

## **Using transaction log analysis to assess student search behavior in the library instruction classroom**

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### **1. Introduction**

Librarians have many tools at their disposal for assessing library instruction, but it is rare to assess each individual student as they search for information. Through the analysis of search transaction logs the authors of this article were able to observe this key student behavior for 29 sections of a general education communication course taught in the spring semester of 2011. This study includes a total of 1,636 unique searches performed by 579 students using Easy Search, the federated search system developed at the University of Illinois. The results and analysis provide suggestions for librarians teaching undergraduates to construct more relevant, targeted searches. These lessons can help librarians both in the classroom and at the reference desk. As libraries increase options for student searching, ranging from native databases to federated search tools to web-scale discovery systems, we must remain cognizant of how students search in order to determine how best to help them construct searches that provide quality, relevant results.

The primary purpose of this study was to observe how students searched during a library instruction session. The authors were interested in assessing several things: whether students followed the teacher librarian and put into practice search strategies taught during the class, what resources the students selected, how they interacted with automated suggestions from the search tool, and whether they were persistent in revisions to their own searches. In each instruction session, students first participated in a

common class search during which the librarian taught strategies for creating an effective search statement. Following the initial class exercise, students returned to the search engine and constructed searches for their own topics. The search transactions logs allowed us to observe whether students participated in and completed the demonstration search, selected the recommended databases, and applied these same strategies when searching independently for their own topics. Thus, the transaction logs help to assess instruction in the classroom, and they suggest best practices for instruction at the reference desk. In particular, the findings have implications for virtual reference, where librarians cannot see how (or if) students are implementing search instructions.

## **2. Literature review**

### *2.1 Student search strategies*

The number of studies that focus on real-time student searching and transaction log analysis is small. Moulaison (2008) used transaction logs to examine how users searched in the OPAC at an academic institution. She primarily sought to discover two things: how users employed advanced search features and what users did when they encountered a failed search. She observed that users generally did not construct complex searches and that they did make attempts to correct and revise search queries when a search failed. The log analysis of Nicholas *et al* (2009) showed, not surprisingly, that student search skills became more complex as they gained more search experience. Antell and Huang took a slightly different approach in utilizing both transaction logs and user observation interviews in their study. They note the dual approach allowed them to “glean information about users’ perceptions of search success” (Antell and Huang, 2008, p. 75).

Several authors focused on primarily lower-division undergraduate students. Holman (2011) examined the information seeking behaviors of first-year students and sought to identify the mental models they

employed when searching for information. A number of common punctuation mistakes, misspellings, and repeated errors significantly affected the results of student searches. Holman's findings indicate students rely on simple search queries and do "not seem to have solid or strong mental models of the search mechanisms" (Holman, 2011, p. 26). Similarly, Porter focused on the search strategies of millennial students and discovered that "students did not exhibit detailed search strategies for each task" and spent "very little time and energy... developing search terms" (Porter, 2011, p. 276).

Zimmerman (2012) also examined the search behaviors of millennial students and noted that these students often found library resources difficult to search. He also observed the important role of the library and librarians, given the increased need for information literacy skills to most effectively utilize the variety of resources available.

Ren (2000) and Monoi *et al* (2005) examined student assessment of self confidence in their online searching abilities. In both cases the authors observed a relationship between student confidence and searching and noted that "college students' self-efficacy in electronic information searching was significantly higher after library instruction, which combined lecture, demonstration, hands-on practice, and an assignment of library electronic information searching" (Ren, 2000, p. 327). The study of Monoi *et al* also found "that mastery experiences during the course had an impact on the increased levels of students' confidence in their online searching skills" (Monoi *et al*, 2005, p. 102). These findings both correlate to the objectives of the library instruction that was the focus of our study. Conversely, an analysis of student search behavior conducted by Chen found that while students were successful generating keywords they were unable to "develop more sophisticated search keywords" (Chen, 2009, p. 344), despite receiving additional instruction and hands-on searching. Chen does nonetheless note that students who identified more sophisticated keywords were more satisfied with their results.

Conner and Browne (2013) used a different approach to studying student search strategies through the use of information visualization. Using tools that included Google Wonder and EBSCO Visual Search, along with more traditional strategies such as a keyword matrix, they discovered students “used less than half of their brainstormed terms (Conner and Brown, 2013, p. 99).

