chrome web browser or Apple's Safari web browser.

Sampling

The NorthCarolina.edu website's intended audience of all North Carolina residents. Demographics of the sample will not be considered since there will be no control over the public website's users, nor is generalizability the goal of such a process. Therefore, the Facebook adverts (Appendix A) were shown only to Facebook users that had self-identified North Carolina residency. The listing on the UNC-CH website, Research for Me, excluded all users not in North Carolina. Even though the nationality of some users were non-American, each respondent was located in North Carolina at the time of testing.

Nine people responded and completed the prescreening survey. While researchers have observed between 5-400 volunteers in their studies, (Denton, Moody, and Bennett, 2016, Pant, 2015, Kvasnicová and Kremeňová, 2015, Peker, et al., 2016, Duncan and Durrant, 2015), Nielsen found that as few as five users can identify 80% of website problems (2000). Open enrollment lasted six days, collecting nine participants and satisfying the minimum number of users.

Availability of Resources

The resources needed for this project were readily available even after making required COVID-19 revisions. Equipment and costs are detailed in Figure 3. Since the study utilized human participants, IRB noted the data collected required Level II security measures. UNC-CH's Level II security measures include encrypted data transmission, password protected data storage,

and plans for destruction of data after conclusion of study. As a student, the tools required for Level II security were available to me at no cost.

Figure 3: Costs

Item	Cost	Extended Cost
Researcher's Computer	(Employer provided)	\$0
User's Computer	(User provided)	\$0
Qualtrics Software	(Employer provided)	\$0
Facebook Recruitment Ads	\$130.42	\$130.42
Participant Incentive	\$25 x 9	\$225.00
<hr/>		
TOTAL		\$355.42

Data Collection

Before each testing session, each user completed a pre-screening questionnaire (Appendix C). After initial email contact, each participant was codified by his or her email, minus the domain. In each testing session, I asked the participants questions from the script (Appendix E) while video recording the user's faces or screen activity. I made notes regarding users' answers, errors, or other interesting occurrences during the sessions. Screen and audio captures of the sessions allowed me to go back and review each session in terms of the success criteria and watch users' activity more closely in case anything was missed.

Data Analysis

After the testing sessions, the recordings and surveys were reviewed and the data were quantified into Nielsen's five elements of usability.

Learnability

According to Nielsen, learnability is the easiest to measure (1993). In the sessions, I asked the participant to complete a task and measured the time to completion. Later, I assigned a nearly identical task for the participant and compared the result. If the website has good learnability, the time it takes to complete the task should be shorter the second time since the user learned the task the first time. Therefore, the change in time will determine the website's learnability.

Efficiency of Use

As with learnability, efficiency was measured by timing users completing similar tasks and measuring the time between completions. If the website has a low efficiency, the time should decrease or stay the same; if the website has an efficient design, the time to complete tasks will decrease (Bailey, 2006).

Memorability

As with the prior two elements, memorability can be measured by comparing the time it takes to complete a task with no prior knowledge and then repeating the same or similar task (Louise, 2003). Therefore, I approached the measurement and quantification of memorability the same as with learnability and efficiency: I asked a participant to complete a task and recorded the

time it took to completion. Later, I asked the participant to complete a near identical task and compared the times.

Error and Recovery

Experts agree that systems should be free from errors and if a user does encounter an error, how easily the user can recover becomes important (Nielsen, 1993, Dingli and Cassar, 2014). To test for errors and error recovery, users were observed and errors were noted by the administrator or by the participant using the post-test questionnaire (Wang, 2014). Errors were categorized as minor, serious, and critical per the U.S. Department of Health and Human Services n.t.b.

- **Minor problems** were those that kept users from completing tasks as quickly or easily as they otherwise might but only briefly delayed progress.
- **Serious problems** were those that significantly slowed users' progress toward task completion or led users to less-than-ideal, but still acceptable, answers.
- **Critical problems** were those that prevented users from completing tasks at all or led users to incorrect answers.

Satisfaction

Finally, Nielsen states that all systems must be subjectively pleasant to use, lest the user abandon the system (1993). To measure satisfaction, users were asked to self-identify satisfaction levels in a post-test questionnaire.

