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Almost in the Wild: Student Search Behaviors When Librarians Aren't Looking

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Almost in the wild: Student search behaviors when librarians aren't looking

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Highlights:

- Students performed searches in a traditional database and two versions of a discovery system
- Different search behaviors were observed between categories of search tools
- Patterns of facet use among participants led to the definition of three categories of student facet users: non-users, heavy users, and top-level users
- Certain search behaviors were found to either aid or hinder students in their selection of high quality sources

Almost in the wild: Student search behaviors when librarians aren't looking

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Abstract

Academic libraries offer a variety of tools for students to find information, including discovery systems and traditional library databases. This study contributes to the growing body of knowledge on student information-seeking behaviors by comparing how upper-level students majoring in Social and Behavioral Sciences use these two categories of search tools. Student search behavior and the use of search features, facets in particular, are quantified for each tool. The authors explore with statistical analyses whether these practices aid or hinder students in their search for high quality information. Qualitative data from student interviews is selectively employed to aid in explaining the results. Key findings include the differential use of search features in the discovery system versus the traditional database, and the relationships between the use of certain facets and the quality of sources chosen by students. Implications for instruction, search interface configuration, and default settings are discussed.

(H1) Introduction

Academic libraries offer a variety of tools for students to find information, including discovery systems and traditional databases. But what do we know about how students use these different tools to find information? Librarians may observe students searching during reference interactions or instruction sessions, but these observations only give us a brief glimpse of student searching behavior. In this study, we aim to delve deeper into student use of search tools to uncover patterns that can inform our practice.

The overarching research question we endeavor to address is: What is the relationship between student search behaviors and the quality of sources that they choose? In other words, how do the ways in which students employ library search tools aid or hinder their attempts to find good sources? In order to explore this question, we needed to first observe and describe student search behavior. We then needed to find ways to quantify the characteristics that make a source high quality in the context of undergraduate-level research. This allowed us to look for relationships between search behaviors and source quality, which can help us make decisions about how to teach students to use library tools, how to configure the interfaces of these tools, and what their best default settings might be.

Discovery systems and traditional databases provide student searchers with different interfaces and different search experiences. Both types of search tool were included in this study, allowing us to see how student behavior differed between tools. Through screencasts of students searching, interviews with students, and self-reported student data, we explored student use of facets and other search features, time spent searching, and sources chosen.

This study was performed at California State University, Monterey Bay (CSUMB), a public, comprehensive university with an enrollment of around 7,000 FTE, 88% of whom are undergraduates. We are a Hispanic-Serving-Institution, with the largest proportion of students

(42%) identifying as Latinx. Forty-four percent of our undergraduate students are transfers, 49% are underrepresented minorities, and 51% are first generation college students. Our undergraduate students are 33% low income and 51% Federal Pell Grant eligible.

(H1) Literature Review

Much of the literature on student search behavior in library search tools observes that students show a lack of understanding about how library discovery systems and traditional databases work and are thus challenged when using them (e.g. Cockrell & Jayne, 2002; Georgas, 2014). The literature covers two relevant areas: student information-seeking behaviors, including the act of searching and the use of search tool features, and student evaluation of the information sources (e.g. Bloom & Deyrup, 2015; Dempsey & Valenti, 2016; Hamlett & Georgas, 2019; Holman, 2011). Relatively few of the articles that focus on student search and evaluation behaviors also use citation analyses or bibliometrics to explore the quality of search results. Analysis of citations (Dahlen & Hanson, 2017; Leeder, Markey & Yakel, 2012; Pearce, 2019; Rosenzweig, Thill & Lambert, 2019), whether gathered from actual research assignments or through students' selection of information sources in a simulated activity, can inform researchers interested in student ability to select and evaluate information sources.

(H2) Influence of Google on student searching

While many students choose Google as their starting point for research assignments (Bloom & Deyrup, 2015; Connaway, White & Lanclos, 2012; Holman, 2011), Perruso (2016) found that this is not to the exclusion of library search tools and that, once familiar with library tools, students will choose from among them. Thomas, Tewell, and Willson (2017) also found that students do not necessarily start with Google. However, Google-like searching is so endemic, even when students are using more traditional library databases, that Bloom and Deyrup (2015) use the phrase "Google Dependence" to represent a behavioral pattern observed in their study participants. While libraries are continuing to invest in traditional databases, they are also investing heavily in discovery systems, expecting tools that imitate Google and Google Scholar with search features such as sophisticated relevance ranking and natural language search algorithms, all in a single search box (Hamlett & Georgas, 2019).

(H2) Discovery configuration and facet use

While discovery systems may fulfill these expectations in part, librarians also expect discovery systems to provide adequate access to resources held by their libraries, as well as search facets akin to the familiar limiters and filters of traditional databases. Researchers looking at facet usability, like Nelson and Turney (2015), caution libraries to make those facets less like traditional limiters, rather using language that is understandable to even novice users. They also note that discovery systems have become a sort of hybrid, providing features students are familiar with from commercial websites along with facets and limiters available in more traditional databases. They compare facets on commercial sites with those used in library search tools, advising careful selection of facet labels with attention to personalization for users, as commercial sites do. However, no matter how carefully thought out search features and facets are, many students use default search settings (Asher, Duke, & Wilson, 2013), even

when taught how to use facets and limiters (Dempsey & Valenti, 2016). In addition, students are often unclear about how their search behaviors affect their search results (Bloom & Deyrup, 2015; Hamlett & Georgas, 2019; Holman, 2011).

(H2) Student search behavior across library search tools

Studies have addressed aspects of student use of discovery systems and/or traditional databases. Pearce (2019) notes that libraries still have little evidence of which tools are most appropriate for which levels of student search expertise, and that it does not necessarily hold true that traditional databases best serve advanced users while discovery systems are preferable for novice users. Our previous research (Dahlen & Hanson, 2017) found that, while students often preferred the discovery system, the sources they chose from a subject-specific abstracting and indexing database were more authoritative. When given a search task, there is a connection between student search process satisfaction and time on task, as well as one with familiarity of task and task completion (Zhang, 2008). Research on search behavior has noted the speed with which some students search and select. Unfortunately, when applied to library discovery systems and more traditional databases, the speed with which students searched for, skimmed, and then evaluated results, a process described partly by Bloom and Deyrup (2012) as “foraging,” can lead to mistakes, overly simplistic searches, or failure to evaluate sources (Holman, 2011). In library search tools, when students see a single search box, regardless of whether this is in a discovery system or in a traditional database, they assume that natural language searching, sophisticated relevance ranking, and spelling correction underlie the interface (Holman, 2011). Further, researchers have found that students using library search tools tend to rely on one search strategy, and do not effectively refine searches or employ advanced search techniques. For example, students were more apt to revert back to previous results lists (Bloom & Deyrup, 2015; Dempsey & Valenti, 2016) or move to another search tool than to significantly revise their search terms (Holman, 2011). Boolean searching, even when made available to students via advanced search interfaces, is not well understood or effectively used (Dempsey & Valenti, 2016; Georgas, 2014; Holman, 2011). Students also tend to rely on the relevance ranking in library search tools and trust in the authority and accuracy of those sources ranked as more relevant (Asher, et al., 2013).

(H2) Student facet use across library search tools

Facets, meant to augment search boxes and provide a way for students to focus their searching, are often underutilized (Asher, et al., 2013; Bloom & Deyrup, 2015; Dempsey & Valenti, 2016; Rose-Wiles & Hofmann, 2013). Students don't always understand the facet/limiter itself (Nelson & Turney, 2016); some users simply select a wrong facet and don't realize the search failed because of this (Trapido, 2016), or are simply overwhelmed with choices (Muglia & Namei, 2017). Many researchers conclude that, no matter how intuitive and sophisticated the search tool, there is an ongoing need for information literacy instruction. Findings from the literature can help inform and/or modify pedagogy (Bloom & Deyrup, 2015; Crist, Leahy & Carbery, 2019; Dempsey & Valenti, 2016). Rosenzweig, Thill, and Lambert (2019) suggest that we adapt our pedagogy to engage more authentically with students on the importance of evaluating the sources they select, wherever they select them, noting that students will continue to use familiar search tools and techniques for finding information. Some researchers also

advocate for changes to the tools themselves, particularly when naming facets, adjusting relevance ranking of results, and allowing more natural language searching, to align more with students' conceptions of search (Asher, et al., 2013; Nelson & Turney, 2015).

(H1) Methodology

Capturing student search behavior that is truly "in the wild" while respecting student privacy would be a difficult endeavor. We did what we considered to be the next best thing, which was to recruit students to perform searches on a given topic in several search tools, and, with their permission, to record their searches and subsequent conversations. A librarian was present in the room while students were searching, available to clarify tasks and ask follow up questions, but we did not watch students as they were searching, and let participants know that we would not do so. We hoped that this would ease any self-consciousness, though we recognize that being in an experimental setting may have had some effects on participant behavior that we are not able to predict.