## *2.2 Instruction and federated search tools*

After libraries increased their use of federated search to enable easier discovery across multiple search tools a little over a decade ago, librarians began to study the use of these tools and user satisfaction with them. However, literature that is focused on the use of federated search tools in the course of library instruction is more limited and reflects many instruction librarians’ skepticism of using federated search tools in the classroom. When Lampert and Dabbour examined librarians’ responses to federated search technologies in both reference and instruction, 61% of respondents indicated they did not teach federated searching in their instruction sessions due to decreased ability to use controlled vocabulary, inability to limit to peer-reviewed sources, suspicion of the precision of the search, and lack of time to teach such tools (Lampert and Dabbour, 2007, p. 261). Further, the majority of participants responded that federated searching had a negative or neutral impact on information literacy skills and indicated a preference for teaching databases in the native interface (Lampert and Dabbour, 2007, p. 262).

Cox (2006) provided an analysis of the impact of federated searching on the use of the ACRL Information Literacy Competency Standards (<http://www.ala.org/acrl/standards/informationliteracycompetency>). He noted that a student’s desire to conduct a federated search first might “be beneficial when using federated searching products” because the results of a federated search can provide an overview of their topic (Cox, 2006, p. 256). He also observed that students have

some difficulty knowing exactly what they are searching and whether they are searching the most appropriate resources the library has available, indicating "Search sophistication is particularly essential when searching multiple resources" (Cox, 2006 p. 259). Cox surmises that the use of federated search tools will not negatively impact the information literacy standards of students, if they have proper instruction. LaBelle also examined the ACRL Information Literacy Competency Standards to discover "how federated searching fits..." (LaBelle, 2007, p. 237). He concluded that federated searching provides a tool that meets the students' preference for searching and that librarians may need to "adopt a more lenient interpretation of indicators and outcomes that allows for technological innovations to take their place within the information research process" (LaBelle, 2007, p. 250).

Students appreciate such tools more than librarians do. Belliston found that 70% of students preferred federated searching (Belliston, 2007, p. 478), and Tang observed that students viewed federated searching more positively than librarians (Tang, 2007, p. 230). Lampert and Dabbour found that 53% of students responded positively to federated searching while 77% indicated it met their expectations for ease of use (Lampert and Dabbour, 2007, p. 269). Armstrong studied first-year students in order to "compare the efficacy of searching and the relevancy of search results retrieved from a federated search tool to a single multidisciplinary database" (Armstrong, 2009, p. 292). She discovered 70% of students preferred federated searching and 51.6% of them felt their results were more relevant (Armstrong, 2009, p. 295). Korah and Cassidy (2010) found federated search use highest among freshmen, sophomores, and juniors; also, undergraduate students expressed greater satisfaction with the tool than did graduate students. Korah and Cassidy recommended librarians "continue to educate students on information literacy and help them understand contexts in which federated searching is the most useful course of action" (Korah and Cassidy, 2010, p. 331). Williams et al. conducted usability testing of a federated search engine and discovered a majority of students noted it was "faster, easier, and less

confusing to use" (Williams et al., 2009, p. 134). Overall the majority of students participating in their focus groups expressed satisfaction with the tool and many of the students "urged us to incorporate federated search in our library instruction" (Williams et al., 2009, p. 137). Georgas (2013) studied student preferences for Google or a federated search tool for research purposes and learned students found the federated search tool to be more efficient, preferred it to Google, and would recommend it to their friends (Georgas, 2013, p. 177).

As exhibited above in the literature, there were authors that both analyzed transaction logs and examined the search strategies of college students. However, none of these studies took place during the context of library instruction. This study is unique in that the data analyzed is from the actual transaction logs of the library instruction classes.

### **3. Methodology**

#### *3.1 The class and assignment*

This study analyzes transaction logs from 29 sections of Communication 101 (CMN101), Public Speaking, at the University of Illinois at Urbana-Champaign during the spring semester of 2011. Each class held its regular meetings three days a week for 50 minutes, two days a week for 80 minutes, or one evening each week for 170 minutes. CMN 101 serves to fill the public speaking requirement for several degree programs, primarily in the Colleges of Business; Agriculture, Consumer, and Environmental Sciences; and Education. As such, students in these courses come from a variety of majors. The majority of students who took the course were freshmen, with decreasing numbers of sophomores, juniors, and seniors. Graduate Assistants (GAs) in their second, third, or fourth semester pursuing a degree from the Graduate School of Information and Library Science taught the majority of the library instruction sessions. Many of them had prior teaching experience, whether in a school setting or as a teaching

assistant in another discipline. The GAs participate in an intensive training program at the start of their assistantship that includes observation of experienced teacher librarians and team teaching prior to teaching independently. During the course of the academic year each GA teaches between 22 -40 classes. For clarification and simplicity, this study refers to those providing library instruction as "librarians." The bulk of the classroom instructors were Teaching Assistants (TAs) in the Department of Communication, referred to as "classroom instructors" in this study.