Chapter 5: Limitations

While this study has been successful in determining the usability of the NorthCarolina.edu website, there were a few minor limitations that should be considered before repeating this study or applying the findings to another website.

Sample

Since the NorthCarolina.edu website is designed to appeal to all North Carolinians, the sample's demographics would have ideally matched the state's population. Unfortunately, according to data retrieved from the U.S. Census Bureau (<https://www.census.gov/quickfacts/NC>) and the self-reported data from respondents, the markups did not match. For example, NC's female population makes up 51.4% of the population as compared to the 44.4% of female participants. The most notable difference was minority representation. Minorities make up approximately 30% of NC's population while participants self-identified as a minority made up 44.4% of the sample. Even though the percentages did not match exactly, there was enough diversity in the sample to provide varied results.

Recruitment

Ideally, the study would have been made available to all North Carolinians and conducted in person at locations across the state to better develop understanding of users' environments and possible technological challenges. Due to health and safety concerns, recruitment took place solely online.

Chapter 6: Findings

Summary

Conducted over the course of three days, the testing sessions gathered data that attempted to measure Nielsen's five elements of usability. During testing, some users immediately became proficient with the website while others struggled. Surprisingly, users found critical errors on the site from which they were unable to recover leading to abandoned tasks. Additionally, unexpected discoveries were made with regards to recruitment and KPIs.

Answer to Research Questions

Summary of experience

In asking, "What website metrics are most indicative of a successful higher education non-transactional website?" I hoped to find a single number that could indicate the success of a website the same way that conversion rates indicate the general success of a transactional website. In each session, each participant attempted the tasks in very different ways, generating data that had no observed relationship to satisfaction or task completion. For example, I reviewed the sessions while looking for bounces (when a user lands on a page and immediately leaves). Some users immediately completed the task and bounced to the home page. Other users would begin the task by clicking on links, bouncing between pages, and ultimately abandon the quest. As a result, both users would generate high bounce rates, but the data would not imply success or failure. Simply, after reviewing each testing session in terms of Google Analytics' available data (pageviews, bounce rates, time on page, and session duration), I found no relationship between metrics and participants actions.

The sessions did, however, reaffirm the value of usability testing and provided useful feedback, as well as validation of the importance of the five elements of usability. In every testing session, some users completed the tasks quickly, others struggled but still completed tasks, while many gave up after encountering critical errors. As a direct result, the remainder of this report will focus on insights gleaned from the testing sessions while considering the five elements of usability.

Learnability, Efficiency of Use, and Memorability

To measure learnability, efficiency of use, and memorability, users were assigned a task and timed. Later, a similar task would be assigned and the times compared. If the website has a low efficiency, the time should increase or stay the same; if the website has an efficient design, the time to complete tasks will decrease (Bailey, 2006). Unfortunately, the questions designed to test learnability were not similar enough to produce computable results. Across users, some finished tasks immediately while others struggled before abandoning it. Even with the same user, some tasks would take less than a minute while a similar tasks may take three or four minutes. With each session, I saw evidence that these differences can be attributed to the adherence to design best practices and lack of familiarity with the university system.

Initially, the website users stated they found the website to be useful. Each user explored the homepage and the primary menu allowed users to browse and locate general topics. While working, the placement of the search box and visual hierarchy of the pages helped the users search for information that they did not see in the primary menu. Unfortunately, some of the users did not understand the terms or icons required by the tasks. For example, during the task “report an accessibility barrier,” only one participant understood the term “accessibility” in terms

of web design, and she admitted to working with vulnerable populations and using the term in her work often. None of the users understood or identified the accessibility icon even though it was in the header on every page. Additionally, users commented that industry terms and phrases used on the website “didn’t make sense” and caused many to give up while looking for information.

Errors and Recovery

During the testing sessions, users found many errors. Errors were categorized as minor, serious, and critical per the U.S. Department of Health and Human Services n.t.b. definitions. During the testing, no minor errors and only one serious error was recorded. The single serious error was noted when a user misspelled a search term and attempted to navigate to nonexistent pages. After the user discovered her error, she corrected the spelling, reentered her search, and completed the task. Therefore, the recovery time of the error was close to none. While few minor and serious errors might seem like good news, every user encountered critical errors that led to unfinished or abandoned tasks.