(H2) Participants

In Spring 2015, we recruited 50 student participants, using \$50 Visa gift cards as incentives. Our population of interest was juniors and seniors majoring in Social and Behavioral Sciences (SBS), an interdisciplinary major in which students can concentrate in anthropology, archaeology, geographic information systems, political economy, Native American studies, social history, or sociology. While this group is not representative of our entire student body, we thought it desirable to gain a deeper understanding of a subset of students rather than a more superficial understanding of a group with greater diversity in class standing and area of study. As a non-random sample, our participants may not be representative of the population of SBS upper-level students, though with 62% female and 38% male, the gender makeup of the sample does reflect that of our campus and of the SBS major. In an attempt to be as un-invasive as possible, we did not record participants' age or race/ethnicity, though we can report that for upper-level students in this major, the largest race/ethnic groups are Latinx (48%) and White (34%), and that 63% of students are 24 and under. Sixty-eight percent are first generation college students, 52% are underrepresented minorities, 47% are low income, and 75% are transfer students.

Our sample of 50 represents 26% of the population of upper-level SBS majors. The sample was mixed with regard to how many library instruction sessions they reported attending at our institution (see Figure 1). These numbers change somewhat when we include one-on-one library consultations along with classroom instruction sessions (see Figure 2), but we continue to see a wide range of exposure to library instruction in this sample. This variation is likely due in part to native CSUMB students receiving 1-3 library instruction sessions in their General Education curriculum. Transfer students may have received library instruction at their previous institutions, but that is not reported here.

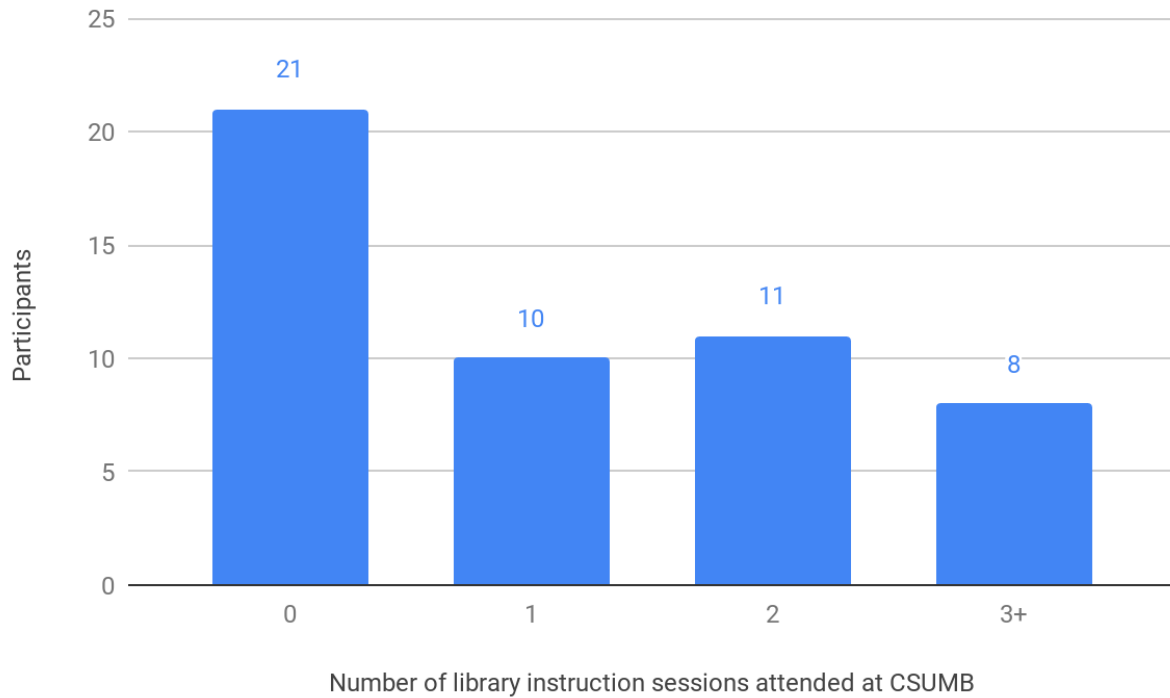


Figure 1: Participant self-reported attendance at classroom library instruction sessions

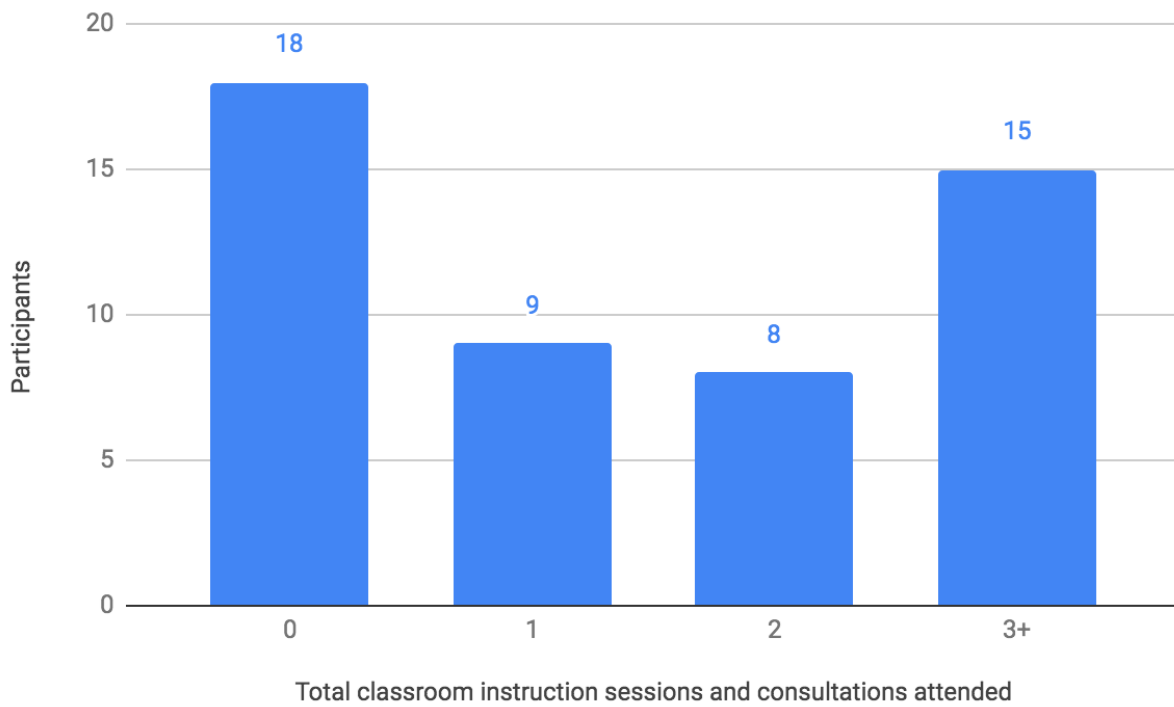


Figure 2: Participant self-reported attendance at all library sessions, including classroom and one-on-one consultations

(H2) Data collection

This study was approved by our Institutional Research Board, and participants consented to perform searches in several search tools and to have their searching and their subsequent conversations recorded with screencasting software (Camtasia Relay). Each student was given one of two search prompts (see Appendix A) that we designed to reflect the kind of broad research topic that social science students often begin with when writing a research paper. Participants were asked to search three tools in a randomly assigned order, finding two of the “best quality” articles on their topic in each. “Best quality” was intentionally left vague to allow students to employ their own criteria when selecting articles. Search time was not limited, and the length of the sessions ranged from 26 to 84 minutes, with an average of 46 minutes.

Searches were performed in three search tools: EBSCO’s Social Sciences Abstracts and two versions of ProQuest’s Summon. Social Sciences Abstracts was chosen as a representative subject-specific indexing and abstracting database that would be appropriate for students to use for social science research. In addition to the configuration of Summon that our library was providing at the time (hereafter “default Summon”), we created a “pre-scoped” version of Summon in which subject areas were limited to social science disciplines and newspapers were excluded. Our intention was to see whether modifying a discovery system to more closely mimic a subject database would affect how students use it.

For each article chosen by participants, we had two librarians who were not present during the searches assign scores for authority, based on Leeder et al.’s (2012) taxonomy, and scores for relevance, determined by the relevance rubric developed for this project (see Appendix B). Publication dates were also recorded, allowing us to track the currency of the articles chosen. Currency was measured by how many years ago (or, rather, years before this data was collected) an article was published.

The screencasts of student searches were analyzed and every action that participants took during their searches was transcribed. The use of facets was one action of interest, and we recorded whether (and in which search tools) students used facets to limit their search. The facets used by students included those limiting results to scholarly sources, to full text only, to a specific format, to a range of dates, to a subject or topic, and to a language. Table 1 outlines the differences in the facet labels between search tools and gives some examples, when applicable, of sub-facets found under each facet. Our instance of Summon had separate facets for “topic” and “subject area.” “Subject area” typically included disciplinary areas, but the “topic” facet was more difficult to interpret, sometimes including disciplinary areas (e.g. sociology), formats (e.g. article), and topics (e.g. bilingual education, gender). For the purposes of this study, we have grouped Summon’s “subject area” and “topic” together, as there is substantial overlap and this allows for easier comparison with Social Sciences Abstract’s subject facet. Social Sciences Abstracts (SSA) has two additional facets that are not included in this analysis because none of our participants used them and they do not have an equivalent in Summon: publication and publisher.