The library instruction took place at the beginning of a unit during which the students were assigned an informative speech in which they were expected to "share information effectively." The assignment requires students to locate a minimum of three factual, credible sources, two of which were to be no older than 24 months, and one that had been published within the past six months. The concept of "credible" is problematic for many students because they interpret the expectation of credibility as being synonymous with scholarly when, in fact, this is not necessarily the case. This confusion on the part of the students is understandable, as requirements for sources in the majority of their classes specify academic, scholarly sources. However, in the case of this particular assignment, in which they share information with their peers, the specialized language and technical focus of many scholarly articles is not the best choice for effectively reaching their audience.

One of the goals of the library instruction for this course, which consisted primarily of college freshmen, was to create a positive search experience. Ren, has similarly noted, "...it appears library instruction would be most effective if it not only teaches the basic skills but also cultivates in the students a positive attitude and a strong motivation to continue to learn and practice those skills on their own" (Ren, 2000, p. 323). By focusing on the creation of a search strategy that was likely to result in a set of relevant results, the authors sought to create a positive library interaction that would instill a degree of

confidence in the students. While other studies, such as Ren (2000), Chen (2005), and Monoi et al (2009), focused on surveys and questionnaires to gauge student perceptions of success and confidence, this study did not include personal interactions with students that sought their opinions or sense of self-efficacy. Rather, the authors sought to observe and assess the search process of individual students during the course of library instruction, including elements such as keyword selection, database selection, and general interaction with the search tool through the analysis of transaction logs.

In preparation for the class, students were required to complete a concept map in which they note their topic, identify keywords, and list alternative language for those keywords (Figure 1). During the session, librarians encouraged students to add additional keywords/search terms to their concept maps when they saw subject terminology displayed in relevant articles during their individual searches. After an introduction to the library and a discussion focused on completing a concept map, students followed along with the instructor and completed a demonstration search in a federated search tool. Using the demonstration topic (*Video games cause violent behavior in children.*), students performed a keyword search with the keywords “*video games*” and *children*. The librarians emphasized as a learning outcome that the use of quotation marks around words commonly used as a phrase required Easy Search to search those words as a phrase rather than as individual search terms (Figure 2). Given that more advanced search techniques, such as Boolean logic and subject searching, are often unsuccessful in a federated search, those techniques are not discussed. Students begin independent searches for their own topics approximately 20 – 25 minutes after completing the demonstration topic and examining the results for that search in the native databases.

<Figure 1>

<Figure 2>

### 3.2 *The search tool*



Developed at the University of Illinois as an alternative to the commercially available federated search tools, Easy Search allows users to search multiple sources simultaneously, including databases, the online catalog, reference sources, and Google Scholar. Developing the product within the library allowed for the creation of numerous iterations of Easy Search, each of them focused on user needs within specific libraries and disciplines in the larger University Library. One benefit of Easy Search is the ability to customize search results so that they are returned in a specific order, rather than the first-returned order of many federated search tools. Given the tendency of students to select the items at the top of a result list, the customized display allows the library to place those resources librarians feel would be most helpful for the students at the top of the results list. This practice, in turn, encourages students to select those resources rather than Google, which is notorious for returning results quickly and rising to the top of federated search result lists.

The Undergraduate Library's Easy Search serves students beginning their research, and, as such, the sources included are intentionally limited to a small number that represent a variety of resource types that are both appropriate for lower-division undergraduate research and conducive to library instruction. Search results are returned in broad categories by material type, and each category comprises a limited number of select resources appropriate for general, undergraduate research that is likely to encompass a broad array of topics. The categories and sources include:

- Journal and Magazine Articles: includes Academic Search Premier (EBSCO), Academic OneFile, and Scopus. Though not necessarily a typical undergraduate search tool, Scopus was initially included in Easy Search as the anchor database for the limit operations. (It is no longer necessary.)
- Current News Sources: Newspaper Source (EBSCO).
- Books, Ebooks, Media: the online catalog.

- Dictionaries, Encyclopedias, etc.: Online reference sources such as Credo Reference, Gale Virtual Reference, and CQ Researcher.
- Web Search Engines: Google Scholar.

The results are listed by source and provide links to the native database with the article results (Figure 3). The Easy Search results page affords important opportunities for the librarian to discuss the types of sources available and in which situation a particular source may be the most relevant or appropriate.

<Figure 3>

Easy Search provides an assistive mechanism that provides occasional suggestions for an additional database or a library-created subject guide (LibGuide) relevant to the topic searched. This contextual search assistance is triggered by the use of specific search terms. In addition, specific suggestions may be triggered by the search itself. These suggestions include:

- Spelling: *do you mean...*, similar to Google and other search engines.
- Author redo: prompted by a two word search pattern.
- Direct links to commonly used sources included in the search terms: for example a subject guide or Facebook.
- Links to e-journal titles.