In every testing session, each user encountered at least one critical error. The most common critical error seemed to be unfamiliar terminology that confused students and lead to incorrect information. For example, when users were asked to log in to the website (www.NorthCarolina.edu), they often landed at the online programs page and attempted to log in there (online.NorthCarolina.edu/). While they felt the task was complete, they could not answer any follow up questions regarding the log-in process. The second most common error was the brand confusion between the UNC System office at www.NorthCarolina.edu and the UNC-Chapel Hill Campus website (www.unc.edu). Other critical errors included broken links and the

discovery of placeholder text. When users attempted navigating the virtual tour links, each link was broken and displayed a 404 page not found error with no fallbacks, no default search behavior, and no suggested course of action. Finally, the most critical error occurred when a user was exploring the site attempting to locate information. On a second level page (one page sub the primary menu in the site architecture), the page was blank with only the word “LOREM” displayed. Both the user and I were speechless and only when the participant laughed did the session continue. The placeholder text “LOREM” is indicative of an unfinished website and poor quality control and erodes the user’s perception of the brand.

Ultimately, the critical errors identified are in three main categories: poor information architecture, overly formal tone of content, and information density. In regards to the poor information architecture, the users often became lost after an average of four clicks and would default to the site search. In compounding the poor architecture, many times the user would be unfamiliar with the formal tone of content and formal terms being used on the website. For example, many people familiar with the University System understand the term “advancement” while none of the students interviewed knew the context. Another example occurred as none of the students knew what “accessibility” meant in the context of the website. Only after an explanation of ADA Compliance did the participants understand, indicating a clear disconnect between the content generators of the website and the visitors. Further, when a user was asked to submit an ADA request, he went to the Accessibility feature menu looking for the contact link. Finding no link, he commented, “It just seems like it should all be in the same place.”

Satisfaction

Even with the critical errors, the users seemed to enjoy the site and rated a high level of satisfaction during and after use. During testing, each user commented that the site appeared modern and stated that the photos of students were nice and engaging. Most of the users (six of the nine) were pleasantly surprised to find an interactive map on the campus page and said as much, while less than half of the users (four of the nine) did not like the functionality of the map. The behavior the users objected to were popups of information windows regarding the campuses that appeared when a mouse rolled over the campus marker. For clarification, six of nine users liked the map and four users did not like the roll-overs; only two users liked the map but did not like the roll overs.

Additional Findings

During the testing process, many additional discoveries were made before, during, and after the testing sessions. Though the recruitment methods were not being tested, the process found that Facebook advertisements did not perform as well as the free listing on the research4me.unc.edu website. In the sessions themselves, an attempt was made early on to stay as close to the script as possible, yet I found moments of candid banter generated unique user insights.

In recruiting for the study, I created nearly identical ads for the Facebook social media website and the Research for Me on the UNC-CH website. The Facebook advertisements (Appendix A) had a total cost of \$130.42USD. The UNC-CH listing was free for researchers. Within the first five days, I had a total of nine respondents, all from the UNC-CH website. The Facebook ad generated one candidate who did not respond to the initial screening email. Simply,

the Facebook recruitment advertisements (Appendix A) were a complete loss compared to the UNC-CH website.

In the actual testing sessions, I attempted to stay as close to the script as possible. I found that while testing, the formal language and structure of the test generated usable data. When I deviated from the script with brief explanations or answering questions, the participant would often reply with insightful comments. For example, when tasked with reporting an accessibility barrier, the participants found the accessibility menu but few of the respondents located the contact link. In a later testing session, I watched a participant stumble through the site silently and I asked, “what are you thinking right now?” Looking for the contact link, she casually stated, “you’d think the email link would be with all the other accessibility stuff.” Structurally, the site had been built in phases with many functional additional and deletions over time. With the participant’s lack of preconceptions and common sense approach, her suggestion seemed obvious, yet new.

Chapter 7: Discussion

The implications of this study are clear for the staff that maintain NorthCarolina.edu. Those charged with maintaining and improving the site can review these findings, examine the problems identified, and consider the suggested solutions.