Table 1: Facet labels and examples in Summon (both versions) and Social Sciences Abstracts

	Summon label	Summon sub-facet examples	SSA label	SSA sub-facet examples
Scholarly	“Scholarly only”	n/a	“Scholarly (Peer Reviewed) Journals”	n/a
Full text	“Full-text only”	n/a	“Linked Full Text”	n/a
Format	“Format”	Journal article, dissertation, newspaper article	“Source Types”	Academic journals, reviews, magazines
Date	“Publication date”	n/a	“Publication date”	n/a
Subject/Topic	“Topics” “Subject area”	Social sciences, sociology, article, gender, bilingual education Education, psychology, women’s studies, political science	“Subject”	Gender stereotypes, psychology, education of immigrants
Language	“Language”	English, Japanese	“Language”	English, Spanish

We also noted when students went beyond the first page of search results, if they clicked on a subject heading, and whether they changed the default sort order. In Summon, additional student actions included switching from basic to advanced search, adding results beyond the library’s collection, clicking on a suggested database, and opening a suggested article at the bottom of an article record (under the heading “people who read this journal article also read”). Having a tally of these actions allowed us to see how features were used differentially between search tools, and also allowed us to explore correlations between certain actions and the quality of articles that students chose.

At the conclusion of each search session, the librarian facilitating the session asked each participant about their impressions of the search tool, why they chose each article, and to what extent they considered publication date, credibility, and relevance when selecting articles. The qualitative data from student responses to these interview questions were transcribed by NVivo

Transcription. We then coded the transcribed data in NVivo, using open and axial coding techniques. While describing the qualitative data is beyond the scope of this paper, some findings are mentioned here to aid in our understanding of the quantitative results.

Finally, student participants completed a brief survey. This included self-reported information on GPA, number of library instruction sessions attended, and whether the student had attended a one-on-one consultation with a librarian.

This study is a continuation of a previous investigation by two of the authors, which largely employed the same methodology and dataset but analyzed student search tool preferences and the quality of articles selected (Dahlen & Hanson, 2017).

(H1) Results

(H2) Facet use

The frequency of facet use in each search tool can be seen in Figure 3. The scholarly facet was the most frequently selected: by 52% of participants in default Summon, 50% in pre-scoped Summon, and 38% in SSA. The next most frequently used was the format facet, selected by 44% of participants in default Summon, 38% in pre-scoped Summon, and 20% in SSA. The facet limiting results to full text only was used by 28% of participants in default Summon, 24% in pre-scoped Summon, and 14% in SSA. The date facet, which appears as a slider in SSA and a “From: _____ To: _____” range in Summon, was employed by 14% of participants in default Summon, 16% in pre-scoped Summon, and 24% in SSA. The subject/topic facets were used by 22% of participants in both versions of Summon, and by only 2% of participants in SSA. Finally, the language facet was used by 8% of participants in both versions of Summon, and not at all in SSA. Twenty-eight percent of participants did not use any facets in any of the search tools; 72% used one or more facet.

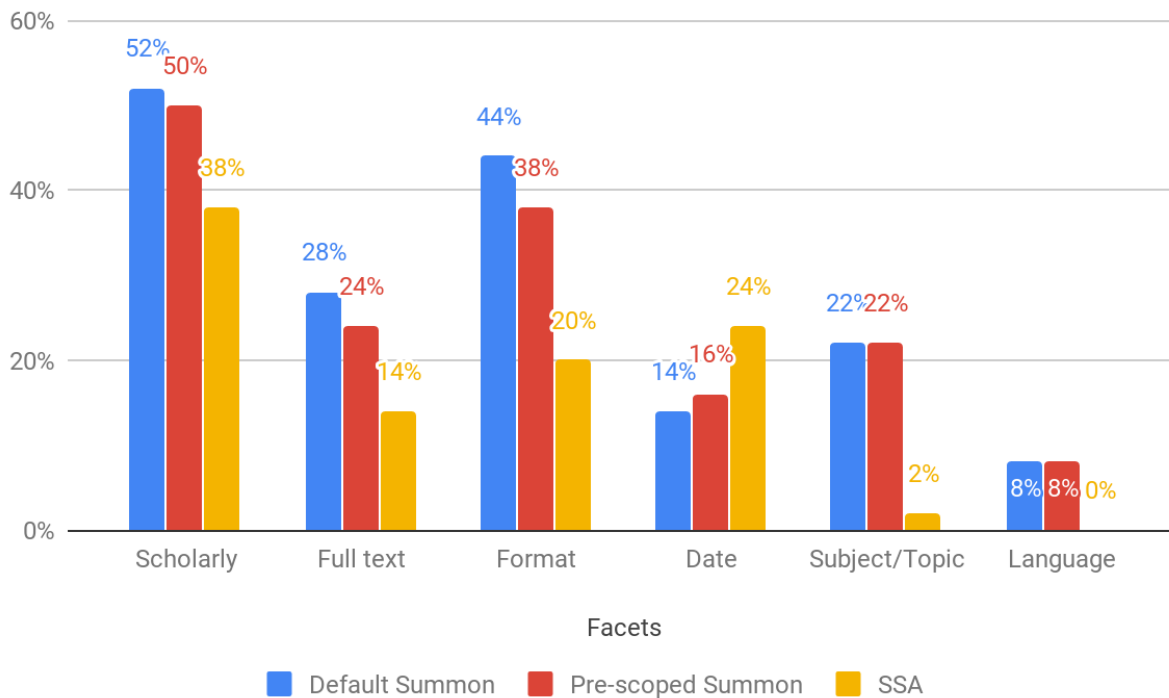


Figure 3: Frequency of facets selected by tool

We ran descriptive analyses on patterns of facet use in each platform. On average, students used the most facets in default Summon (mean=1.6), and the least facets in SSA (mean=1.1), which is a significant difference at the $p < .01$ level. Students also used significantly more facets in pre-scoped Summon (mean=1.5) compared to SSA ($p < .01$). The difference in number of facets used in default and pre-scoped Summon was not significant.

We also used an exploratory factor analysis to look for patterns in the use of facets. We found a significant relationship between high use of facets in one platform being connected to high use in the other platforms. Combining all features together had a strong internal reliability (Cronbach's Alpha=.86).

A more nuanced picture of student facet use emerges when we look at the tables showing the correlations between use of facets in each tool (see Tables 2-4). In each search tool, use of the scholarly facet is most strongly correlated with use of the full text facet. Use of the full text facet is correlated only with use of the scholarly facet in both default Summon and SSA, and most strongly in pre-scoped Summon. The scholarly facet is correlated with other facets in each tool, and the format, date, subject/topic, and language facets each have some correlations with each other (with the exception of the language facet in SSA, as no participants used it). Our interpretations of these patterns will be elaborated in the discussion section below.

Table 2: Facet use correlations in default Summon

	Scholarly	Full text	Format	Date	Subject/ Topic	Language
Scholarly	1					
Full text	.42**	1				
Format	.37**	.26	1			
Date	.39**	.01	.46**	1		
Subject/Topic	.32*	.21	.41**	.48**	1	
Language	-.02	.14	0.18	.31*	.38**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

1. A positive correlations coefficient should be interpreted as a positive relationship and negative as a negative or inverse relationship. The closer the number is to 1 or -1 the stronger the relationship.

Table 3: Facet use correlations in pre-scoped Summon

	Scholarly	Full text	Format	Date	Subject/ Topic	Language
Scholarly	1					
Full text	.47**	1				
Format	.29*	.14	1			
Date	.11	.39**	.33*	1		
Subject/Topic	.24	.04	.48**	.30*	1	
Language	.15	.01	.23	.07	.38**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 4: Facet use correlations in Social Sciences Abstracts

	Scholarly	Full text	Format	Date	Subject/ Topic	Language
Scholarly	1					
Full text	.52**	1				
Format	.33*	.23	1			
Date	.43**	.18	.30*	1		
Subject/Topic	.18	-.06	-.07	.25	1	
Language	n/a	n/a	n/a	n/a	n/a	n/a

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

(H2) Use of search features

In addition to facet use, we recorded a number of other actions that student participants performed in the search tools (see Figure 4). The first of these was whether participants went beyond the first page of results in their search process. Note that our two versions of Summon listed 10 results per page, while SSA provides 20. In default Summon, 48% of participants went

beyond the first page of search results, while 50% did so in pre-scoped Summon and 22% in SSA. All of these tools provide linked subject headings in article records that take the user to a new set of search results classified with that subject. Only 2% of participants used these subject heading links in default Summon and SSA, and 6% used them in pre-scoped Summon. No other linked fields (e.g. author, journal) were used.