Transaction log analysis was chosen as the primary methodology because it offered the opportunity to unobtrusively observe real-time student search behavior. However, one potential drawback of transaction log analysis is the availability of the logs. As a home-grown federated search tool, Easy Search provides logs controlled by the library, but researchers may be limited by the degree to which particular vendors of proprietary systems provide logs routinely or by request. Because students in this study followed links from Easy Search into particular databases, it was not possible to examine any

refinement to searches that occurred once a student chose a database. Thus, it was important to analyze the logs with respect to search behaviors most relevant to the initial search string construction and database choice. This methodology helped to assess whether students successfully applied particular search concepts, but could not provide information about whether their searches were ultimately successful in finding particular relevant articles.

#### 4. Analysis

Transaction log analysis promises benefits for assessment of student behavior in the classroom, but the logs come in a form that requires significant processing before the librarian can interpret them. Though the Easy Search transaction logs are normally compiled in an Access database, for this study they were converted to an Excel spreadsheet for ease of use. Transaction logs were limited to the IP ranges for the computers in the instructional space during the times of the CMN 101 classes. The instructor's computer was also identified and removed from the results. Each search session was assigned an individual *sessionid* that corresponded to the date and IP address. Further, each unique search was assigned a *searchstatid*. Each sessionid could have as many searchstatids (events) as possible to represent all searches in a search sequence. For each event, transaction log fields included information on the action performed by the student (usually entering a search), the previous search by that student, the time of the search, any suggestions for improvement made by the Easy Search interface, and any databases the student clicked on from the results page. While events usually consisted of a student entering a search, they also comprised any clicks of interface suggestion links, such as corrections to the spelling of terms, redoing the search as an author search instead of keyword search, or following a link to a specific suggested journal or resource title. Despite this useful information on student searching, however, the logs then need interpretation for analysis.

Any analysis of transaction logs requires the development of a scoring rubric to classify student behaviors in the course of a search; such a rubric should tie into the primary purpose of a given study. In this case, students received scores for each unique transaction log event based on three general categories: their construction of search terms, their database choices, and their ability to respond appropriately to search recommendations made by the Easy Search interface (see Figure 4). The librarians divided the scores for the construction of search terms and database choices in two groups: those for the initial search performed as a class demonstration (students were instructed to follow along on their own computers) and those performed independently by the students using the topics they had each chosen for their assignment. This division would allow the librarians to see how much students retained from the initial search. Other collected data included the specific databases students clicked beyond Academic Search Premier and Newspaper Source (the suggested databases for the assignment), the total number of searches for each student including the initial demonstration search and independent searches, and what search revision suggestions Easy Search made for each search. Students were instructed specifically to select one of the two EBSCO databases as this interface was used to teach the concepts of database searching. Although there are other resources that would have been appropriate for this type of student research, one goal of the instruction was to allow sufficient time for students to search in and become comfortable with one interface. Gaining comfort and confidence using the EBSCO interface provides students with the ability to then explore other interfaces independently. The broad coverage of Academic Search Premier and Newspaper Source also allows most every student to feel successful in these initial search experiences.

<Figure 4>

From these scores, the librarians determined frequencies for each rubric score by section and for all sections combined, and, based on these frequencies, percentages for each score overall. One

complication arose in the process of totaling scores for the independent searches. While students used time at the end of class to perform searches related to their own speech topics, some also used Easy Search before class started. The independent searches, then, were further divided into those performed before and after instruction. The totals revealed the number of students performing at various levels and how many students in each class participated in the initial and independent searches. Therefore, they provided information useful to analyze for trends in non-participation.

This process of developing a rubric and scoring the transaction logs relies on the interpretation of the researchers. Transaction log data, as any data gathered in research, never speaks for itself but relies on analytical frameworks and the research questions driving them. For the present study, important decisions included what search behaviors to track, how to score particular behaviors, and whether to score each individual transactions or assign only overall individual scores for each student. Moreover, any scoring of search behaviors was done without the knowledge of what students thought at the time of the searching. Antell and Huang (2008) used interviews to supplement their transaction log analysis in order to assess more qualitative factors for select students, and such information would aid analysis here. However, their study examined search behaviors outside of the classroom. As a study taking place during real-time instruction, performing an interview during searching would have disrupted others as well as posing other difficulties. While this study assumed that most students approached searching in earnest to get useful results except when they did not participate in the independent search, it is always possible that students had different goals in mind. It is noteworthy in this regard that the timing of the library instruction session in the semester encourages earnest student participation on their topic.