Problems and Solutions

Learnability, Efficiency of Use, and Memorability

Learnability, efficiency of use, and memorability were measured by assigning a task, timing the users time to completion, and comparing the times. I discovered two issues. First, some users accomplished tasks within seconds while others struggled. Users often commented that they didn't understand the terms, icon, and jargon on the site. Second, the tasks did not seem similar enough to provide comparable data.

First, many of the users indicated that they simply didn't understand the terms and icons on the website. During testing, users made comments, such as "I say it but I didn't know what [that term] meant" and "Oh, we call that course catalog, not program inventory." Even though the website is designed for all North Carolinians, many of the sections and verbiage were developed by internal UNC System office personnel. To help non-System personnel navigate and use the site, more testing should be done by North Carolinians unfamiliar with the internal structure of the University System. When non-employees express confusion, the headlines, links, and other text should be rewritten into plain English or other languages as required. If the terms cannot be changed due to legal or policy restrictions, the simplified plain text should be included in a linked help section or available as a contextual tool tip.

Users also commented that the icons were confusing, particularly the accessibility icon. As a recipient of Federal aid, the University System is required by Federal law to be compliant with the Americans with Disability Act (ADA). All the text and icons must be easy to understand and discern by all people. Unfortunately, the small accessibility icon was of too low contrast and too esoteric to be recognizable and understood by even regular users. To accommodate users of all abilities, the icons and terminology should be reviewed by a Federal ADA compliance specialist before being placed on the website. If a Federal representative is unavailable, the icons and text should be tested with a focus group consisting of users with disabilities.

Errors and Recovery

During the testing sessions, users found many errors with the website. No minor errors were discovered, only one serious error, but many critical errors. The single serious error occurred when a user entered a search term and misspelled a word leading to an incorrect page. The user quickly found her error, reentered her search and then found the correct results. Since each occurrence of user confusion can lead to an uncompleted task, an unhappy user, or a site exit, every effort to keep users happy and retained must be made. As a result, the user should have been given a spelling suggestion when she typed in her misspelled search term. When she entered “mathmatics” in the search field, she should have been given results for the term “mathematics” highlighted and a subtext link stating “Search instead for mathmatics.”

Major errors encountered included lack of user understanding and user confusion. As stated earlier, users were often confused by unfamiliar terms, jargon, and unfamiliar icons. As noted, public review should correct most problems.

After terms and icons, brand confusion caused the most user errors. Even through the UNC System is the parent organization of UNC-Chapel Hill, all but one of the participants assumed the testing sessions were for the UNC-CH website. To better differentiate between the two organizations, the UNC System website should include a confirmation message when a user arrives on the page. Additionally, all pages, materials, content sections and images should include some reference to the UNC System Office; ex. watermarks on images, linked references to the UNC System, and adding the keyword term “UNC System” where available. Finally, the UNC-CH website should also note that it is one of many constituents of the UNC System.

Users also discovered broken links when attempting to navigate the website. When users visited the campus pages for the virtual tours, some were excited to find links to virtual tours of the campuses ... only to be disappointed when the links were broken. To make matters worse, the users were shown simple “404 – Page not found” text and given no suggested pages, no default search results, no fallback, and no chance of easy recovery. Since users are most likely to leave a site when they encounter errors, they should be offered suggestions when the obvious goal is unavailable. To reduce user exit, they should be greeted with one or more of the following options when they encounter a “page not found” error. First, the user should be greeted with search results for the unavailable page they are looking for. If the page has been moved, the search results would provide the correct page. If the page was removed and the content reconstituted, the search results would display that page.

The most egregious error occurred when a user navigated from a top-level page to a second level page and found a blank page with simply the word “LOREM” (short for “lorem ipsum dolor...” The placeholder text “LOREM” is indicative of an unfinished website and poor quality control and erodes the user’s perception of the brand. To prevent similar occurrences,

only approved final content should be published to the website. Further, the site should be searched for any placeholder terms such as lorem, ipsum, dolor, placeholder, placement, and other possible temporary terms.