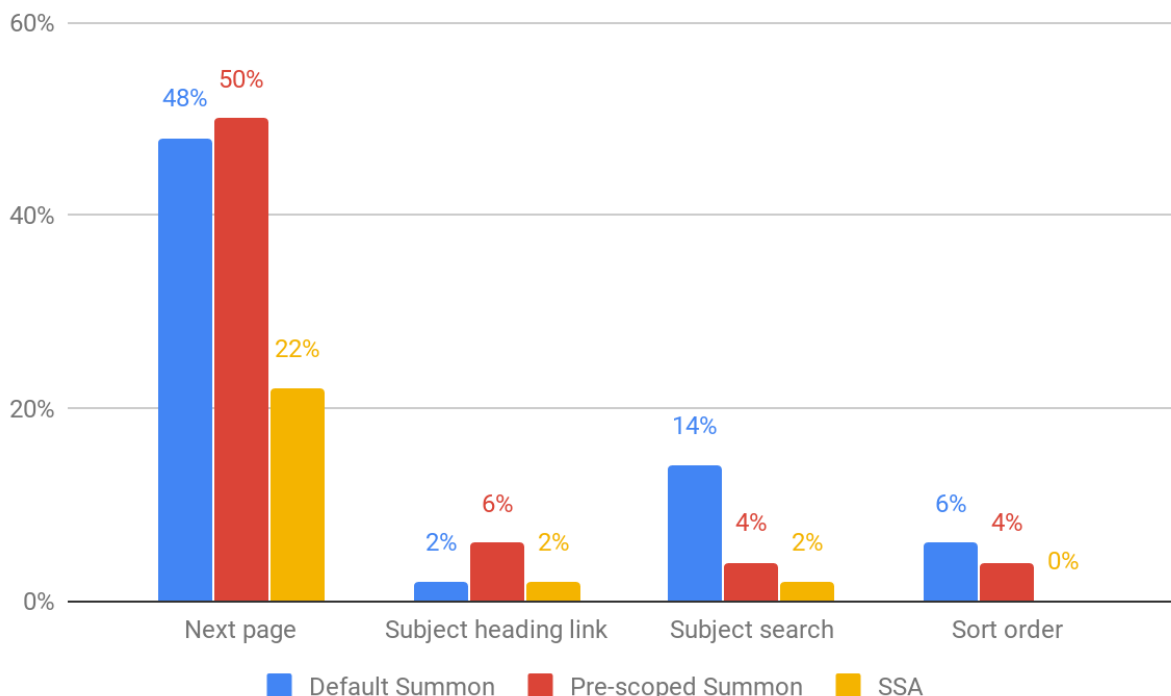


Figure 4: Frequency of actions performed by tool

In each tool, the default search performed is a keyword search, but users are able to select from a drop-down menu other fields to search, including subject searching. Fourteen percent of participants did this in default Summon, 4% in pre-scoped Summon, and 2% in SSA. Each search tool also has a default sort order for search results, with our Summon instances defaulting to relevance order and SSA to “date newest.” Users may change this sort order when viewing the results list, but very few in our study did so. Six percent of participants changed the default sort order in default Summon, 4% in pre-scoped Summon, and none in SSA.

(H2) Summon-specific search features

Certain actions that participants performed in the two configurations of Summon do not have an exact equivalent in SSA. These are represented in Figure 5. One of Summon’s features is to suggest additional articles at the bottom of an article record, using the heading “people who read this journal article also read.” Forty-two percent of our student participants clicked on one of these suggested articles in default Summon, and 34% did so in pre-scoped Summon. When asked during the post-searching interviews what they liked or disliked about each search tool, 42% of the participants mentioned (unprompted) the suggested articles feature. Of those who mentioned it, 95% appreciated the feature, finding it “useful,” “helpful,” and “awesome.” Only

one participant did not like it, finding it distracting. SSA has a somewhat analogous feature, but instead of prominently displayed article titles at the bottom of an article record, there is a link in the left-hand navigation bar that reads “Find Similar Results using SmartText Searching.” Only 2% of participants used this option in SSA. Clicking on a suggested article in both versions of Summon was positively correlated with the number of article records viewed (default Summon: $r=.302, p<.05$; pre-scoped Summon: $r=.289, p<.05$).

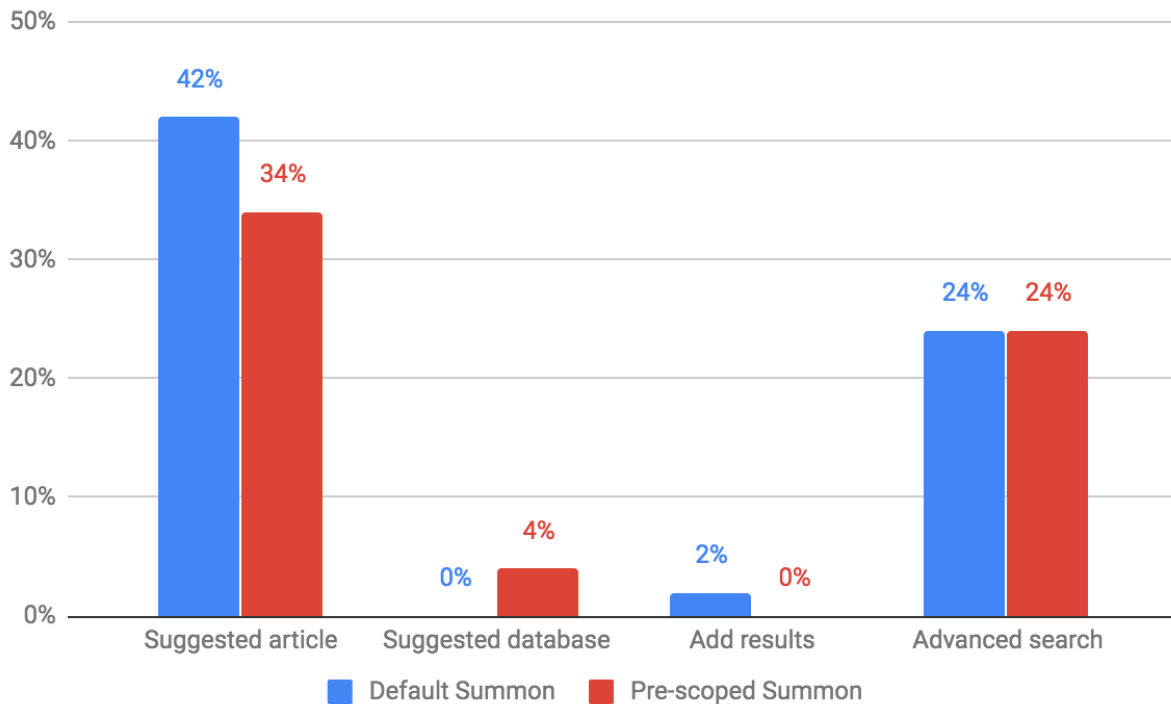


Figure 5: Frequency of Summon-specific actions performed

Summon also suggests databases, though not for every search. When it does appear, it is at the top of the results list, with the label “We found a specialized database that might help you,” followed by a link to the database. ERIC was the database most frequently suggested during these searches, and it was clicked by 4% of participants using pre-scoped Summon. Another feature is the option to “add results beyond the library’s collection,” which expands the results to include articles without full text. Two percent of participants in default Summon employed this option. Finally, while our configurations of Summon initially present a basic search box, users can click “advanced search” to bring up a screen with multiple search boxes with Boolean operators and a few facet choices (format, subject area, date). Twenty four percent of participants in each instance of Summon used the advanced search screen.

(H2) Search feature use correlations

As each article selected by students was assigned scores for authority and relevance, we were able to see whether participants’ use of facets, use of other search features, or survey responses correlated with these scores. Table 5 shows the average scores, as well as minimum

and maximum scores, for authority and relevance of articles chosen, as well as the currency, measured by how many years ago an article was published. Out of a possible 4 points, the average authority score was 3.89; out of a possible 3 points, the average relevance score was 2.78. These scores indicate that overall, students chose articles that were quite authoritative and relevant. On average, students picked articles that were published about 10 years ago.

Table 5: Average, minimum, and maximum scores for authority, relevance, and currency

	Authority (scale of 1-4)	Relevance (scale of 0-3)	Years ago published
Mean	3.89	2.78	10.02
Minimum	3.35	2.08	2.17
Maximum	3.96	3.00	19.33

The scholarly facet was an area of particular interest as it was one of the most frequently used. There was a positive correlation ($r=.33$, $p<.05$) between authority scores and the use of the scholarly facet only in default Summon (not in pre-scoped Summon or SSA). This means that in default Summon, which is the search tool with the highest amount of non-scholarly articles, participant use of the scholarly facet was associated with the selection of articles with greater authority.

The “full text” facet limits the search results to those that have linked full text. While this facet is present in all three search tools, and used by 14-28% of participants (see Figure 3), it was not a particularly meaningful limiter in our versions of Summon, which were already largely limited to articles with linked full text. In SSA, an indexing and abstracting database, it makes a much bigger difference in the number of search results displayed. It also made a difference in the relevance of the articles chosen by participants in SSA, with a negative correlation between the use of the full text facet and article relevance scores ($r=-.41$, $p<.01$).

It is interesting to note that there was no correlation between the use of the date facet and the currency of the articles selected in any of the search tools.

Among the self-reported items on the participant survey were GPA, attendance at one or more library instruction sessions, and participation in a one-on-one consultation with a librarian. Though not the focus of this study, we also tested the relationship between these variables and student search behavior to determine if they were a mitigating factor in how students interacted with these search tools. We did not find a significant relationship between any of those factors and either the use of the scholarly facet or the total number of facets used; therefore, we did not use these variables as a control in the other analyses.

Other participant actions recorded included going beyond the first page of search results and using the advanced search feature (the latter only in Summon). We used mean comparisons (T-tests) to gauge whether either of these actions were related to more relevant or authoritative article scores, but no significant results were found.