## **5. Discussion**

A total of 579 students in 29 sections, an average of approximately 20 students per section, participated. These students performed 1,636 unique searches: 644 searches during the demonstration search and 992 independent searches (46 pre-instruction searches, 946 post-instruction).

The cumulative statistics for the initial search (Figure 5) and independent search (Figure 6) revealed that most students (95.2%) performed the initial search and (to a slightly lesser extent) followed the demonstration on their own computers successfully. The most significant hang-up for most students at this phase was reproducing the distinction between two keywords by using quotation marks to bind the phrase "video games" (17.5% of searches had this problem). Generally, students chose the correct database. Some searches (14.0%) resulted in no database choice, but over half (48/92) of these searches were followed by a student revising her search successfully and then proceeding to the correct database. These results are in line with those from Moulaison's analysis of OPAC transaction logs. She found 52.3% of students relaunched an unsuccessful search by changing or modifying their search terms (Moulaison, 2008, p. 235).

<Figure 5>

<Figure 6>

The rate of participation for independent searching after the initial walk-through search was lower at 77.5%. While most searches did end up at the correct database, students had significant difficulties in their construction of appropriate search strings. Under a quarter (23.4%) of these searches successfully combined two keyword terms or phrases relevant to the topic and distinguished them appropriately with the use of quotation marks. If a student's search terms included two distinct keyword terms, neither of them a phrase, the selection of search terms was scored as being successful.

The vast majority of searches did not generate any Easy Search suggestions for revision; only 31 (4.8%) of the initial searches and 120 (12.7%) of all independent searches after the initial walk-through prompted such suggestions. In slightly under half (45.2%) of the initial searches that generated suggestions, the student made appropriate changes, ignored inappropriate changes, or both; in the others (54.8%), students made inappropriate changes, ignored appropriate changes, or both. Independent searches produced a slightly higher percentage of appropriate revisions to inappropriate: (60% to 40%). Misspellings constituted the largest number of suggestions from Easy Search and, in most cases, students ignored the suggestions that would have corrected their spelling errors. Though not in the context of a class setting, Moulaison (2008) and Holman (2011) both noted similar findings in their studies. Moulaison observed typographical errors resulted in students not finding results and, as in our study, the failed search was rerun a second time, with the incorrect typing (Moulaison, 2008, p. 236). The low numbers of suggestions overall limits the significance of these numbers; however, students did not perform overwhelmingly well or poorly in either case.

The compiled data show that while students in these classes generally followed along with the demonstration searches, they were less frequently successful in applying the instruction elements to their own independent searching. The fact that the most common problem in the initial search was the reproduction of quotation mark use is indicative of what became a broader problem in the independent search. The prevalence of the same errors across these results provides cause for librarians to think about the strategies they employ when teaching students techniques for selecting keywords and entering them into a search tool. This serves to emphasize the importance of librarians providing clear instructions and search tips to students during the course of a class in as many formats as possible. In this case, it is probably best to err on the side of over-emphasizing an instructional element. Such a

practice can also be effective when helping students at the reference desk. "Letting students drive" and observing their search behaviors allows librarians to see the keywords students select and the search strategies they employ, creating opportunities to make suggestions that help create more robust searches and better results. This provides the opportunity to apply the same techniques used in the classroom setting, such as the use of quotation marks to bind phrases and entering different keywords or concepts in separate boxes in a database. Employing these techniques in the case of virtual chat reference can be difficult, yet there are strong similarities to the classroom. As in the information literacy classroom, the librarian cannot always see what each student is doing on their own computer, and being aware of student search practices, such as those observed in this study, provides the librarian with strategies for assisting students in the creation of stronger search statements. Instructions sent in chat need to be precise and explained clearly in order to help increase the likelihood that students will apply them correctly and understand why they are doing so.

Looking at particular instances of problematic search constructions revealed some common problems. In particular, many students misunderstood the pattern of the demonstration topic in the initial search and reproduced it in an inappropriate fashion. The initial search for video games and children was accompanied by verbal explanation of the use of quotation marks to bind phrases such as "video games" and search for them alongside another keyword or phrase (in this case "children"). Students, however, frequently interpreted quotes simply as a way to distinguish one term from another regardless of whether the term in quotes was the phrase, and in other cases also used quotation marks unnecessarily around single-word search terms (See Figure 7). While these results were disappointing, they were more positive than the findings of Holman's study of student searches outside of an instruction context. An examination of the use of quotes in her study found "...no student accurately used quotes in any of the observed searches" (Holman, 2011, p. 23). Both of these studies indicate that search techniques that



some librarians may assume are common knowledge for students, e.g. the use of quotation marks to differentiate phrases, are simply not the case. Taking additional time to have students brainstorm, as a class, a variety of keywords and keyword phrases, including the placement of quotations marks, is a strategy that can serve to emphasize their usage. Librarians providing reference services should be mindful that many students do not understand the use of quotation marks when searching for phrases and incorporate this instructional element into the assistance they provide.