Satisfaction

Even with critical errors, the users seemed to enjoy the site and rated a high level of satisfaction during and after use. Each user commented that the site looked modern and they enjoyed the imagery; some even commented excitedly they recognized people or places in the media. To increase user satisfaction, more high-quality imagery should be used and include real students on constituent campuses. Users also enjoyed the interactivity of the campus map but did not like the pop-ups on the map. Therefore, the pop-ups should be removed and other interactive elements should be added. Simple animations such as java link-rollovers or image effects should be utilized to make text-heavy pages or pages with high bounce rates more engaging and retain users.

Additional Discoveries

During testing, discoveries regarding topics that were not being tested were made. Additional discoveries include recruitment methods and the advantages of deviating from the testing script.

To recruit the testing sample, I placed advertisements on Facebook and listed the study on the UNC research website. While the Facebook advertisements cost about \$130USD and had the potential of reaching a tremendous number of potential candidates, only one person made contact and that single candidate did not complete the prescreening survey. The UNC research

recruitment website, research4me.unc.edu, cost nothing. The free advertisement generated many contacts and ultimately provided all the participants. In the future, Facebook advertisements should not be used when other free services are available.

During the testing sessions, I attempted to stay as close to the testing script as possible and generated usable feedback. In contrast, at times I would need to deviate from the script and either clarify tasks, give explanations, or ask for clarification. In these moments of casual conversation, I found that users were more eager to provide candid yet valuable feedback they may not have volunteered otherwise. As a result, future testing should have the same type of questions as this study, but be written in a more casual tone. Further, participants should be encouraged to share more candid feedback, open opinions, and encouraged to talk freely. The hope would be that users would give unique and unbiased insight into challenges they face.

Critical Evaluation of Study

Strengths of the Study

Due to the historic and unprecedented events of the coronavirus pandemic, the real strengths of the study only became apparent as the original testing conditions became unavailable. First, when the coronavirus shut down the UNC-CH campus and in-person testing was no longer an option, the flexibility to perform remote testing allowed the study to continue. With participants safe in their homes using their personal equipment, the sessions may have produced more accurate results. Second, since the study was testing websites, the users were by default internet users and familiar with web browsing. Since the sample had prior knowledge and had the necessary equipment on hand, almost no time was lost between recruitment and testing.

Users simply connected to the Zoom service and browsed the site from the comfort of their safe home.

Weaknesses of the study

While the study was successful in determining an answer to the research question and discovering elements of a successful higher education website, I believe the study may have been flawed from the outset. By attempting to relate two disparate concepts, web metrics and usability, the distinction is subtle but there doesn't seem to be any real overlap of metrics to the chosen testing methods. Further refinement of the methods is recommended.

Additionally, the study suffered from other issues involving the script, the terminology, and the sample size. As noted, when the script was followed, many users gave curt and simple answers. When the formal script was read and then embellished with an explanation or anecdote, the participant seemed to relax and offer more candid feedback. Future testing scripts should experiment with generalized tasks and discussion topics to allow the test administrator to tailor the verbiage to be more flexible and friendly in the moment.

I would consider the second biggest weakness of the study to be the terminology gap. Many terms are common in higher education that many students simply do not know. For example, users looking for classes searched by class name or a course catalog while the website only listed an "academic program inventory." Of the nine users, three located the course. I have no doubt that all the users could have located the courses if I had given them the translation. Finally, I feel the sample size was large enough to identify most of the website issues, but I would like to have seen more participants with greater cultural and geographic diversity. Future studies should make more effort to recruit a better representative sample of North Carolina's population so the results could be better generalized to other sites.

Chapter 8: Conclusion

This study has revealed that website analytics cannot generate a “magic number” to determine the success or failure of a higher education non-transactional website à la a commercial website’s conversion rate. As a result, the best way to determine the success of a higher education non-transactional website is through guided inquiry. By speaking directly with user and listening to concerns, watching screen activity, and offering feedback, unknown problems can be found and rectified in a timely manner at a reasonably low cost. Further, website analytics could be used to accommodate the technical needs of the users. In conclusion, simply, web metrics cannot be substituted for guided inquiry usability testing.