(H2) Search behaviors

(H3) Article records viewed

Another action recorded was the number of article records students viewed during their search and selection process. This number varied from zero (in the case of a few students who picked all their articles based only on information in the results list) to sixteen. The mean number of articles viewed in each search tool was 4.5, with no significant difference between the tools. In pre-scoped Summon, the number of article records viewed was negatively correlated with the authority scores of articles chosen ($r=-.37, p<.01$) and had no correlation with the relevance score. In both default Summon and SSA, article records viewed was negatively correlated with the relevance scores of chosen articles ($r=-.33, p<.05$ for both tools), but had no correlation with the authority score.

(H3) Opening full text

As participants searched, they exhibited differences in whether they would open the full text of an article before choosing it as one of their two articles in each tool. Forty percent of participants never opened the full text before selecting their articles. Thirty-four percent sometimes opened the full text, meaning that they opened full text before selecting between one and four of their six total articles. The remaining 26% always or almost always opened full text for the articles they chose, meaning for five or six of their six articles. Opening full text was positively correlated with search time in each of the tools (default Summon: $r=.36, p<.05$; pre-scoped Summon: $r=.50, p<.01$; SSA: $r=.39, p<.01$), and positively correlated with article records viewed only in default Summon ($r=.30, p<.05$). Opening full text was not correlated with higher relevance or authority of articles chosen.

(H3) Time spent searching

The time that participants spent searching in each tool was recorded. As shown in Table 6, there were no significant differences in search times among the tools, nor did the minimum and maximum times vary greatly. There is a large gap, however, between the minimum and maximum searching times in each tool, indicating a great deal of variation among participants. As noted above, search time was positively correlated with opening full text in each of the tools. It also had strong positive correlations with article records viewed in each of the tools (default Summon: $r=.49, p<.01$; pre-scoped Summon: $r=.66, p<.01$; SSA: $r=.47, p<.01$). Time spent searching was negatively correlated with relevance in default Summon ($r=-.39, p<.01$), and negatively correlated with authority in pre-scoped Summon ($r=-.32, p<.05$).

Table 6. Participant search time by tool (min:sec)

	Default Summon	Pre-scoped Summon	SSA
Average time	9:58	10:39	10:09
Minimum time	2:24	3:17	1:24
Maximum time	22:38	23:57	26:22

(H3) Frequency of article selection

Each student participant selected a total of six articles (two from each search tool) and, as there were only two search prompts, there was substantial overlap among participants in the articles selected. One hundred and thirty eight unique articles were selected, with 85 selected only once and the remainder multiple times (see Figure 6). The article selected most frequently was chosen 14 times, and the average across articles was 2.2 selections. To explore the factors contributing to some articles being chosen more than others, we performed a mean comparison (T-test) of the articles that were selected three or more times ($n=32$) to those that were selected only once or twice ($n=106$). The articles that were selected three or more times had a significantly higher average authority score, with a mean of 3.95 compared to the mean of 3.81 for articles selected only one or two times ($p<.001$). These more frequently selected articles also had a significantly higher average relevance score, with a mean 2.91 compared to the mean of 2.55 for articles selected one or two times ($p<.001$). There was no significant difference in the date published between the two groups of articles.

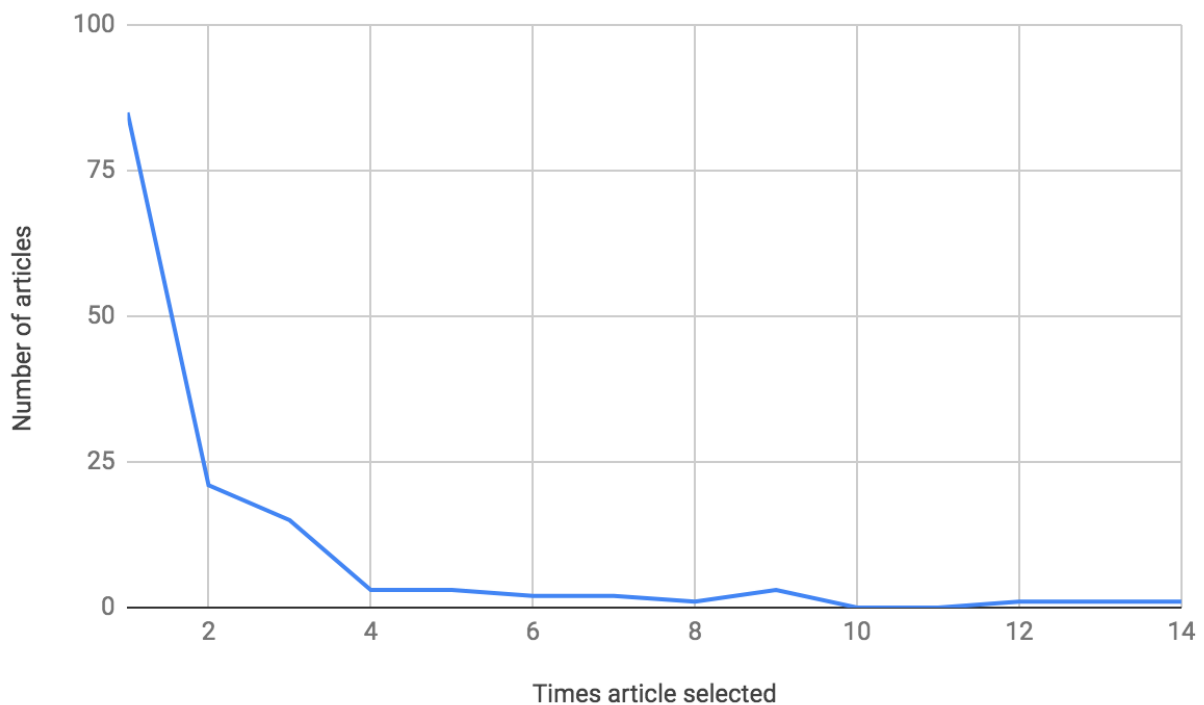


Figure 6: Frequency of article selection by participants

(H1) Discussion

(H2) Facet use

The main category of search features we explored were facets. What we see in the frequency of facet selection (see Figure 3) is that each facet was generally used by half or fewer of our participants. This reinforces previous observations of low facet use among students (Asher,

Duke, & Wilson, 2013; Bloom & Deyrup, 2015; Dempsey & Valenti, 2016; Hamlett & Georgas, 2019). With the exception of the date facet, facet use was lower in SSA than in either version of Summon. There are two plausible explanations for lower facet use in SSA. One is that the search interface makes the facets less visible to students, leading to lower use. Another explanation is that the list of results is so much smaller in SSA that students do not feel the need to narrow their search further.

Our factor analysis found a pattern of high selectors, meaning that students who exhibit high facet use in one search tool tend to exhibit high use in the other search tools as well. The correlations shown in Tables 2-4 show strong correlations between the scholarly and full text facets, in addition to correlations among some of the remaining facets. These correlations, in addition to our observations from viewing the screencasts of students searching, lead us to define three categories of student facet users: non-users, heavy users, and top-level users.

(H3) Non-users

Twenty-eight percent of our participants did not use any of the facets in any of the three tools. These students may not have noticed the facets, may not have recognized their utility, or may not have thought their search results needed to be limited. The use of facets was not correlated with attendance at one or more library instruction sessions or participation in a one-on-one consultation with a librarian, so it cannot be explained by these variables.

(H3) Heavy users

On the other end of the spectrum are the heavy facet users, who employed many if not all of the available facets. From our observations, these students started at the top of the facet list and systematically went down the list, making selections in most of the facet areas. This pattern is more common in the two versions of Summon, where the interface includes the expansion of all facets to display the subfacets underneath. In SSA, the pattern did not extend to the subject/topic and language facets, which are lower on the facet list and not expanded. The language facet was not used by any participants in SSA, and the subject/topic facet was used by only 2%.

(H3) Top-level users

The third category of facet user falls between the first two in their frequency of facet use. We are calling them “top-level users” because these students tended to use only the two facets that in each tool are displayed at the top of the facet list: scholarly and full text. In our instances of Summon, the scholarly facet is first in the list, followed by the full text facet. In SSA, this order is reversed. The strong correlations between these two facets indicates that they are frequently used together, and this is reinforced by our observations that many students did not go farther down the facet list than these top two. This pattern is most likely influenced at least in part by the position of the facets, as a previous study by some of the authors uncovered a statistically significant increase in use of a facet when placed higher on the page (Dahlen, Garcia, & Hanson, 2018). However, students’ perception of the utility of these two facets may also be a factor. Seventy-six percent of participants mentioned that they were specifically looking for scholarly articles or that they used this facet to ensure that their search was limited to scholarly

sources. Use of the full text facet is likely increased by its position near the top of the page and its proximity to the scholarly facet.

As noted previously, the high use of facets was not correlated with attendance at library instruction sessions or consultations with a librarian. It was also not correlated with GPA, which is one measure of academic performance. It remains unclear why some students are frequent facet users while others are not.