<Figure 7>

The generation of keywords by many students indicates they often struggled to identify alternative terminology that may have resulted in a more successful search, despite completing a concept map prior to class. Chen observed similar behavior in a semester-long study of student search behavior, noting students “were not able to develop more sophisticated search keywords after receiving more instructions and search experience” (Chen, 2009, p. 344). Many students exhibited persistence in their searching, but the selection of search terms, sometimes compounded by spelling problems or problems in search string structure, likely did not yield the most relevant results (Figure 8). Once again, taking a few moments to brainstorm alternate keywords as a class can help students better understand the importance of this step and stress its role in the research process.

<Figure 8>

Numbers of non-participants for individual sections also suggest interesting trends. For example, the percent of students per class who did not participate in the independent search was greater for the afternoon and evening classes (28.1% nonparticipating per class versus 18.7% in the mornings) and to a lesser extent in the longer classes taking place on a Tuesday-Thursday schedule or evenings (24.6% versus 20.7% on the Monday-Wednesday-Friday schedule). Variations in these non-participation rates appear in Figure 9. These findings fit local observation that students may lose focus more easily in the afternoons or in the last part of longer classes. However, time of day has seldom been studied as a

factor in student engagement in library instruction, and moreover in college classroom settings in general. In a review of the education literature on student participation, Rocca (2010) noted only two articles versus more coverage of other logistical factors. Those two did not provide consistent outcomes: Howard and Henney found evening classes to have higher participation rates (Howard and Henney, p. 394), but Howard et al. found afternoon classes to have higher participation and evening classes to have lower participation (Howard, et al., 1996, p. 15). While librarians have some ability to work with instructors on time of semester for instruction, the time of day is generally predetermined. The lack of control over this factor may be a reason for the lack of study; however, if a real impact exists it might still affect librarian planning for instruction, including the possible use of tools such as flip lectures or other alternative instructional arrangements.

<Figure 9>

## **6. Conclusion**

Transaction logs may hold promise for assessing both student search strategies and instruction in ways that go beyond this study. When librarians have greater awareness of common problems in student searching, this knowledge can be used in the classroom and at the reference desk to help students delineate keywords and keyword phrases and use them appropriately to yield more relevant results. In a large instruction program with a number of different teacher librarians and classroom instructors such as the one involved in this analysis, section numbers can be compared against particular instructors. Though it was not the focus of this study, such numbers suggested students in library instruction sessions with more experienced librarian instructors had the most success. However, such an approach would only provide one data point in what should be a larger assessment scheme. For example, whether the instruction happened in the morning or afternoon seems to have played a role in student non-participation. Comparing participation based on the teaching experience of both the classroom instructor and the librarian could provide more concrete information on the impact experience brings to

the classroom. Further richness to such a study could be achieved by using the model of Antell and Huang (2008) and incorporating user observation interviews in order to gather qualitative information.

Overall, these transaction logs point to the continued trouble students have in constructing keyword searches on research topics. While students in this study were able to use quotation marks correctly more frequently than in previous studies, the overall rate was fairly low. The patterns of misuse, however, suggest common misconceptions that can be targeted as instructors revise their teaching strategy to better communicate the purpose of quotation marks to bind particular phrases. While librarians can hardly change course schedules, the patterns in participation rates may suggest a need to vary teaching styles, particularly in afternoon or longer class periods, in order to keep students' attention. The use of transaction logs as an evaluative tool for library instruction provides great potential for assessing the effectiveness of the instruction. Accessing transaction logs from a "home grown" system such as that in place at the University of Illinois is likely to be a much simpler process than accessing transaction logs from a commercial product. Working with a vendor can present challenges in both format and presentation of the data. Additional transaction log analyses could utilize computers in a library's public spaces. Such a study would provide information about how students search independently, outside of a class setting, and serve to inform reference practices. Transaction logs provide librarians with the ability to shape their instruction, whether in the classroom or at the reference desk, to meet the needs of the students and create a more positive learning experience.

