2017

Decoding Virtual Reference: Using Chat Transcripts to Guide Usability Testing and Improve Web Design

Kate E. Wimer
University of Denver, kwimer@georgefox.edu

Decoding Virtual Reference: Using Chat Transcripts to Guide Usability Testing and Improve Web Design

Abstract

This paper seeks to support user-centered library website design by exploring a low-effort strategy for identifying patron needs and the natural language used to describe them. The literature review cross-references library literature on chat reference with broader studies on website navigation and cognitive modeling, and briefly reviews other studies that have used chat transcript analysis as a usability tool. Word count analysis of two terms of chat reference transcripts showed several trends in patron language, particularly highlighting the benefits of usage-based navigational design. Recommendations for further usability testing are offered, as is an analysis of the method as a starting point for busy libraries.

Document Type

Capstone Project

Degree Name

MLIS

Department

Library and Information Science

First Advisor

Shimelis G. Assefa, Ph.D.

Second Advisor

Carrie L. Forbes, MLS

Keywords

Library science, User experience, Chat reference, Usability, Libraries

Subject Categories

Library and Information Science

Decoding Virtual Reference:

Using Chat Transcripts to Guide Usability Testing and Improve Web Design

Kate E. Wimer

University of Denver

Library and Information Science Program: Capstone Project

Submitted June 5, 2017

Shimelis Assefa, Faculty Advisor

Carrie Forbes, Second Reader

Abstract

Background and Aim

Given the importance of user-centered design in library websites and virtual reference environments, this study sought to utilize existing chat transcript data at the University of Denver library to build a framework of patron patterns and natural language in students asking reference questions.

Method

This study employed a word-cloud analysis on cleaned transcript data to identify patterns in student language and behavior when describing reference needs on the library website. Data from two consecutive fall quarters were analyzed separately and trends were identified by comparison.

Findings

This study identifies five top term/phrases in student chat transcript data: “Article”, “Help, Search, Find”, “Access”, Search Function terminology, and “Paper”. Overall findings suggest that although students do often identify their target goal, they primarily describe their needs in terms of the actions or assignments that they are trying to complete. There is some indication that recent changes to the library website should be monitored or further tested for usability.

Conclusions

Further study is recommended, especially in the areas of navigational hierarchies and patron behaviors. The current website is organized around items. This study supports the idea from the literature that it should instead be organized around actions.

Contents

Abstract……2

Contents……3

Introduction……...5

Literature Review……..6

Background……15

About the Library.……...15

LibAnswers and Transaction Tracking……...16

Library Migration……16

Methodology……...17

Transaction Data…….18

Qualitative Analysis……19

Findings……...21

Article …….21

Help, Search, Find……...21

Figure 1: Top Twenty Words for Each Fall Term…….21

Access …….22

Figure 2: Highlighting the term "access"……22

Search Functions……22

Figure 3: Highlighting terms relating to search functions……..23

Paper……23

Discussion and Recommendations..……... 24

Current Library Website……..25

Figure 4: Screenshot of the University Libraries website……..25

Articles……26

Help, Search, Find……...26

Access……26

Search Functions……27

Paper……27

Potential Flaws in the Data……28

Recommendations for Further Study……30

Conclusion……...31

References……...32

Appendix A: Full Word Count Tables……35

Appendix B: Word Clouds……36

Introduction

On March 15, 2012, *Library Journal* posted coverage of a new study on the barriers to information that are caused by library jargon (Kupersmith, 2012). The article itself was titled, "Users Don't Know What Libraries are Talking About, Studies Find" (Schwartz, 2012). The comments which followed the summary of the new publication ranged from defense of patron intelligence and cries of librarian arrogance to snarky notes about other "terminology" (book, search, library) that could be "dumbed down" to acquiesce to patron ignorance. This quick blurb and the conversation it sparked highlights a debate that has been a part of the library profession from the start. Do we express our systems and our profession in natural language, or do we expect our patrons to learn the precise jargon of the field? In the end, Kupersmith's extensive list of terminology found to be misunderstood and his assertion that links this to an average user success rate of 52% in the databases are compelling arguments for natural language, at least in asynchronous virtual environments where the librarian is not available to explain and guide a patron through the resources.

In addition to this, an ACRL blog in 2011, writing in context of the changes wrought by increasingly virtual holdings, stated, "users prefer not to be mediated by librarians in locating and using information and resources" (Kim, 2011). The article argues that modern patrons of academic libraries do not value our instruction or tutorials, but would rather be provided with resources to expedite researching on their own. This model of thinking, combined with the argument for natural language, has brought many librarians to reconsider website design and virtual reference models. The question becomes, how does a library identify the natural language and research needs of their patrons to create a website that those patrons can easily navigate and interact with? This study suggests that chat transcripts from the reference desk can provide

insight into these patterns by capturing native language and interpretations of current design. Through qualitative analysis of a selection of student transcripts over two successive fall quarters at the University of Denver, it seeks to highlight these trends and identify the extent to which the current library website design reflects them.

Literature Review

Research on virtual environments in the field of library science is notably thin until the mid-2000s, but literature on usability, and specifically on usability in the web, has been around since the early 1990s. This review will begin with brief coverage of usability concepts, focusing on mental models and the importance of web design to user persistence and loyalty (return behavior). It will then cover an overview of library-specific research into the translation of reference design into the virtual environment as well as library-specific research of online patron behaviors. It will highlight several studies that have already pioneered the methods proposed in this study, and will finally review coverage of how usability and reference theory can be combined for better library website design.

Don Norman famously wrote about what have come to be called "Norman Doors" in his book, *The Design of Everyday Things* (rev. 2013). According to Norman, everyday objects should not need labels or instructions in order to be used. For example, when designing a door, the only option visible on the "push" side should be to push, and there should be some sort of visual cue (hinges, the location of a plate or push-bar) that makes the functionality so obvious that a user might not even notice that they have used the door (Norman, 2013, p. 3). Norman goes on to write that many design deficiencies occur because designers and engineers do not consider the human element of usability – that is, that people are not always logical, that they are extremely complex, and that they generally don't read instructions. He argues that effective

design should reflect how how people really behave, rather than how they should ideally behave, which requires a more detailed knowledge of the end-user than is usually available to developers kept away from front-end interactions (Norman, 2013, p. 6). This same paradigm is visible in libraries, where website design is often accomplished away from the User Services departments (and sometimes outside of the library itself!).

Norman also writes about the conceptual system image, the mental model used to understand an environment. He notes that humans build system images in many ways, but that a large part of any given image is previous experience and current information input: that is, the experiences, tools, and vocabularies we bring from our past, and the information readily displayed in the current environment (Norman, 2013, p. 31). He explains that the designer's mental model of what the system looks like and does is not necessarily the same as the end user, but rather than expect the end user to conform to the designer's model, the system should strive to match the user or at least should anticipate the user's need for documentation and design cues as to function (Norman, 2013, p. 32).