(H2) Search features

(H3) Going beyond the first page of results

While previous research has indicated that students are unlikely to go beyond the first page of search results (Asher, Duke & Wilson, 2013; Georgas, 2014; Gewirtz, Novak, & Parsons, 2014; Hamlett & Georgas, 2019; Holman, 2011), this was not true for our participants' use of Summon and SSA. About half of our participants went beyond the first page of results in the two instances of Summon, which listed 10 results per page. Far fewer went beyond the first page in SSA, which displays 20 results per page. This low number is partly explained by the many cases in which participants' searches in SSA only yielded one page of results. These findings contradict the assumption that students are not willing to go beyond the first page of search results, at least for our sample of upper-level social science majors. Our previous study showed that with a constant discovery system interface, users are more likely to go beyond the first page of results when 20 results are displayed than when only 10 are displayed (Dahlen, et al., 2018). It is worth questioning, however, whether it is worthwhile to encourage students to go beyond the first page of search results. We found no correlation between this behavior and the relevance, authority, or currency of articles chosen, so it may be that this behavior is not as desirable as librarians imagine, or that it is only useful in certain circumstances (e.g., in more exhaustive searches).

(H3) Subject headings and subject searching

Participants did not exhibit much use of subject headings, either by clicking on linked subject headings or by using the drop-down menu in an advanced search. The latter is perhaps not a recommendable strategy to those not solidly familiar with controlled vocabulary, and is not frequently taught at our institution. In fact, similar to the participants in Holman's (2011) study, those students who changed the drop-down menu to search by subject seemed to do so with the mistaken impression that "subject" was being used in a very general sense, as they did not change their search terms from their initial keywords or give other indications of understanding that a controlled vocabulary was being employed. This reinforces the finding of Georgas (2014) that students are willing to experiment with the search features available to them. In contrast, clicking on linked subject headings is a strategy we teach in some classes at our institution to help students arrive at a more focused results list; despite this, and similar to the observations of Bloom & Deyrup (2015), this feature is infrequently used. While 36% of our participants reported never attending a library session or consultation, the remainder may have been exposed to linked subject headings but still neglected to employ them in this setting.

(H3) Sort order

Similarly to those in Georgas' (2014) study, our participants changed the default sort order of the results list very infrequently. Our instances of Summon defaulted to relevance order, which is critical for a discovery tool that might return thousands of results for a search. Those students who changed the Summon sort order to "date newest" quickly changed back, probably after seeing some minimally relevant results near the top of the list. SSA, despite defaulting to a "newest first" results list, did not have any of our participants switch its sort order. This could have been a failure to notice the option, which does not stand out from the rest of the page's content, or the smaller number of results not necessitating a revision; in most of our participants' searches, SSA returned only 1-2 pages of results.

(H2) Summon-specific search features

(H3) Suggested articles

Clicking on an article suggestion in a Summon article record was a relatively popular feature with our participants. Its use is especially high considering that Summon does not suggest articles in every article record, and that the numbers recorded only account for students who clicked on the suggested article links, not those who read and considered the suggestions without clicking. A number of participants expressed their appreciation for this feature in post-search interviews. This type of feature is one that students would be familiar with from sites like Amazon, which informs you what users who clicked on a given product ended up buying. This personalized experience seemed to appeal to students, possibly because of its familiarity, or possibly because of the appeal of crowdsourcing an information need. Using this feature was positively correlated with the number of article records viewed in both versions of Summon, though not with the authority, relevance, or currency of articles picked.

As noted above, SSA does have a somewhat similar feature, providing a link in article records to "Find Similar Results using SmartText Searching." Despite the popularity of the suggested articles in Summon, only 2% of users clicked this link in SSA, indicating that they likely did not see it or understand its label. Summon's prominent listing of linked article titles was much more likely to be noticed and used. The use SSA's "find similar results" was negatively correlated with the relevance of articles chosen ($r=-.32, p<.05$).

(H3) Suggested databases

Summon suggests databases in some searches when it is able to identify a database in the library's collection deemed appropriate for the search topic. When our library adopted Summon as our very first discovery system, several of our librarians were excited about this feature, hoping that it would lead students to subject-specific databases where they would get a more focused set of results. In this experiment, Summon did not usually suggest a database to those students searching on the topic of gender stereotypes in children's toys (see Appendix A for full search prompts). For those searching on the topic of academic achievement of children of immigrants, Summon frequently suggested ERIC as a possible database. This suggestion appears at the top of the results list in a prominent location, but only 4% of our participants used it in pre-scoped Summon, and none in default Summon. This might be because participants

were asked to use Summon as their search tool, or because they did not see the utility of this option.

(H3) Add results beyond the library's collection

In our instances of Summon, the default configuration is to display only articles for which we have full text. However, in the results list along with all of the facets for limiting results is an option to “add results beyond the library’s collection,” which expands the results to include articles without full text. Only one participant in default Summon, and none in pre-scoped Summon, employed this option. Perhaps this is not surprising, as usability testing we performed on a different discovery system with the same label (“add results beyond the library’s collection”) indicated that while students understood that this link would expand their search, they seemed to think about this in terms of physical items rather than digital items (Dahlen, et al., 2018). Since we had students looking for articles rather than books, those who noticed this option might have deemed it irrelevant to the task at hand. Our library has since changed the label of this option to “include articles without full text.”

(H3) Advanced search

Previous investigations have noted infrequent use of advanced search options (Dempsey & Valenti, 2016; Hamlett & Georgas, 2019). About a quarter of our participants in each version of Summon went to the advanced search screen and used it to split their search terms into multiple boxes (connected by default with a Boolean AND). Our version of SSA defaults to EBSCOhost’s advanced search screen, so all participants searched SSA using advanced search. While we did not ask participants specifically about the advanced search option in our post-search interviews, a number of them shared their preferences when asked for their impressions of each search tool. Among those who shared, preferences were mixed. Some preferred the advanced search options, noting that they were accustomed to entering search terms in separate boxes. Other participants voiced a preference for the simplicity of the single search box, or noted that the advanced search screen was overwhelming. Of the 42% of students who made a comment about the advanced search option, more had positive comments (69%) than negative (8%) or neutral (23%) comments. A more prominent link to the advanced search option within Summon may increase usage; one participant specifically mentioned not seeing the advanced search option until they were finished searching. Using the advanced search screen was not correlated with selecting more authoritative, relevant, or current articles, so it may be that promoting awareness of this feature would serve primarily to satisfy the preference of those students accustomed to this interface.

(H2) Search behaviors

(H3) Article records viewed

The number of article records participants viewed before making their selections was similar in each tool (mean of 4.5), indicating that neither the search interface nor the number of results (Summon listed thousands while SSA typically listed 1-40) affected how many article records students viewed during their searches. One notable behavior was that a small number of participants did not view any article records in their searches. While these numbers are small

(two participants each in default and pre-scoped Summon; one participant in SSA), it highlights the weight students give to the title of the article when making their selections. (It should be noted that Summon provides a couple lines of the abstract in the results list, so this information was also available to students in their searches.) When asked why they selected a particular article, 28% of participants mentioned the title as a main factor, frequently using the phrase “it caught my eye.” One participant who did open several article records admitted to not reading the abstracts before choosing the articles.

(H3) Opening full text

Student practices varied with regard to how often they opened the full text of an article before selecting it. Perhaps more than other search behaviors, this practice might differ in our experimental situation, where students were only selecting articles, from a real life situation, in which students would use their chosen sources to complete an assignment. It may, however, be reflective of an initial narrowing process that students engage in when completing assignments. A quarter of our participants always or almost always opened the full text of articles before choosing them. While none of these students read the whole article, a number of them exhibited helpful practices such as selectively skimming certain sections of the text (introduction, discussion, conclusion). There was no correlation, however, between the opening of full text and the relevance, authority, or currency of articles chosen, suggesting that the information available in the article record is usually sufficient to make those determinations.

(H2) Relationships between variables

In our Results section, we reported several significant relationships between variables, some of which are more sensical than others. We also reported the lack of relationship between certain variables where a relationship might have been expected. Table 7 presents a summary of significant correlations between facet use or search behavior with the quality of selected articles, and this section will explore these relationships further. The currency of articles chosen is not included in this table as it was not correlated with any of the variables listed.

Table 7. Summary of relationships between facet use, search behavior and quality of articles chosen

		Facets		Search Behavior	
		Scholarly Facet	Full text Facet	# of Records Viewed	Total Search Time
Summon	Authority	+			
	Relevance			-	-
Pre-scoped Summon	Authority			-	-
	Relevance				
SSA	Authority				
	Relevance		-	-	

+ Signifies significant positive relationship between that facet use or search behavior and the quality of articles chosen in each tool based on two-tailed correlations.

- Signifies a significant negative/inverse relationship between that facet use or search behavior and the quality of articles chosen in each tool based on two-tailed correlations. Non-significant relationships are left blank.

(H3) Scholarly facet and authority

Use of the facet limiting results to scholarly sources had a positive correlation with the authority scores of the articles chosen only in default Summon. This is perhaps not surprising, as default Summon included more non-scholarly sources than our other two search tools (pre-scoped Summon excludes newspaper articles, and SSA primarily indexes scholarly journals). However, this result shows the significant effect that facets can have on student source selection. It also reinforces previous findings by some of the authors that the default settings in discovery systems have a substantial impact on student source choices (Dahlen & Hanson, 2017). In that analysis, we found that students chose more authoritative articles in pre-scoped Summon and SSA than they did in default Summon. The current findings expand on this by indicating that when discovery systems are configured to exclude newspaper articles, students do not need to use the scholarly facet to select equally authoritative articles. The same is true for SSA: students who did not use the scholarly facet chose equally authoritative articles as those who did. Because many students are unlikely to change the default settings or use facets (Asher, et al., 2013), how libraries configure the default search parameters becomes even more impactful.