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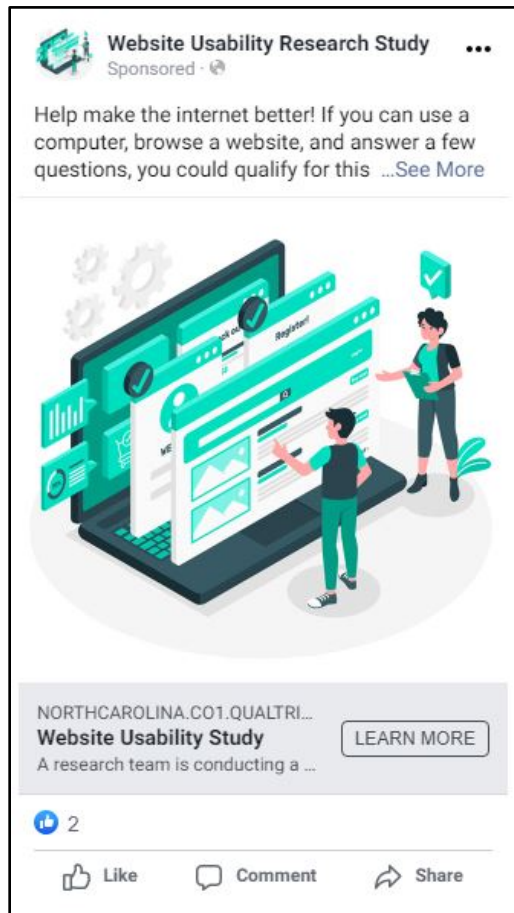
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Appendices

Appendix A: Recruitment Ad

Figure 4: Facebook Advertisement:



Primary Text:

Help make the internet better! If you can use a computer, browse a website, and answer a few questions, you could qualify for this short research study. Compensation may be provided.

Appendix B: Introduction Emails

Hi, [Candidate]

Thank you for signing up so quickly. Please join me at your scheduled time using the Zoom link below. Again, please review the informed consent form and I'll be happy to answer any questions or address any of your concerns at the beginning of the session.

Aaron Hawkins is inviting you to a scheduled Zoom meeting.

Topic: Web Usability Study - April 2020 - [Candidate's First Name]

Time: [Month] [Day], [Year] [Time] PM Eastern Time (US and Canada)

Join Zoom Meeting

<https://us02web.zoom.us/j/88447123632?pwd=Z3BRcU9FRllsSWt5S2xsblptT0Rydz09>

Meeting ID: [Zoom Meeting ID]

Password: [Zoom Password]

Appendix C: Prescreening Questionnaire

The researcher (Aaron Hawkins), is conducting a usability study to evaluate elements of the UNC System Office website as a requirement of the University of North Carolina at Chapel Hill's Master's in Technology and Communications Degree program.

About the study: This research study is looking at how people use websites. Participation will involve two or three emails and an online observation session. The online session should take less than one hour and will involve you completing website tasks using a desktop computer.

Your participation in this study will help improve the website and possibly the quality of life for North Carolinians.

If you're interested, please consider completing the following short survey. If you meet all the criteria, you will be contacted via email to schedule a session.

Do you live in North Carolina?

- Yes
- No

Are you comfortable with your face, voice, and/or screen activity being recorded during the testing session? (You will not be recorded at any time without your knowledge.)

- Yes
- No

Are you comfortable giving your first name and email address for contact? (The research team will only contact you to schedule a testing session.)

- Yes

No

If “Are you comfortable giving your first name and email address for contact? (The research team will only contact you to schedule a testing session.)” Yes Is Selected

What is your preferred email address?

Are you aware that participating in this research study may have risks associated with it?

Anticipated risks may include:

- Mild discomfort
- Mild embarrassment
- Possible breach of personal data (email address).
- There may be uncommon or previously unknown risks

Yes

No

Would you be available for an online video chat that may last up to an hour?

Yes

No

If “Would you be available for an online video chat that may last up to an hour?” Yes Is

Selected, display

Preferred Days

Monday

Tuesday

Wednesday

Thursday

- Friday

Is there any reason you cannot use the Zoom video conferencing software?

- Yes
- No

For security reasons, please check the following box.