Norman works with both physical and virtual design, and his books utilize physical examples to help the reader conceptualize the virtual needs of a user. Tate expressed this connection more explicitly by stating that in order to "make large amounts of information [as in a library] accessible to people without overwhelming them, we first need to think of a collection of information in terms of a spatial environment," (Tate, 2014, p. 18). He goes on to emphasize that even in the digital realm, users perceive environments in spatial terms, and stresses the importance of wayfinding (a concept well-discussed in terms of a library's physical plant) to the virtual environment (Tate, 2014, p. 19-20). Tate suggests six key elements to the construction of information environments: structured districts that match the user's mental model, flexible layers

allowing for easy transport between districts, positional clues to assist in orientation and navigation, survey knowledge (or documentation to assist with where to go next), clear paths to most likely destinations, and coherent interaction between each element of the virtual environment (Tate, 2014 p. 20-21). Again, considering the virtual environment as a physical one helps to keep concepts clear.

Ensuring that navigation is intuitive, learnable and recognizable has been hailed by many researchers as "the key to making [an] experience enjoyable and efficient," (Hassan & Li, 2005, p. 53). One researcher describing online retail even goes so far as to suggest that the time saved with efficient navigation design can lead to consumer trust (Harridge-March, 2006). Other studies have shown that users unable to find content quickly on a given site will leave in search of another source rather than struggle with an interface (McKinney et al, 2002, p. 308; Nielsen & Loranger, 2006, p. 184).

Fang and Holsapple (2011) further explore navigation structure in knowledge acquisition environments by studying website interaction from both expert and novice users. They characterize mental models into two types, structural (how the website works) and functional (how to use the website). They go on to show that subject-oriented navigational hierarchies tend to facilitate the formation of a structural model and a navigational hierarchy structured by use tends to facilitate the formation of a functional model (Fang & Holsapple, 2011, p. 457). An example of a subject hierarchy is the Library of Congress classification system. Items are organized by subject, not necessarily by use, so a user who understands the classifications creates a structural mental model and can describe how books in a library are placed on the shelves. A usage hierarchy might be found in the way kitchen cupboards are organized. Things for drinking out of are to the left of the sink while things for cutting with are in the drawer to the right of the

stove. A user who understands this organization can tell someone how to use the kitchen cupboards (a functional mental model). Because of the flexibility of virtual location, a usage hierarchy can often be even more flexible, locating the same object under multiple usage headings according to its type. Further, Fang and Holsapple contend that structural models require more effort to create, are harder to infer, and still leave the user with an additional step of working out what to do with their knowledge of where things are. They therefore suggest that subject-oriented hierarchy is less desirable than usage-oriented in web-design, as it takes more time and can produce more errors (Fang & Holsapple, 2011, p. 458). Thus, designing websites to provide pathways to the usage-needs of our patrons should be the priority.

Early virtual reference services took some time to demonstrate their value. According to Cummings, Cummings, and Frederiksen, despite initial excitement over the new communications potential that chat reference offered, actual usage did not initially match the hype (2007, p. 81). They set out in 2004 to examine this phenomenon and to determine if the lack of interest in chat was caused by user preference for other forms of reference (Cummings, et al., 2007, p. 82). Through a series of surveys, the librarians discovered that although "many within the academic environment [were] open to the idea of chat-based reference . . . chat reference [did] not compete well against other available reference services." At the heart of this disconnect, they argued, was "user perception of the service" (Cummings et al., 2007 p. 91). Cummings et al. went on to interpret a need for better marketing of the chat reference to make patrons aware of the service, but their findings could also be interpreted more holistically across virtual reference to indicate a need to understand and implement user perception in designing virtual reference environments in order to engage them.

The other issue identified in early virtual reference literature involved translating a reference interview into the online environment. A 2006 study by the University of Western Ontario mobilized library science students to compare in-person reference at the library with its virtual counterpart in two separate interactions. The resulting data was then analyzed for best practices and trends of usage (Nilsen, 2006, p. 91 – 92). The findings were not surprising to librarians who recognized the power of a reference interview. Given that "many patrons do not have a clear idea of what information is needed and most patrons have no idea of the complexity of libraries or of how librarians can help them," a clarifying interview makes sense regardless of modality (Nilsen, 2006, p. 100). The traditional interview requires that a librarian paraphrase the question back to the patron and then clarify any ambiguities or potential variations in the question before attempting an answer. Nilsen supports applying the Reference and User Services Association (RUSA) guidelines across all modalities of reference as a way of saving the time of the librarian and the user and to support the credibility of the virtual service as a whole.

As more and more of the world moved online, there was a natural upswing in the use of virtual reference and chat services, but they were still often thought to be underutilized. In July 2010, Maximiek, Rushton, and Brown found that a significant portion of their online reference traffic actually involved complex reference questions. This contradicted the contemporarily held view that IM or chat services were best suited (and therefore used almost exclusively) for simple or quick questions (Maximiek et al, 2010, p. 365). Taking a deeper look at their chat transcripts to analyze user need and library service, the researchers ended with a series of "lessons learned" which included using "feedback from transcripts to improve the libraries' Web site usability and design," further emphasizing the need to "ensure multiple access points" to information, to use natural language, and to place instructional support at "point of need" (Maximiek et al, 2010, p.

367 – 368). Following their analysis of the qualitative coding process itself, they also concluded that given varying perceptions of "ideal service levels," virtual librarians should "let the behaviors of the users determine when a reference interview is required, and focus training on the RUSA guidelines that are viable in a chat environment" (Maximiek et al, 2010, p. 368). This followed an emerging line of thought that suggested that certain aspects and habits of virtual librarian personality and attitude simply do not translate well into the virtual environment without contexts like body language and facial expression to ground them (see Van Duinkerken, et al., 2009).

Following in the footsteps of Maximiek and colleagues in early 2011, the Virtual Reference Project Manager and the Web Services Department at Mississippi State University (MSU) Libraries pulled chat transactions from the previous April and analyzed the questions and responses to identify the most common questions and the resources that furnished them. They supplemented this data with a word-cloud frequency analysis of users' initial questions over a two year period to determine the most common terminology used by a given demographic when searching for information (Powers et al, 2011, p. 100). Their approach was a little stunted by the need to quickly code a smaller amount of data in order to present design recommendations for their website project, but the intent of their methodology is rather brilliant. Through their analysis, they found several major things: first that, "patrons often do not accurately convey their needs in the initial request for assistance. . .", and second that different student demographics displayed distinct resources needs (Powers et al, 2011, p. 108). These two findings helped them to connect more natural phrases, such as "Find articles" to distinct population needs (graduate students needing to locate articles based on citation or looking for periodical literature) and design the web interface to guide those populations to the correct resources. By identifying the

most common relationships between initial questions, patron terminology, and library resources, the MSU libraries essentially removed the need for a synchronous reference interview for the most common questions that caused their patrons problems.