(H3) Full text facet and relevance

In SSA only, we see a negative correlation between the use of the full text facet and the relevance of the articles chosen. It is logical that this relationship would not apply to our instances of Summon, as the default is to display articles with full text. As an indexing and abstracting database, SSA provides full text for a subset of articles, but in most cases, a full-text link resolver in the article record connects the user to the full text in a different database (or, if not available, provides a link to request with interlibrary loan). Because such a high percentage of article records in SSA are eliminated by limiting to full text, it stands to reason that students using this facet would pick less relevant articles, as they have severely limited their results. This has implications for instruction, as students learning to use databases could be steered away from this option, or for interface configuration, as EBSCO databases allow for re-ordering or removing facets.

(H3) Date facet and currency

The date facet was one of the less frequently used facets, and the only facet that was used more frequently in SSA than in Summon, despite SSA's sort order defaulting to "newest first." The increased use of the date facet in SSA might be explained its relatively high position in the facet list, where it appears just below the full text and scholarly facets. In contrast, Summon's date facet is second to last in the facet list, and a facet's higher position on the page has been shown to increase its use (Dahlen, et al., 2018). Use of the date facet was not correlated in any of the tools with the currency of the articles chosen. In post-searching interviews, 62% of participants noted that they were paying at least some attention to the date of publication when selecting their articles, with 38% saying it was an important consideration. It may be that students who consider publication date to be an important criterion are mentally filtering by date

even when they do not use the date facet. Additionally, 26% of participants mentioned that their strategy is to select a mix of older and newer articles, which might confound the relationship between the date facet and currency.

(H3) Instruction and facet use

Some of the literature on discovery systems states or implies that librarians should continue providing instruction for students on using them (Crist, Leahy & Carbery, 2019; Dempsey & Valenti, 2016; Rosenzweig, Thill & Lambert, 2019), despite their seemingly straightforward interfaces. This advice likely stems from the observation that many students do not take full advantage of the search features that might aid them in their quest for information. It is worth noting, then, that we found no relationship between the number of library instruction sessions, or one-on-one consultations with a librarian that a student had attended, and either their use of the scholarly facet or the total number of facets they used. While measuring the impact of library instruction was not the focus of our study, we tested the relationship between instruction and search behaviors to determine whether participation in library instruction sessions was a mitigating factor in how students interacted with these search tools. Because this was not the focus of our study, the instruction this sample of students received (64% reported attending one or more classroom instruction sessions or consultations) may or may not have specifically addressed the use of facets of other search features in Summon, SSA, or other library search tools. Additionally, we recorded the number of instruction sessions students reported attending at our institution, but library instruction sessions attended at other institutions were not captured. Further research, building on such studies as that of Dempsey and Valenti (2016), who looked at student facet use following targeted instruction, is needed to determine whether instructional interventions are effective in increasing student use of facets and search features.

(H3) Article records viewed, relevance, and authority

The relationships we found between the number of article records a participant viewed during their search and the relevance and authority scores of the articles they chose are not easy to explain. First, in pre-scoped Summon, the number of article records viewed was negatively correlated with the authority scores of the chosen articles. This means that students who viewed more article records in this tool tended to choose less authoritative articles. Second, in default Summon and SSA, there was a negative correlation between the article records viewed and the relevance score, meaning that students who viewed more article records were more likely to choose less relevant articles. While these relationships are not intuitive, we might speculate that students who are less experienced or less confident searchers would feel compelled to look at more articles before choosing, and also end up picking articles with lower relevance or authority. We might also say that viewing more article records is not sufficient to prompt students to choose better articles.

(H3) Time spent searching and other variables

Perhaps unsurprisingly, the amount of time that students spent searching in each tool was correlated with how often they opened full text and how many article records they viewed. It is easy to imagine that opening more full text and viewing more article records would lead to longer search times. Opening full text and viewing article records are only correlated with each

other in default Summon, showing that these two actions are not always paired (searchers may view many article records without ever opening full text). Interestingly, time spent searching was not correlated with going beyond the first page of results, though this latter variable was correlated with article records viewed in two of our tools (pre-scoped Summon and SSA). Spending more time searching was also not sufficient to lead students to choose better articles, with authority, relevance, and currency either not correlated or negatively correlated with search time. Additionally, search times were similar in each of the search tools, suggesting that none of these tools is “easier” for students to use in the sense of allowing them to find sources more quickly.

(H3) Frequently selected articles

As described in the results section, the articles that students selected more frequently had significantly higher relevance and authority scores than those selected less frequently. Overall, the articles selected by students were good quality, with high authority and relevance scores. We find these results to be a promising indicator of our students’ ability to evaluate sources from library search tools and select high quality articles. The class standing of these students (juniors and seniors) and their enrollment in a major known to emphasize scholarly sources likely had a substantial effect on their ability to select authoritative and relevant articles. This finding offers a counterpoint to the literature on satisficing behaviors among students (Agosto, 2001; Connaway, Dickey, & Radford, 2011; Holman, 2011). This is not to say that our students do not engage in satisficing behaviors, but rather that, in this experimental setting, they exhibited an ability to go beyond satisficing and select high quality sources.

(H2) Limitations of study

In this study, we chose to focus on understanding a specific subset of students: juniors and seniors majoring in Social and Behavioral Sciences (SBS). This limits the generalizability of our findings, though we might imagine that the patterns we observed would be similar for other upper-level students majoring in the social sciences. At our institution, SBS faculty place a high emphasis on scholarly sources and often encourage students to use JSTOR, factors that likely influenced student behavior in this study.

Participants were sampled by convenience, rather than randomly, so they may not be entirely representative of the population of interest. While we attempted to create prompts and tasks that were realistic to the kinds of searching students do for their classes, participants may have behaved differently in this artificial search environment than they would if they were truly “in the wild.”

We used one discovery system (with two configurations) and one database as representatives of these categories of tools. Different results might be observed with other databases and discovery systems. Our instances of Summon were implemented with a search interface created and employed by our university system, which works with Summon’s API, so the layout may be different for other Summon users.

(H1) Conclusion

This study demonstrates that students' facet use, search behavior, and quality of articles selected were influenced by the type of tool used and by the way that tool is configured. Improving students' source selection is not only a matter of teaching students how to use a tool, but also about modifying the system to encourage useful behaviors and facet selection. One lesson here is that discovery systems may not be as intuitive as we think. Even for our sample of upper-level students in a major where scholarly sources are emphasized, and who had very high authority scores on average, the use of the scholarly facet in default Summon was correlated with higher authority of articles chosen. This implies that even experienced students who do not use facets in a discovery system are more likely to choose less authoritative sources. Possibilities for addressing this include emphasizing facets in instruction, configuring interfaces to make key facets as visible as possible, and changing the default settings of discovery systems.

(H2) Instruction

Emphasizing facets, and the scholarly facet in particular, in instruction sessions seems to be an obvious option for improving the authority of student source choices. As previously noted, we found no correlation between instruction and facet use, though our instruction sessions were not specifically designed to cover facet use (and thus may or may not have directly addressed it). Regardless, it seems advisable for librarians to continue showing students what facets can do, as those students who choose to employ the scholarly facet may experience improved outcomes.

It is worth noting that many of the search features or search behaviors we observed did not have a relationship with increased authority, relevance, or currency of articles chosen. However, we do not interpret that finding as an imperative to de-emphasize these during library instruction. Student use of library search tools is probably based in large part on familiarity and preference. Showing students search features that they find attractive (e.g. suggested articles, advanced search) might keep them coming back to the tool regardless of whether it improves their outcomes.

While the relevance scores for articles chosen were high overall, in two of the tools (default Summon and SSA), the number of article records viewed was negatively correlated with the relevance of articles chosen (in pre-scoped Summon there was no relationship). In all tools, going beyond the first page of results had no correlation with relevance. These findings are somewhat counterintuitive, as we might expect students who view more article records to choose more relevant articles. While this result might be a matter of confusion over too many choices, we see it, along with the observed over-reliance on article titles in source selection, as a call to action to more explicitly teach students to evaluate relevance. Unlike authority, which has been highlighted in library instruction sessions at our institution, evaluating for relevance is more likely to be given lip-service than explicitly taught. This is starting to change at our

institution, and while a description of our new efforts is beyond the scope of this paper, we are eager to see how this impacts our students.

(H2) Interface configuration

While others have called for database designers to make modifications to interfaces to accommodate student tendencies (Georgas, 2014; Holman, 2011), we would like to encourage librarians to make some changes themselves. Many databases and discovery systems allow subscribing institutions to modify certain aspects of their interfaces, including the order, labels, and positions of facets. Many of our findings here have reinforced those of our previous study, (Dahlen, et al., 2018), which found that positioning a facet higher on the page leads to greater use, as does expanding the facet so that subfacets are visible.

Because the scholarly facet was correlated with higher authority scores in default Summon, we recommend positioning the scholarly facet at the top of the facet list in discovery systems. Increased visibility can lead to increased use, which can lead to increased authority. The “linked full text” facet in SSA was correlated with lower relevance scores, yet this facet was part of our observed pattern of “top-level facet users,” likely because it is at the top of the list along with the scholarly facet. We recommend that this facet be moved lower on the page for indexing and abstracting databases, so it does not artificially limit the number of article records that students see, possibly leading to decreased relevance of sources chosen.