- I'm not a robot

Thank you. If you meet the study criteria, the research team will send you an email at the address indicated earlier.

Appendix D: Informed Consent Form

Purpose:

The researcher (Aaron Hawkins), is conducting a usability study to evaluate elements of the UNC System Office website as a requirement of the University of North Carolina at Chapel Hill's Master's in Technology and Communications Degree program. The results will be used to improve the website you will be using today.

Procedures:

As a participant, you will be asked to:

1. Fill out a pre-experiment questionnaire.
2. Be observed as you verbally answer questions and perform tasks on a website.
3. Be recorded as you verbally answer questions and perform tasks on a website.
4. Complete a post-experiment questionnaire.

Confidentiality

Participation in this study is voluntary. All information gathered will be held strictly confidential. The descriptions and findings will be used to compile a report about the website's effectiveness. However, at no time will any of your identifying information be used. You are at liberty to withdraw your consent to the experiment and discontinue participation at any time. If you have any questions after today, please contact Aaron Hawkins at 919-673-0728 or UsabilityStudyApril2020@unc.edu.

I have read and understood the information on this form and had all my questions answered.

Participant's Signature _____ Date: _____

Researcher _____ Date: _____

Appendix E: Testing Script

ACTION: When participant enters room: Administrator casually greets participant.

ACTION: Administrator reads to Participant: [Participant's first name], thank you for participating in this website usability test. I am Aaron Hawkins and I am a graduate student at UNC's Chapel Hill campus. This test is designed to find how easy a website is to use. You and your behavior are not being tested in any way. Our testing session should take no more than 30 minutes. It will include a computer test and a questionnaire. In this session, there are no wrong answers, you can try anything you like, and can take as long as you need. During the testing session, please "think aloud" to help us know your thought processes. With your permission, I would like to video record our session as it will help us better study the website. You can quit the test at any time for any reason whatsoever. You may have refreshments or a short break whenever you need. You may ask questions at any time. Would it be ok with you if I started the video recording now?

If participant agrees: Action: Start video recording.

If participant does not agree: Continue.

Thank you. Today, we will be asking you questions and asking you to perform tasks on the website www.NorthCarolina.edu. As stated earlier, you may pause or quit the test at any time for any reason. When you are ready, we can begin. Let me know when you are ready.

Administrator Notes: _____

ACTION: Administrator reads questions to Participant:

Q1: What's your first name, age, and occupation?

Administrator Notes:

First Name: _____ Age: _____ Occupation: _____

Notes: _____

Q2: Do you use any assistive technologies when surfing the web? For example, do you use high contrast mode, eyeglasses, or a screen reader?

Administrator Notes:

Answer: Yes (record below) No

Notes: _____

Q3: What do you know about the UNC System website, www.NorthCarolina.edu?

Administrator Notes: _____

Q4: When you think of the UNC System website, www.NorthCarolina.edu, what comes to mind?

Administrator Notes: _____

Q5: If you have visited www.NorthCarolina.edu in the past, why?

Administrator Notes:

Answer: Yes (record below) No

Notes: _____

Q6: On the computer in front of you, use any method to open a web browser and visit www.NorthCarolina.edu. Please think out loud while working.

Administrator Notes: _____

Q7: What are your initial thoughts about the www.NorthCarolina.edu visual design?

Administrator Notes: _____

Q8: Before you click on the link titled Our 17 Campuses, what do you expect to find?

Administrator Notes: _____

Q9: Now that you clicked on the link, did it meet your expectations? If so, how? If not, how?

Administrator Notes:

Answer: Yes (record below) No

Notes: _____

Q10: Talking out loud through the task, please try to locate information regarding “Silent Sam.” Please think out loud while working.

Administrator Notes:

Did participant complete the task? Yes No

Notes: _____

Q11: Now locate the institution that offers a class called “Financial Mathematics.”

Administrator Notes:

Did participant complete the task? Yes No

Notes: _____

Q12: How difficult was it for you to change topics?

Administrator Notes: _____

Q13: Using any method, please locate a link to report an accessibility barrier.

Administrator Notes:

Did participant complete the task? Yes No

Notes: _____

Q14: How difficult was it for you to change from looking for classes to reporting a barrier?