A similar study, published in May of the same year, gave a stronger model for grounded theory analysis of chat transcripts from the Iowa State University Library (Passonneau & Coffey, 2011, p. 278 – 281). The extensive documentation of their coding system and the framework they developed as they analyzed their "artifacts of synchronous virtual reference" showcase a measure that can easily be adapted to assist analysis in other libraries. A few notes of caution ring from their discussion; namely that the process of coding transcription data is extensive, requires more effort than might otherwise be thought, and takes a significant amount of time to perform with any amount of detail (Passonneau & Coffey, 2011, p. 280 – 281). This study also highlighted that beyond simply getting patrons to the resources they need in order to pursue research, virtual reference (synchronous models in particular for Passonneau et al.) should place importance on assisting "authentic learning," adding instruction to the list of values held by strong virtual reference environments (Passonneau & Coffey, 2011, p. 277).

In 2015, the University of Manitoba in Winnipeg returned the scholarly discourse to transcript analysis, using NVivo to create a quantitative content analysis of virtual reference transactions (Armann-Keown, Cooke, & Matheson, 2015, p. 656, 659). Their study is notable in several ways, particularly in its assertion that the analysis performed would "allow the Library to make informed decisions about staffing levels, operator training, patron instruction and Web site content" (Armann-Keown, et al., 2015, p. 664). Manitoba did not analyze for natural language use, but it did use an extensive and detailed codebook (Armann-Keown, et al., 2015, p. 670- 672)

and it drew well-articulated conclusions from the data about the apparently unmet needs of the libraries' virtual patrons.

Identifying again the idea of resources embedded at point of need, Collard and Whatley wrote in 2011 with findings that suggested that users did not lack persistence or even struggle necessarily with identifying their needs or terminology, but rather returned failed searches due to poor search mechanics and misidentification of the contents of a given database (Collard & Whatley, 2011, p. 164). Their study identified queries and search results as a way of examining patterns in patron information discovery and behavior. In addition to discovering that some of their patrons were attempting to ask "non-search related reference questions" of the databases, they also found that 44 percent of their patrons with "subpar search strategies" did not pursue further help (unlike the other 56 percent who recognized their need), indicating that the subpar results they returned were "good enough", represented all that was available, or were simply "willing to give up" (Collard & Whatley, 2011, p. 163). All of this points to a "persistent need to educate users about the tools available to them," how to best utilize them, and what kinds of results to expect from quality searches (Collard & Whatley, 2011, p. 163).

As established in the research literature, virtual reference services must follow at least some basic RUSA guidelines, modified to fit the online medium. Further, having identified reference transcripts and transactions as a strong source for establishing patron need and perspective, the question then becomes how to asynchronously draw users through a virtual reference environment to the information they need through tailored web-design. This is best accomplished by pushing users through some basic form of reference interview to isolate true need, and strategically placing instructional support throughout without seeming pedantic, condescending, or artificial. One key strategy to accomplish this is to "go beyond the Virtual

Reference service itself – to bridge the gap between the user and the *librarian*, rather than the user and the service" (Mu, et al, 2011, p. 126). Mu and colleagues came to this conclusion after extensive research into what website models and designs facilitated the best traffic flow and information discovery. In particular, they examined accessibility (visibility of the link, clearly labeled functions for all click-through navigation), the willingness of patrons to utilize the option to ask for help, and what impact intrusion (whether the link to resources is large, whether it requires the user to navigate away from their current virtual activity, and the merits and disadvantages of pop-up offers of assistance) had on clicks (Mu, et al, 2011, p. 126 – 127). Their findings, based on participant interviews after the usability studies, showed that patron opinion of virtual reference services is not caused by the interface design. Rather, patrons appear to bring their own biases about whether or not these services are useful, remedial, or entirely unnecessary to the virtual environment. However, there does seem to be some significance between patron willingness to use such services and two conditions of design: that "users are aware of its existence (it is clearly seen), and the link is clearly labeled with its function" (Mu, et al, 2011, p. 126). As to intrusion, it appears that the best remedy for potential poor reception is to tie elements to a "trustworthy" brand image or to a specific and identifiable librarian (Mu, et al, 2011, p. 127).

Education has been interested in utilizing cognitive psychology to identify thresholds or "bottlenecks" in student concept mastery for well over a decade (Middendorf & Pace, 2004, p. 3). The library community is just starting to seriously shift in this direction, developing our own threshold concepts for research and information discovery. It is time for us to seriously consider how our virtual reference environments support and even advance mastery of the skills our users need to navigate the ever-more virtual world of scholarship. We can accomplish this by creating

an online environment that meets our patrons where they are, utilizing terminology and structures that match the mental models created by their instructors and external online experiences. To pursue such an online environment, this study sought to determine what users are looking for and how they describe it as the first step to better web design for virtual reference.

Background

About the Library

Student population. The University of Denver University Libraries serves a private research university comprised of roughly 10,000 students split evenly between graduate and undergraduate studies. The University of Denver offers over 200 programs of study from traditional humanities to hard science and from professional degrees to Doctors of Philosophy. The library serves all of this extremely diverse population and also occasionally fields questions from the connected schools of Law and Theology as well as serving local residents as a government repository and open resource. There has been particular growth in recent years in the number of online students, between the expansion of University College (primarily offering continued education and professional degrees), growth or addition of online programs throughout campus, and the large number of undergraduate students who study abroad each year. For many of these students, visiting the website is the only interaction they ever have with University Libraries.

Collection and services. The libraries subscribe to over 1,000 databases, covering roughly 60 subject areas. Primary research support is provided by the Research Center, a service point for the Reference Department. The Research Center is comprised of a traditional reference desk, staffed by highly trained graduate students, and a consultation room, staffed by faculty

reference librarians and experienced graduate students with additional training. The Reference Department has an extensive collection of LibGuides, and began a subscription to Springshare's LibAnswers in July of 2015. Library users can ask for help in a myriad of ways, including in-person, via an Ask Us form, by email, by phone, or by live chat. For more complex questions, consultations are offered in-person, over the phone, or online via web-conferencing software.

LibAnswers and Transaction Tracking

The Research Center has kept data on transactions at the desk for decades, but the implementation of the LibAnswers system has made this easier to collect by keeping everything in one place, and connects more information across the system than was feasible before. For example, although other chat services (including the product previously used by the library) collect transcripts, LibChat allows the Research Center staff to add information on incoming chats to Analytics (the central LibAnswers transaction logging system) as soon as the transaction is finished with a simple click of a button, ensuring a more reliable logging of transactions, but also connecting the transaction data directly to the transcript. This creates a sort of pre-coded treasure trove of organic patron data, all available at the click of a few buttons.