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Figure 1: Sample Concept Map for Library Instruction Sessions with Sample Search Topic

### Create a Concept Map for Your Topic

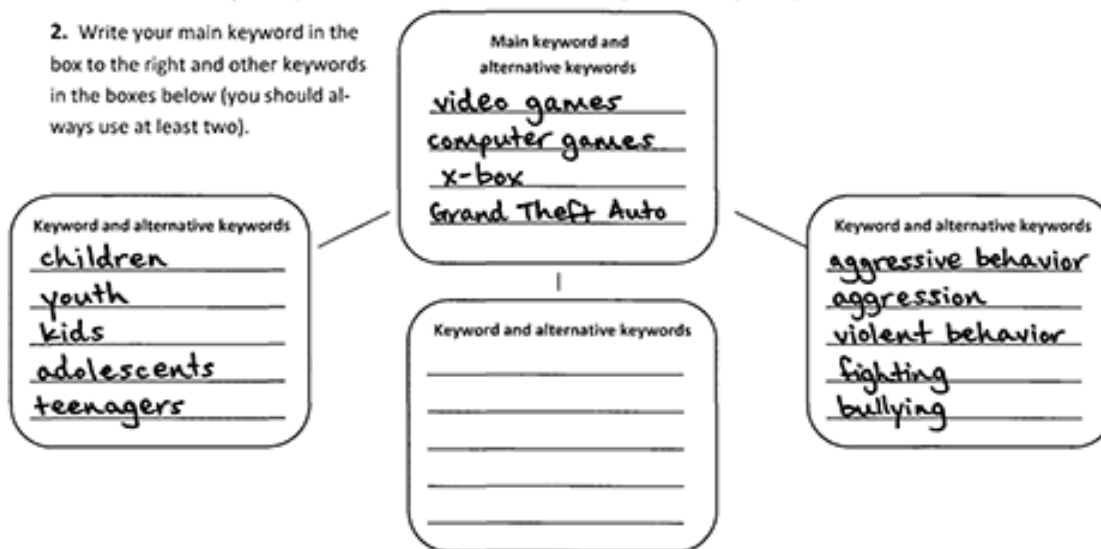
Name: Johnny Gutenberg  
 Class/Section: \_\_\_\_\_

The concept map will help you brainstorm your topic and identify what concepts or keywords to use as you search for information. It also helps you identify what you already know about your topic, provides you with an opportunity to think about your topic in new ways, and identify gaps in your knowledge. Ultimately it will make your information search more effective and efficient! To complete your concept map follow the steps below.

TOPIC: Video games can cause aggressive behavior in children.

1. Write your topic in the box above and circle the keywords or keyword phrases.

2. Write your main keyword in the box to the right and other keywords in the boxes below (you should always use at least two).

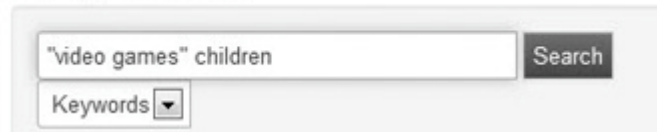


3. List below the subject disciplines professionals who publish articles about your topic are likely to come from. For example: Medicine/health, Business, Social science, Psychology, etc. Identifying potential subject areas will help you decide where to search for information.

Subject area #1 sociology      Subject area #2 education      Subject area #3 psychology      Subject area #4 \_\_\_\_\_

**Figure 2: Easy Search with the In-Class Sample Search**

## Easy Search



The image shows a search interface titled "Easy Search". It features a search input field containing the text "video games" children. To the right of the input field is a dark grey button labeled "Search". Below the input field is a dropdown menu with the text "Keywords" and a downward-pointing arrow.

Figure 3: Easy Search Results Page with In-Class Sample Search

### UIUC Library Easy Search Results

Search Term(s) Entered:

[Ask a Librarian](#) for live help with this question  
[\[+/-\]](#) Related terms:

**Retrieving Results...**

<b>Multi-Subject Article Databases</b>	
Academic Search Premier (Ebsco)	<a href="#"><u>2656 MATCHES</u></a> <a href="#"><u>536 PHRASE</u></a> <a href="#"><u>71 TITLE</u></a>
Academic Onefile (InfoTrac)	<a href="#"><u>444 ARTICLE MATCHES</u></a>
Scopus	<a href="#"><u>1275 MATCHES</u></a> <a href="#"><u>12 PHRASE</u></a> <a href="#"><u>110 TITLE</u></a>
Primo Articles	Searching ...
<b>Current News Sources</b>	
Newspaper Source	<a href="#"><u>3554 ARTICLE MATCHES</u></a>
<b>Books, Ebooks, Media in UIUC &amp; Illinois Libraries</b>	
University of Illinois Library VuFind+ Catalog	<a href="#"><u>136 MATCHES</u></a> <a href="#"><u>512 PHRASE</u></a> <a href="#"><u>18 TITLE</u></a> <a href="#"><u>4 E-BOOKS</u></a>
University of Illinois Library Classic Voyager Catalog	<a href="#"><u>104 MATCHES</u></a> <a href="#"><u>4 E-BOOKS</u></a>
<b>Primo All -- Articles, Books, Digital Content</b>	
Primo Blended Results	Searching ...
<b>Dictionaries, Encyclopedias, etc.</b>	
Gale Virtual Reference	<a href="#"><u>1420 BOOK MATCHES</u></a>
CREDO Reference	<a href="#"><u>105 BOOK MATCHES</u></a>
CQ Researcher	<a href="#"><u>45 ARTICLE MATCHES</u></a>
<b>Web Search Engines</b>	
Google Scholar	<a href="#"><u>GOOGLE SCHOLAR PAGE MATCHES</u></a>