These are two specific recommendations, but we might also generally state that, following our current and earlier findings (Dahlen, et al., 2018), facets that librarians want students to notice and use should be positioned higher on the page and expanded rather than collapsed.

(H2) Default settings

It is worth reiterating that in pre-scoped Summon, which was configured to exclude newspapers and include subject areas within the social sciences, the use of the scholarly facet was not correlated with higher authority of articles. If students tend to use the default settings on search tools, and if instruction is unlikely to make a large impact on that behavior, then changing the default settings on discovery systems is an option for improving the authority of articles that students select.

There are several valid arguments against this option, including the usefulness of newspaper articles and other non-scholarly sources for certain purposes. Additionally, changing the default settings does not teach students transferable skills regarding source evaluation, though this argument might also be posed against the very availability of facets, at least those that do not have a Google equivalent. However, Hamlett and Georgas (2019) found that students were more likely to choose facets in the initial search box, via a drop-down menu, before they landed on the results page. Having such an option available to limit to scholarly sources in the initial search box might be an acceptable way to make this option more visible to students without changing the default settings. As we have previously suggested (Dahlen & Hanson, 2017), pre-

scoped discovery system widgets might have a place on research guides, if not the library home page.

(H2) Importance of departmental faculty

One final takeaway is that despite not taking full advantage of the facets and search features of these tools, our participants chose high quality articles overall. Chances are that they did not become good source selectors through library instruction alone, especially considering that library instruction was not correlated with the use of facets or with the authority, relevance, or currency of articles chosen. In post-searching interviews, many students mentioned (either explicitly or implicitly) the influence of their instructors in shaping their standards for source selection. This topic will be explored in greater depth in a forthcoming paper, but it is worth noting here that converting faculty into advocates for information literacy might have a greater impact on student search behavior than teaching students to use facets.

Further Research

Student information-seeking behavior continues to be a rich area of research for librarians. A particular area of future interest that arises from our findings is to what extent library instruction has concrete impacts on student search behavior. While our study did not find a correlation between the two, our instruction was not designed with this end in mind. It would be worth exploring whether an instructional intervention targeted at increasing student use of facets or other search features would have the intended effect.

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(H1) References

- Agosto, D. E. (2002). Bounded rationality and satisficing in young people's web-based decision making. *Journal of the American Society for Information Science and Technology*, 53(1), 16-27. <https://doi.org/10.1002/asi.10024>
- Asher, A. D., Duke, L. M., & Wilson, S. (2013). Paths of discovery: Comparing the search effectiveness of EBSCO Discovery Service, Summon, Google Scholar, and conventional library resources. *College and Research Libraries*, 74(5), 464-488. <http://dx.doi.org/10.5860/crl-374>
- Bloom, B., & Deyrup, M. M. (2015). The SHU research logs: Student online search behaviors trans-scripted. *The Journal of Academic Librarianship*, 41(5), 593-601. <https://doi.org/10.1016/j.acalib.2015.07.002>
- Crist, E., Leahy, S., & Carbery, A. (2019). "I'd say it's good progress": An ecological momentary assessment of student research habits. *Recasting the Narrative: Proceedings of the Association of College and Research Libraries 2019 Conference*, April 2019, 692-701. Retrieved from <http://www.ala.org/acrl/sites/ala.org.acrl/files/content/conferences/confsandpreconfs/2019/I'dSayItsGoodProgress.pdf>
- Cockrell, B. J., & Jayne, E. A. (2002). How do I find an article? Insights from a web usability study. *Journal of Academic Librarianship*, 28(3), 122-132. [https://doi.org/10.1016/S0099-1333\(02\)00279-3](https://doi.org/10.1016/S0099-1333(02)00279-3)
- Connaway, L. S., Dickey, T. J., & Radford, M. L. (2011). "If it is too inconvenient I'm not going after it": Convenience as a critical factor in information-seeking behaviors. *Library & Information Science Research*, 33(3), 179-190. <https://doi.org/10.1016/j.lisr.2010.12.002>
- Connaway, L. S., White, D. S., & Lanclos, D. (2012). Visitors and residents: What motivates engagement with the digital information environment?. *Proceedings of the American Society for Information Science and Technology*, 48(1), 1-7. <https://doi.org/10.1002/meet.2011.14504801129>
- Dahlen, S. P. C., & Hanson, K. (2017). Preference vs. authority: A comparison of student searching in a subject-specific indexing and abstracting database and a customized discovery layer. *College & Research Libraries*, 78(7), 878-897. <https://doi.org/10.5860/crl.78.7.878>
- Dahlen, S., Garcia, K., & Hanson, K. (2018). Comparing apples and bananas? A/B testing for discovery layer optimization. *The Academic Library in Times of Change: Proceedings of the California Academic and Research Libraries Association Conference*, April 2018.

Retrieved from http://conf2018.carl-acrl.org/wp-content/uploads/2019/07/dahlen_research_abtesting.pdf

- Dempsey, M., & Valenti, A. M. (2016). Student use of keywords and limiters in web-scale discovery searching. *The Journal of Academic Librarianship*, 42(3), 200-206. <https://doi.org/10.1016/j.acalib.2016.03.002>
- Georgas, H. (2014). Google vs. the library (part II): Student search patterns and behaviors when using Google and a federated search tool. *portal: Libraries and the Academy*, 14(4), 503-532. <https://doi.org/10.1353/pla.2014.0034>
- Gewirtz S. R., Novak, M., & Parsons, J. (2014). Evaluating the intersection between WorldCat Local and student research. *Journal of Web Librarianship*, 8(2), 113-124. <https://doi.org/10.1080/19322909.2014.877312>
- Hamlett, A., & Georgas, H. (2019). In the wake of discovery: Student perceptions, integration, and instructional design. *Journal of Web Librarianship*. <https://doi.org/10.1080/19322909.2019.1598919>
- Holman, L. (2011). Millennial students' mental models of search: Implications for academic librarians and database developers. *The Journal of Academic Librarianship*, 37(1), 19-27. <https://doi.org/10.1016/j.acalib.2010.10.003>
- Leeder, C., Markey, K., & Yakel, E. (2012). A faceted taxonomy for rating student bibliographies in an online information literacy game. *College & Research Libraries*, 73(2), 115-133.
- Muglia, C., & Namei, E. S. (2017). Academic libraries, filtering, and the "tyranny of choice." *At the Helm Leading Transformation: Proceedings of the Association of College and Research Libraries 2017 Conference*, March 2017, 1-14. Retrieved from <http://www.ala.org/acrl/sites/ala.org.acrl/files/content/conferences/confsandpreconfs/2017/AcademicLibrariesFilteringandtheTyrannyofChoice.pdf>
- Nelson, D., & Turney, L. (2015). What's in a word?: Rethinking facet headings in a discovery service. *Information Technology and Libraries*, 34(2), 76-91. <https://doi.org/10.6017/ital.v34i2.5629>
- Pearce, A. L. (2019). Discovery and the disciplines: An inquiry into the role of subject databases through citation analysis. *College & Research Libraries*, 80(2), 195-214. <https://doi.org/10.5860/crl.80.2.195>
- Perruso, C. (2016). Undergraduates' use of Google vs. library resources: A four-year cohort study. *College & Research Libraries*, 77(5), 614-630. <https://doi.org/10.5860/crl.77.5.614>

- Rose-Wiles, L. M., & Hofmann, M. A. (2013). Still desperately seeking citations: Undergraduate research in the age of web-scale discovery. *Journal of Library Administration*, 53(2-3), 147-166. <https://doi.org/10.1080/01930826.2013.853493>
- Rosenzweig, J. W., Thill, M., & Lambert, F. (2019). Student constructions of authority in the framework era: A bibliometric pilot study using a faceted taxonomy. *College & Research Libraries*, 80(3), 401-420.
- Thomas, S., Tewell, E., & Willson, G. (2017). Where students start and what they do when they get stuck: A qualitative inquiry into academic information-seeking and help-seeking practices. *The Journal of Academic Librarianship*, 43(3), 224-231. <https://doi.org/10.1016/j.acalib.2017.02.016>
- Trapido, I. (2016). Library discovery products: Discovering user expectations through failure analysis. *Information Technology and Libraries*, 35(3), 9-26. <https://doi.org/10.6017/ital.v35i3.9190>
- Zhang, Y. (2008). The influence of mental models on undergraduate students' searching behavior on the web. *Information Processing & Management*, 44(3), 1330-1345. <https://doi.org/10.1016/j.ipm.2007.09.002>

Appendix A: Search prompts

Each participant was assigned one of the following tasks:

1. You are writing a research paper on the effects of children's toys on gender stereotypes. Find 2 of the best quality articles to use.

OR

2. You are writing a research paper on the factors that affect the academic achievement of children of immigrants. Find 2 of the best quality articles on this topic.

Appendix B: Relevance rubric

Score	3	2	1
Relevance	Source directly addresses one or more aspects of the topic	Source partially addresses an aspect of the topic	Source addresses topic in a very limited way

A score of 0 for articles not addressing the topic was also permitted, as were half points for articles falling in between categories.