Library Migration

In June of 2016, University Libraries migrated to the Ex Libris system, including a shift from Sierra to Alma on the back end and from Encore and Summon to Primo on the front end. This also brought a slight design change in the website as the discovery system consolidated to a single product, and the library began using the LibGuides databases management tool with the loss of the ERM within the old system. This has caused some shift in the questions asked at the desk, as it is a new (and unfamiliar) system and as there were some implementation issues even into the early fall quarter. This study is considering data from before and after the migration even

with the potential discrepancies, as the goal is to identify universal mental models which should not have been greatly affected by the migration.

Methodology

There are some things that front-end staff simply know about their patrons. Thanks to continual interaction with the people who actually use the library systems, a quick chat about disconnects and bottlenecks in user behavior can easily turn up a hefty amount of anecdotal evidence of issues and breakdowns in physical and virtual user environments. Unfortunately, the staff on the front lines are not usually the staff designing, adjusting, or supporting the libraries' systems, and anecdotal evidence is not always a powerful tool for initiating change. Without asking developers to staff a user services desk to see trends for themselves, how can we convey reliable data? One potential answer lies in the often barely-touched mountain of data that service points often collect from their interactions. Often things like transaction data, transcripts, and emails are kept as a routine record of the work done on a given shift – a sort of justification of services. However they are also an imprint of the routine interactions experienced by staff, who recognize patterns in their experiences and turn those into knowledge. With a full record of user interactions, some basic qualitative inquiry can turn up reliable and examinable data that supports the insights of these desks in a way that is transferable to other departments.

This study is the first part of a larger endeavor to bring navigation design closer to patron mental models. It comprised of a word-count analysis of chat transcripts to identify the language used most often by patrons when describing their needs to Research Center staff, and suggests a second analysis of the data to identify the resources paired with the most commonly expressed needs.

Transaction Data

In order to keep the size of the sample manageable in the time allotted for completion of this study, chat transactions were only considered from the fall terms (ten weeks, roughly September through November) of 2015 and 2016 and where the user was identifiable as a student. Because of the influx of new students, fall quarter tends to cover most of our basic questions, while the continued high percentage of graduate students ensures that it also includes complex reference questions. The process of logging a transaction separates any personal information from the data itself, effectively anonymizing it, but it does include data on the affiliation of the patron (student, faculty, staff, etc.) alongside information on the question type. The transaction data was further narrowed to only those marked in Question Type as "Research – Known Item" and "Research – Topic". These two categories comprise about a third of the transactions at the Research Center desk and include questions like "Can you help me find X article?" or "I need to research educational strategies to increase persistence," but not questions where the underlying issue was an error with access ("I can't log in to access Y article"). Narrowing to these two categories helped to focus the study, but it also automatically weeded out transactions that did not align with the learnability of the website in terms of information seeking and virtual reference. The initial proposal for this study sought to explore differences in patterns between patron types but within the parameters set by the time period and type, the sample sizes were not large enough to constitute significant findings. Following the model of Powers, Shedd, and Hill (2011), the final selection of chat transaction data (285 transactions total) was exported into an Excel spreadsheet for further cleaning, organizing, and analysis.

Although the data is regularly cleaned by the Research Center as it is processed for backup and assessment, a group of library staff also made a pass through the transcripts captured

in each transaction log to ensure that identifiable information (name, email, ID number) was removed. In order to capture patron language patterns, responses from the Research Center staff had to be removed as well. Two options were explored for this step. Initially, each individual transcript was copied from the spreadsheet and pasted into Notepad++, where the search and replace feature could be used to replace the identifier at the beginning of each message with a tag. A regular expression formula was then used to remove all content between the <Research Center> tag and the <User> tag, effectively removing both the identifiers and the Research Center's responses. This was a fairly effective method, but was not viable for all 285 transcripts (and certainly not sustainable for future inquiry of larger datasets following the same method). In pasting each transaction, it became clear that the text from the Excel cell was being treated as a whole string, capped on each end with quotation marks. With the quotation marks removed, the line breaks in Notepad++ copied back to a fresh Excel sheet as new lines, placing each message on a new row. This process was easier to apply to sets of 50 – 100 transcripts at a time, making it much more efficient. Once the last set was pasted back into Excel, the Text to Columns feature could be used to separate the message from the identifier, using the colon as a limiter (this also had the effect of highlighting any hyperlinks missed in the first pass of cleaning the data, ensuring that URL fragments didn't corrupt the analysis). By sorting the first column to include only the Research Center account names, the content in the second column (i.e. that which had been sent by a staffer) could be deleted out so that the column when the filter was removed only contained language from the patron. This formed the final dataset for analysis.

Qualitative Analysis

Many options were considered to perform the necessary qualitative analysis on the transaction dataset, including programs like *Nvivo* or Optimal Workshop's *Reframer* as well as

simple hand coding with a highlighter and a codebook, but in the end, Shedd's method of utilizing a word cloud to quickly get to the heart of the data turned out to be the most practical. Although the thought of analysis via word cloud generator isn't particularly impressive, the basic functionality of a generator is exactly the kind of analysis sought by this study, that is, frequency of word usage and a list of the most common language employed in describing a patron's research process and needs. The University of Denver's Office of Teaching and Learning (OTL) has run workshops on using Tagul, now WordArt.com. WordArt offered several benefits to this process. First, it allows for import of words from CSV format as well as via cut and paste from a spreadsheet. It also has a toggleable function to remove common words (an editable list) and allows phrases to be kept together in processing. Once text is loaded, the system generates a chart showing each word alongside its usage count in order of greatest usage to lowest. Words can also be removed from this chart, allowing for further cleaning of the data. Although the default setting is not to display words by count number, turning this on is an easy and effective way to quickly see results.

The cleaned column of patron inputs from each year was placed into separate word clouds, and common words were removed along with any that had been used less than ten times. There was a sharp decline in the usage counts at 10, and a great abundance of words at or below this count, so removing them helped to focus the analysis and cleared some of the clutter from the visualization. The top 14 terms (10 percent of the whole) from each year were then compared for trends. Data from each year was kept separate to accommodate the effects of the migration on reference interactions and to look for any dramatic shifts in terminology with the change. Identified trends are discussed in the Findings section of this study.