**Figure 4: Scoring Rubric**

	<b>Performance Level 3</b>	<b>Performance Level 2</b>	<b>Performance Level 1</b>
<b>Initial Class Search</b>	Student: Enters both search keywords and uses " " for phrase	Student: Enters both keywords but fails to use quotes for phrase or used quotes incorrectly	Student: Enters one of the search keywords
<b>Initial Database Selection</b>	Student: Selects Academic Search Premier	Student: Selects different database	Student: Does not select a database
<b>Independent Search</b>	Student: Enters both search keywords and uses " " for phrase	Student: Enters both keywords but fails to use quotes for phrase OR Enters keywords both keywords correctly but uses quotes incorrectly OR searches for a single phrase in quotes	Student: Enters only one of the search keywords (not a phrase)with or without quotes OR Keyword phrase without quotes
<b>Independent Search Database Selection</b>	Student: Selects Academic Search Premier	Student: Selects different database	Student: Does not select a database
<b>Interaction with Easy Search Suggestions: Initial Search</b>	Appropriate suggestions made and applied Irrelevant/inappropriate suggestions ignored	Appropriate suggestions made and not applied Irrelevant/inappropriate suggested made and applied	No suggestions were made N/A
<b>Interaction with Easy Search Suggestions: Independent Search</b>	Appropriate suggestions made and applied Irrelevant/inappropriate suggestions ignored	Appropriate suggestions made and not applied Irrelevant/inappropriate suggested made and applied	No suggestions were made N/A

**Figure 5: Initial Searches**

Students performing initial search: 551  
 Students not performing initial search: 28  
 Rate of participation in initial search: 95.2%  
 Total searches: 644

<b>Rubric Score</b>	<b>1</b>	<b>2</b>	<b>3</b>
Searching	17 (2.6%)	113 (17.5%)	514 (79.8%)
Database Choice	90 (14.0%)	4 (0.6%)	548 (85.4%)

Students clicking on databases besides ASP during initial search: 34

**Figure 6: Independent Searches**

Students performing independent search: 449  
 Students not performing independent search: 130  
 Rate of participation in independent search: 77.5%  
 Total searches: 946

<b>Rubric Score</b>	<b>1</b>	<b>2</b>	<b>3</b>
Searching	258 (27.5%)	466 (49.3%)	221 (23.4%)
Database Choice	206 (21.8%)	14 (1.5%)	725 (76.7%)

Students clicking on databases besides ASP during independent searches: 86

**Figure 7: Common Errors in Use of Quotation Marks**

<b>Model Search</b>	"video games" children
<b>Used to distinguish two key terms, without regard to which term had multiple words</b>	"celebrity" role model fiscal policy "obama" "exercise" college students "concussion" mental health
<b>Used unnecessarily</b>	"make-up" "cosmetics" "vegetarian" "stress" "google" "facebook"
<b>Used as emphasis</b>	law "controls" our actions
<b>Other marks</b>	(tattoos and history)

Figure 8: Persistent Search Examples

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\*All spelling and spacing replicates original searches.

**"college students" world news**  
**"late night television" college students**  
**information from late night television**  
**weekend update snl**

**exercise "proper diet"**  
**diet more important that exercise**  
**diet health**  
**proper diet**  
**"proper diet" healthy body**  
**diet vs. exercise**  
**diet more important than weight**  
**diet key to fatloss**  
**diet fatloss**  
**diet fat loss**

**"top 100 fims" afi**  
**"top 100 fims"**  
**top 100 films**  
**American film institute**

**young entrepreneurship**  
**young entrepreneurship America**  
**entrepreneurship**  
**"young entrepreneur"**  
**young business owners**

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**Figure 9: Rates of Nonparticipation in Independent Searching by Class Start Time, Class Schedule, and Combined**

Schedule	Mon-Wed-Fri (50-minutes)	Tue-Thurs (80 minutes) or Evening (170 minutes)	All Schedules
AM Start	16.4% (32/195)	21.6% (33/153)	18.7% (65/348)
PM Start	27.3% (35/128)	29.1% (30/103)	28.1% (65/231)
Combined	20.7% (67/323)	24.6% (63/256)	22.5% (130/579)