Administrator Notes: _____

Q15: Can you find the website login screen? Can you attempt to log in?

Administrator Notes:

Did participant complete the task? Yes No

Notes: _____

Q16: Would you feel a sense of connection to the website after logging in? Why or why not?

Administrator Notes: _____

Q17: Did you notice or were you previously aware of the information for future students on the
UNC System website?

Administrator Notes:

Did participant notice? Yes No

Notes: _____

Q18: If there was one thing about the UNC System website, www.NorthCarolina.edu, website
that you wish would never change, what is it? Why do you like it?

Administrator Notes: _____

Q19: If you could change one thing about the UNC System website, www.NorthCarolina.edu, what would it be?

Administrator Notes: _____

Q20: Is there anything else you would like to say about the UNC System website, www.NorthCarolina.edu?

Administrator Notes: _____

ACTION: Administrator reads to Participant: This concludes the computer portion of the testing session. Please complete this questionnaire to the best of your ability.

ACTION: Administrator gives post computer testing questionnaire to participant. Please hand the questionnaire back when you are finished.

ACTION: Participant hands back completed post-experiment questionnaire.

ACTION: Administrator reads to Participant: Thank you. I am now happy to answer any questions or listen to any concerns you may have.

ACTION ITEM: Administrator pauses for approximately 10 seconds.

ACTION: Administrator reads to Participant: If you have questions, please call or text me at 919 673 0728 or email at aaronghawkins@gmail.com. Again, thank you for participating. If you have no further questions or additional concerns, this concludes our session. Thank you again for your participation.

Appendix F: Post-test Questionnaire

Gender: _____

Native Language: _____

Race (please circle):

American Indian

Hispanic

Asian or Pacific Islander

White

African American

Other: _____

Highest Level of Education Completed (please circle):

High School

Master's Degree

2 Year Degree

Doctorate

Some College

Other: _____

Bachelor's Degree

On an average day, how many hours would you say you spend on the internet using a desktop or laptop computer?

0 - 3

4 - 7

8 - 11

12 - 15

16 - 19

More than 18

On an average day, how many hours would you say you spend on the internet using a mobile device like a smartphone or tablet?

0 - 3

4 - 7

8 - 11

12 - 15

16 - 19

More than 18

On a scale of 1-5 (1 being novice and 5 being expert), please rate your skill level with:

Computers in General: 1 2 3 4 5

The Internet: 1 2 3 4 5

Reading Online: 1 2 3 4 5

Please list your 3 favorite non commercial websites (1 being favorite):

- 1. _____
- 2. _____
- 3. _____

Please list your 3 favorite websites (1 being favorite):

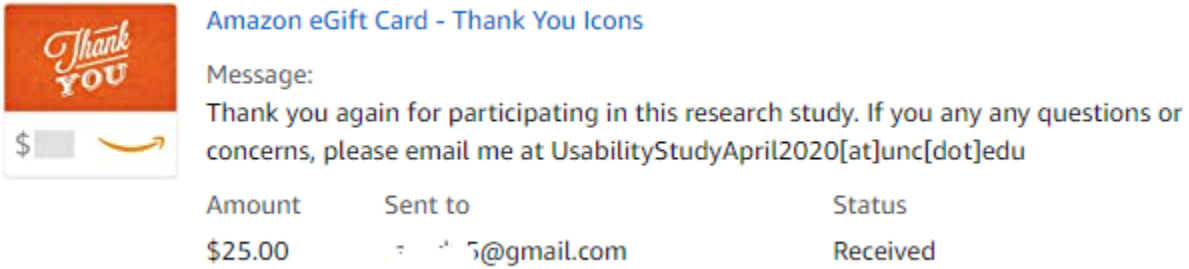
- 1. _____
- 2. _____
- 3. _____

Please list your 3 most visited websites (1 being most visited):

- 1. _____
- 2. _____
- 3. _____

Appendix G: Conclusion and compensation contact

Figure 5: Card and Message



Message Text

Thank you again for participating in this research study. If you have any questions or concerns, please email me at UsabilityStudyApril2020[at]unc[dot]edu.