Findings

Article

The results of the study were two word charts and two word clouds. In the aggregate, they showed clear trends in patron language that can be further explored in usability studies and utilized in web design (figure 1). For example, the number one term used was “article”, (even the usage count was similar across the terms). The next highest ranked term that is in the same usage context as “article” is “journal”, ranked number 6 in 2015 and number 11 in 2016. “Article” was favored 2.4 times more often than “journal” in 2015, and 4.4 times more often in 2016.

Chat Transcript Top 20 Word Usage Comparison, Fall 2015 and Fall 2016

Fall Quarter 2015		
Rank	Text	Use
1	Article	125
2	Help	102
3	Find	90
4	Search	66
5	Research	56
6	Journal	53
7	Access	39
8	Database	35
9	Summon	26
10	Paper	26
11	Source	26
12	Specific	26
13	Book	24
14	Topic	23
15	Page	21
16	Way	21
17	Peer Revi	21
18	First	20
19	Right	20
20	More	20

Fall Quarter 2016		
Rank	Text	Use
1	Article	118
2	Access	92
3	Search	90
4	Help	88
5	Find	85
6	Look	72
7	Research	59
8	Need	59
9	Database	32
10	Book	30
11	Journal	27
12	Online	25
13	Paper	24
14	Google	19
15	Click	19
16	Resource	18
17	Right	18
18	Text	18
19	Login	17
20	Class	17

Figure 1: Top Twenty Words for Each Fall Term
See appendix for full list.

Help, Find, Search

Clustered near the top of the charts are also the terms “help,” “find,” and “search,” terms that might be useful in labeling a usage-based navigational path to either further documentation and assistance, and to ways to locate materials in the site.

Access

In comparison, the charts mirror the migration narrative as experienced by the Reference desk and show some intriguing trends. For example, between the two years, the term "access" more than doubled in use, rising to rank second in 2016 with a total count of 92 usages across the quarter (figure 2). This trend appears to coincide with noted confusion from our users when they returned to find online access to library resources had shifted. It also appears to align with the implementation of an "Access Online" tab built into the discovery layer records.

Chat Transcript Word Usage Comparison
(Access highlighted), Fall 2015 and Fall 2016

Fall Quarter 2015		
Rank	Text	Use
1	Article	125
2	Help	102
3	Find	90
4	Search	66
5	Research	56
6	Journal	53
7	**Access**	**39**
8	Database	35

Fall Quarter 2016		
Rank	Text	Use
1	Article	118
2	**Access**	**92**
3	Search	90
4	Help	88
5	Find	85
6	Look	72
7	Research	59
8	Need	59

Figure 2: Highlighting the term "access".

Search Functions

Also of note is the change in terminology used to describe questions about search functions and discovery tools (figure 3). First, there is a clear gap between the simple term, "search", and the names of proprietary services (Summon, Google, Compass). In 2015, the highest ranked proprietary term ("Summon") was used almost three times less often that the term "search", at a ratio of 26 to 66. In 2016, that gap widens even more dramatically, with the highest

Chat Transcript Word Usage Comparison, Fall 2015 and Fall 2016

Fall Quarter 2015		
Rank	Text	Use
1	Article	125
2	Help	102
3	Find	90
4	**Search**	**66**
5	Research	56
6	Journal	53
7	Access	39
8	Database	35
9	**Summon**	**26**
10	Paper	26
11	Source	26
12	Specific	26
13	Book	24
14	Topic	23
15	Page	21
16	Way	21
17	Peer Reviewed	21
18	First	20
19	Right	20
20	More	20
21	See	20
22	**Google**	**19**
23	Review	19
57	Write	12
58	Professor	12
59	Make	12

Fall Quarter 2016		
Rank	Text	Use
1	Article	118
2	Access	92
3	**Search**	**90**
4	Help	88
5	Find	85
6	Look	72
7	Research	59
8	Need	59
9	Database	32
10	Book	30
11	Journal	27
12	Online	25
13	Paper	24
14	**Google**	**19**
15	Click	19
16	Resource	18
17	Right	18
18	Text	18
19	Login	17
20	Class	17
21	Student	17
22	Start	17
23	Way	17
57	Number	12
58	**Compass**	**12**
59	Lot	12

Figure 3: Highlighting terms relating to search functions. Note the leaps between the simple term "search" and the names of proprietary tools as well as the significant shift of "Compass" down the list.

ranked proprietary term ("Google") being used almost five times less often than "search" (ratio is 19:90). That second comparison also highlights the second notable change between years. In 2015, "Summon" and "Google" were relatively close, ranked 9th at 26 uses and 22nd at 19 uses respectively. The library discovery tool was described by name slightly more often. In 2016, the order shifts and the gap widens, with "Google" ranked 14th at 19 uses, and "Compass" ranked 58th at 12 uses. Note that the usage of the term "Google" actually stays constant while the terms "search" rose and "Compass" fell. This lines up with another trend noticed at the Research Center Desk, namely that patrons had trouble identifying the new search boxes on the website as "Compass", instead preferring more general phrases such as "the library search" over the branded name.

Paper

One final term of interest made the top twenty for both charts: paper. It was ranked at tenth in 2015 with 26 uses, and remained steady to the next fall term, where it ranked thirteenth with 24 uses. From the perspective of the desk, this makes a good deal of sense, as the impetus

for most of our student users is the assignment of a paper on a given subject. Many of them phrase their questions to begin "I'm writing a paper about *x* topic for *y* class."

Discussion and Recommendations

If Don Norman's treatise on bad design is to be believed, and if the purpose of a library website mirrors the purpose of the library (that is to say, that its purpose is to enable users to pursue information and access resources), then library website design should be reviewed and even adapted on a regular basis to ensure that it continues to align with the mental models of its users. There are many ways to go about this, from formal usability testing to basic interviews of stakeholders, but collection of usability data takes time, resources, and effort not always available in busy libraries. This study questioned whether there might be existing data collection that could be utilized in new ways to assist in creating snapshots of where a given library website's users are and how they interact with online resources and design. Following the patterns of previous research, and borrowing from their methods, it has developed a model of chat transcript analysis that could easily be implemented by other libraries as a new way to assess virtual reference design and services. By applying this model to data from the University of Denver library, it demonstrates the sort of snapshots that it can generate and tells some interesting tales about user experience of the library website before and after a major migration.

Current Library Website

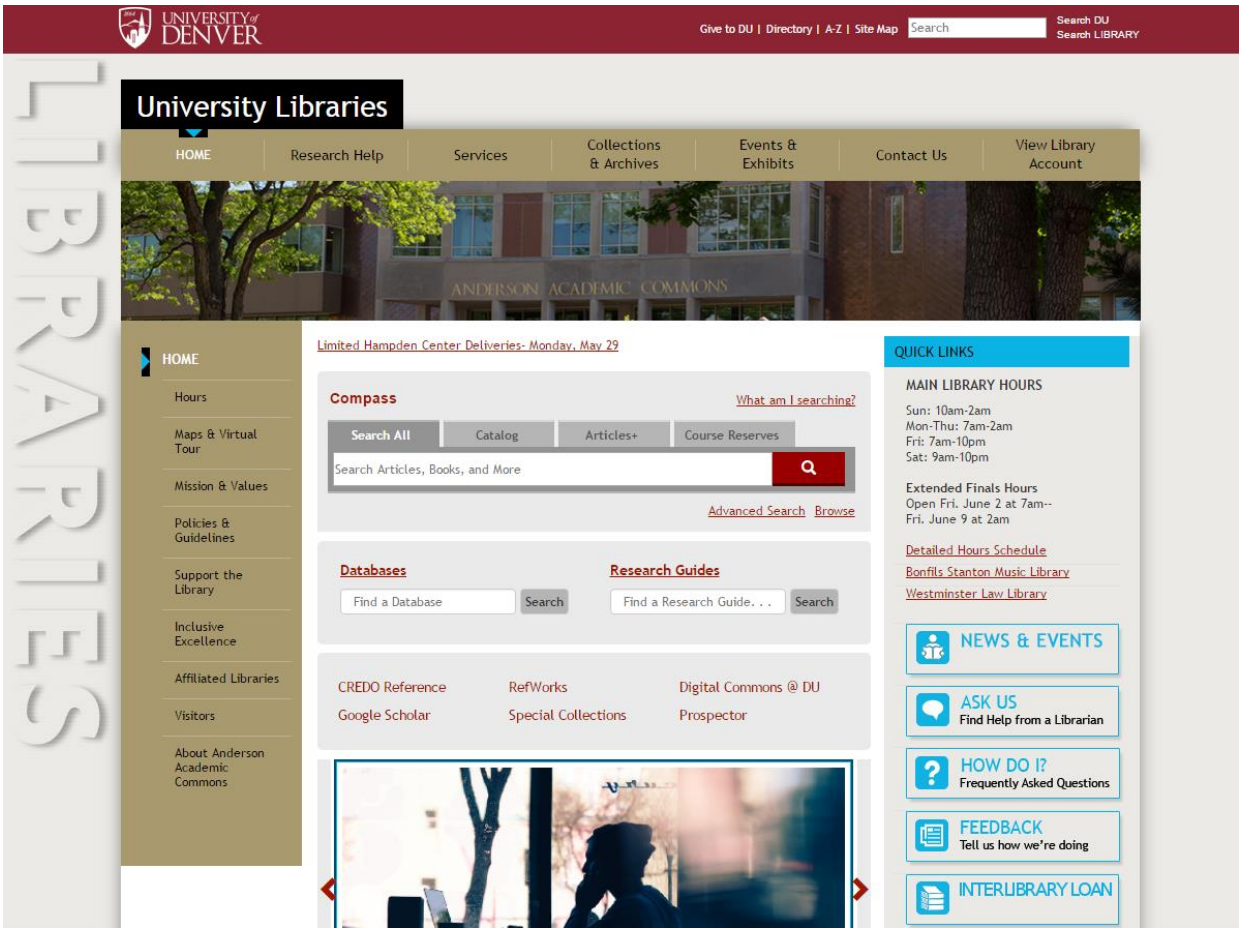

Figure 4: A screenshot of the University Libraries' homepage. http://library.du.edu

Just like with any academic library website, the choices made in design are often much less straightforward than most would expect. Between the requirements of the central university website design standards, the sheer diversity of users and their purposes in accessing the website, and the continually changing nature of the virtual ecosystem, recommendations for change may not be able to consider all factors at play. In addition, University Libraries is currently in the middle of a large usability study and there are already plans for a user interface update in the winter of 2017. With that firmly in mind, however, this study took a brief look at the current University Libraries website to map its findings to current design and make recommendations based on how much of the revealed patterns and trends are reflected there. Although the findings

from this study were not substantial enough to generate large-scale recommendations, there are a few suggestions that might be offered to the website team as they create usability tests and consider the site's current design. The following sections are arranged by terminology or pattern in the order they were identified in the findings, and offer an example of how transcript data can be applied back to the virtual reference environment.

Articles. The current library homepage features the word "article" in two places, both a part of the Compass function. One usage is in the Articles+ tab of the discovery tool, and the other is in the description text in the search box when the default tab (Search All) is selected. These positively reflect the student patterns identified in this study. Moving forward, this language should be kept in new Compass designs, and additional use should be considered in the navigational menus, reflecting patron language in a usage-based navigational model.

Help, search, find. These are fairly common words used by anybody to describe the actions taken by researchers in a library, but they are only featured in a few places on the homepage or in the navigational menus. Much of this is due to the fact that the current library website is built with a subject-based model, with a lot of information about the library, it's history, and its collections offered in navigation menus instead of action-based concepts like "search," "learn about the library," or "discover new collections". Given the evidence in the literature that usage-based navigation more easily matches patron models, and the evidence in the transcripts that patrons use active language to describe their needs, any redesign of the library website should seriously consider adapting the navigational model to task-oriented menus over the current object-oriented structure.

Access. As identified in the findings section, the rise of this term in Fall 2016 coincides (and appears to correlate) with the noted confusion over the new discovery system and the

implementation of the "Access Online" tab. Given this context, this finding would suggest that the pathways to access resources, especially the "Access Online" tab should be a focus of further usability testing, as it appears to have been a significant bottleneck in using the current library website.

Search functions. The abrupt fall in usage of the proprietary term for the discovery system combined with the boost in the use of the term "search" reflects patron unfamiliarity with the new branded name of the discovery tool in 2016. This may be simply a natural phenomenon, but further exploration of user behavior in the site should consider the strength of the branding, and whether a simpler label should be used in place of Compass. Jakob Nielsen continually condemns the use of made-up or branded terminology over simple "legacy" language that is findable by users (Nielsen, 2006). Although it could be argued that the name "Compass" reflects the nature of the tool, and "Summon" certainly caught on with University of Denver users, this trend should be carefully monitored, and Nielsen's argument kept in mind.

Paper. This trend highlights a potential redesign choice for the Research Help page. Although it is itself an object, the phrase "writing a paper" is action oriented. The Research Help website as it stands now is organized primarily by the things that the Research Center does, not the things a user can do with assistance from the Research Center. It is a subtle change, but with the evidence provided by the student transcripts that users identify their needs closely with their current tasks, there is a strong argument to consider making it. This recommendation should be kept with the recommendation to include the term "articles" in more places on the site. Suggested organization might include tasks such as "Finding Articles," "Writing a Paper," or "Citing Sources" with links to library articles (either in the Research Guides or in the LibAnswers FAQ page) listed underneath them. It is worth noting that the current design of the

FAQ page and the language used to title articles is currently highly reflective of the trends found in this study, perhaps because most of these choices came from the Research Center staff themselves and emphasized findability through the colloquial language the staff knew from daily interactions.

Potential Flaws in the Data

As with any study, there are a few places where the methods applied could produce errors in the data. The collection of transcripts was done by downloading the transaction data from the Reference department's LibAnswers system, which relies on correct and thorough input of data by a diverse set of individuals staffing a busy desk. In cleaning and preparing the transcripts for analysis, several mislabeled transactions were found, and although they were removed from the set, they do call into question the strength of the data collected, and suggest that through similar mislabeling into other categories, the dataset may not be complete.

There is also the issue of the relatively small datasets considered in this study, especially when considering the two fall terms separately. Each side of the chart shown in Appendix A represents the language of only roughly 140 chat transactions, several of which are likely repeat users, meaning that the representative sample is relatively small, making smaller differences between word counts perhaps less significant that is useful for full usability analysis. However, the datasets are by nature randomized and (due to the scope of time analyzed), should represent multiple demographics.

There is some concern in the self-selecting nature of the users in chat transactions, as their use of chat means that they are able to find and navigate at least part of the library website. This particular method is not well-suited to uncovering the mental models of those users not already on the website, and so the results must be considered limited. These limitations do not

undermine the strength of the data or its usefulness in considering the usability of the website to those already online, but they do require further study in order to better capture the stories of those users not already in the virtual library environment.

It must also be noted that the nature of word-cloud analysis removes language from its context, which can lead to two issues in the final dataset. First, although a word count can show quite clearly that article is the most popular term used by University of Denver library users, it cannot explain why they were using that term, whether it was their primary goal in accessing the site, or if it was part of a larger phrased concept (such as "Full Text Article", which might indicate that the question was actually about accessing a found item, not about finding an article to begin with). Although this limits how confidently one can extrapolate from the results of this study, it does not wholly diminish its use, as regardless of patron purpose, it does suggest that users may respond better to a menu labeled with the word "article" than they might to one labeled "periodicals". Additionally, by using the transaction data to access chats rather than attempting to code full transcripts without the precoding done at the desk, some of the ambiguity of purpose is weeded out. A question utilizing the word "article" that was actually asking about an issue in accessing the full text should have been coded into a different question type category and not included in the data used for this study.

The second issue of context is the worry that although the library half of the chat conversation is removed, the patron might mirror library language in their half, meaning that some of the instances of word choice may not be the patron's natural inclination, but rather a parroting of the terminology given them by the staffer on the other side of the interface. In cleaning the transcripts of the library messages, this study did consider a random sample for this phenomenon and did not find it obviously present. Should this become a larger worry, transcripts

could be further cleaned to only include the first question from the patron, ensuring that there is no possibility of influence from the library staff. The word cloud generated by this data could then be considered alongside the cloud generated by the fuller transcript as a measure of reliability. Between the small data size and the results of the random sampling, the effort of further reducing the dataset was deemed unnecessary in this case.

Recommendations for Further Study

As stated above, the findings from this study or any other that might employ its model are not comprehensive, but they are unique. Used in conjunction with other codable collected data (such as in the 2010 Maximiek study), the indication of natural language preferences add depth to other indicators of the ways patrons already navigate the library website and expect it to work. Combination with other indicators of trends, with anecdotal evidence from user services staff, or with data from more formal usability studies would indicate better where and how the language discovered in this study should be implemented to better match the mental models of a library's virtual users.

The data could also be used as a reference point for generating user tasks for formal usability testing or as a codebook in considering the resources best combined with patron need. Further studies might follow in the footsteps of Powers et al (2011), and take the same transactions analyzed for word prevalence and attempt to model the patterns that emerged between the language used and the resources provided, creating a list of design recommendations that would place the mental model of the user over the expertise of the library in identifying resources that address the needs as expressed.

University Libraries at DU utilize the LibAnswers ticket system, which made it much easier to connect transcripts and transactions, and which would also enable a similar analysis on

ticket (asynchronous service that communicates between the user's email address and a central tracking system) data, which is also coded into the same question and patron type categories and might make for an interesting counterpoint perspective to the chat analysis.

With continued iterative implementation, the model presented in this study could also be modified to identify patron groups that may be marginalized by the standard design supported by this initial study. Similar methods could be used to analyze trends within these groups, to identify the places where the design was losing them, and to make recommendations to virtual design to better meet their needs.

Conclusion

This study is the first step in conceptualizing and building an asynchronous virtual reference model that would allow patrons to guide themselves through the virtual research process, enhancing their confidence in their own skills while also validating the library as a credible and accessible resource with the ability to provide solid information. The hope is not to replace synchronous or even in-person service, but rather to supplement it, to better understand it, and perhaps divert the most basic of questions into a patron-driven learning model, freeing synchronous service to answer more complex questions. The primary goal of the project as a whole was to empower academic library patrons to obtain threshold information literacy concepts in a way that matches their own cognitive style and needs, to encourage them to deeper, fresher and independent study.

References

Armann-Keown, V., Cooke, C. A., Matheson, G. (2015). Digging deeper into virtual reference transcripts. *Reference services review*, *43*(4), 656 – 672. doi: 10.1108/RSR-04-2015-0024

Collard, S. & Whatley, K. (2011). Virtual reference/query log pairs: a window onto user need. *Reference Services Review, 39*(1), 151 – 166. doi: 10.1108/00907321111108178

Cummings, J., Cummings, L., & Frederiksen, L. (2007). User preferences in reference services: Virtual reference and academic libraries. *Libraries and the Academy, 7*(1), 81 – 96. doi: 10.1353/pla.2007.0004

Fang, X. & Holsapple, C. W. (2011). Impacts of navigation structure, task complexity, and users' domain knowledge on web site usability: An empirical study. *Information Systems Frontiers, 13*(4), 453 – 469. doi: 10.1007/s10796-010-9227-3

Harridge-March, S. (2006). Can the building of trust overcome consumer perceived risk online? *Marketing Intelligence & Planning 24*(7), 746-761. doi: 10.1108/02634500610711897

Hassan, S., & Li, F. (2005). Evaluating the usability and content usefulness of Web sites: A benchmarking approach. *Journal of Electronic Commerce in Organizations, 3*(2), 46-67. Retrieved from http://du.idm.oclc.org/login?url=http://search.proquest.com.du.idm.oclc.org/docview/57641443?accountid=14608

Kim, B. (2011). Research librarianship in crisis: Mediate when, where, and how?. *ACRLog*. Retrieved from http://acrlog.org/2011/08/01/research-librarianship-in-crisis-mediate-when-where-and-how/

Kupersmith, J. (2012) Library terms that users understand. *UC Berkeley Library*. Retrieved from http://escholarship.org/uc/item/3qq499w7

Maximiek, S., Rushton, E. & Brown, E. (2010). Coding into the great unknown: Analyzing instant messaging session transcripts to identify user behaviors and measure quality of service. *College & Research Libraries, 71*(4), 361 – 374. doi: 10.5860/crl-48r1

McKinney, V., Yoon, K., & Zahedi, F. (2002). The measurement of web-customer satisfaction: An expectation and disconfirmation approach. *Information Systems Research, 13*(3), 296 – 315. Retrieved from http://www.jstor.org.du.idm.oclc.org/stable/23015739

Middendorf, J. & Pace, D. (2004). Decoding the disciplines: A model for helping students learn disciplinary ways of thinking. *New Directions for Teaching and Learning, 2004*(98), 1 – 12. doi: 10.1002/tl.142

Mu, X., Dimitroff, A., Jordan, J, & Burclaff, N. (2011). A survey and empirical study of virtual reference service in academic libraries. *The Journal of Academic Librarianship, 37*(2), 120 – 129. doi: 10.1016/j.acalib.2011.02.003

Nielsen, J. (2006). Use old words when writing for findability. *Nielsen Norman Group*. Retrieved from https://www.nngroup.com/articles/web-writing-use-search-keywords/

Nielsen, J. & Horanger, L. (2006). *Prioritizing web usability*. Berkeley, CA: New Riders.

Nilsen, K. (2006). Comparing users' perspectives of in-person and virtual reference. *New Library World, 107*(3/4), 91 – 104. doi: 10.1108/03074800610654871

Norman, D. (2013). *The design of everyday things* (Revised and expanded ed.). New York: Basic Books.

Passonneau, S. & Coffey, D. (2011). The role of synchronous virtual reference in teaching and learning: A grounded theory analysis of instant messaging transcripts. *College & Research Libraries, 72*(3), 276-294. doi: 10.5860/crl-102rl

Pearce, A., Collard, S. & Whatley, K. (2010). SMS reference: Myths, markers, and modalities. *Reference Services Review, 38*(2), 250 – 263. doi: 10.1108/00907321011045016

Powers, A. C., Shedd, J., & Hill, C. (2011). The role of virtual reference in library web site design: A qualitative source for usage data. *Journal of Web Librarianship, 5*(2), 96-113. doi: 10.1080/19322909.2011.573279

Schwartz, M. (2012). Users don't know what libraries are talking about, studies find. *Library Journal*. Retrieved from http://lj.libraryjournal.com/2012/03/academic-libraries/users-dont-know-what-libraries-are-talking-about-studies-find/#_

Tate, T. (2014). Information wayfinding. *Online searcher, 38*(1), 16-21. Retrieved from http://du.idm.oclc.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=lih&AN=94364710&site=ehost-live&scope=site

Van Duinkerken, W., Stephens, J. & MacDonald, K.I. (2009). The chat reference interview: seeking evidence based on RUSA's guidelines: A case study at Texas A&M University Libraries. *New Library World, 110*(3/4), 107 – 121. doi: 10.1108/03074800910941310

Ward, D. (2005). Why users choose chat. *Internet Reference Services Quarterly 10*(1), 29 – 46. doi: 10.1300/j136v10no1_03

Appendix A:
Full Word Count Tables

Chat Transcript Word Usage Comparison, Fall 2015 and Fall 2016

Fall Quarter 2015			Fall Quarter 2016		
Rank	Text	Use	Rank	Text	Use
1	Article	125	1	Article	118
2	Help	102	2	Access	92
3	Find	90	3	Search	90
4	Search	66	4	Help	88
5	Research	56	5	Find	85
6	Journal	53	6	Look	72
7	Access	39	7	Research	59
8	Database	35	8	Need	59
9	Summon	26	9	Database	32
10	Paper	26	10	Book	30
11	Source	26	11	Journal	27
12	Specific	26	12	Online	25
13	Book	24	13	Paper	24
14	Topic	23	14	Google	19
15	Page	21	15	Click	19
16	Way	21	16	Resource	18
17	Peer Reviewed	21	17	Right	18
18	First	20	18	Text	18
19	Right	20	19	Login	17
20	More	20	20	Class	17
21	See	20	21	Student	17
22	Google	19	22	Start	17
23	Review	19	23	Way	17
24	Having	19	24	Take	17
25	Up	19	25	Wondering	17
26	Anything	19	26	Ask	17
27	Study	18	27	Doing	17
28	Online	18	28	Perfect	16
29	Want	18	29	More	16
30	Email	18	30	Again	16
31	Before	17	31	Topic	16
32	Wonder	17	32	Appreciate	16

Chat Transcript Word Usage Comparison, Fall 2015 and Fall 2016 (cont.)

Fall Quarter 2015			Fall Quarter 2016		
Rank	Text	Use	Rank	Text	Use
40	Same	15	40	Reference	15
41	Start	15	41	Specific	15
42	Scholar	14	42	Call	14
43	Trouble	14	43	Last	14
44	Something	14	44	Different	14
45	Type	14	45	Log	14
46	Tried	14	46	Same	14
47	Request	14	47	Password	13
48	Read	14	48	Well	13
49	Awesome	13	49	Email	13
50	Nope	13	50	Having	13
51	Thing	13	51	Available	13
52	Information	13	52	Chapter	13
53	Cite	13	53	General	13
54	Data	13	54	Figure	13
55	Day	13	55	Write	12
56	Law	13	56	Data	12
57	Write	12	57	Number	12
58	Professor	12	58	Compass	12
59	Make	12	59	Lot	12
60	Text	12	60	Very	12
61	Come	12	61	Community	12
62	Well	12	62	Word	12
63	Im	12	63	Long	12
64	Full	12	64	Possible	12
65	Really	12	65	Type	12
66	Problem	12	66	Copy	12
67	Take	12	67	Issue	12
68	Citation	12	68	Scholar	12
69	Refer	11	69	Come	12
70	Actual	11	70	Law	11
71	Please	11	71	Provide	11

Chat Transcript Word Usage Comparison, Fall 2015 and Fall 2016 (cont.)

Fall Quarter 2015			Fall Quarter 2016		
Rank	Text	Use	Rank	Text	Use
79	Again	10	79	Pipeline	11
80	Doing	10	80	Make	10
81	Edition	10	81	Study	10
			82	Account	10
			83	Please	10
			84	Second	10
			85	Actual	10
			86	Day	10
			87	Here	10
			88	Proquest	10
			89	Project	10
			90	Id	10
			91	Best	10

Appendix B: Word Clouds

Chat Transcript Data Word Cloud Fall 2015

Chat Transcript Data Word Cloud Fall 2016