Examining Student Research Choices and Processes in a Disintermediated Searching Environment

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abstract: Students today perform research in a disintermediated environment, which often allows them to struggle directly with the process of selecting research tools and choosing scholarly sources. The authors conducted a qualitative study with twenty students, using structured observations to ascertain the processes students use to select databases and choose sources for a typical undergraduate research assignment outside of the classroom. Based on these observations, the authors developed three personas depicting different approaches to the research process. The authors make recommendations for improving students' success in selecting research tools in a disintermediated environment.

Introduction

In a 2010 presentation by Jane Burke, Vice President of ProQuest, the parent company of the Web-scale discovery platform Summon™, she described the rationale for her product and provided some revealing insights into what many believe is the future of source discovery within libraries.[1] One of her main points was that librarians are increasingly viewed as the unwelcome middle man in a world where students can get whatever information they want, whenever they want it. Her suggested solution was to give students what they want—provide them with an easy search interface, but within the framework of pre-selected quality tools and source evaluation options so seamlessly built into the search process that students will choose quality sources effortlessly. The business term for this process of cutting out the middle man is disintermediation, and

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while this shift may feel alienating to some, it is increasingly a reality, not only in libraries but in many of our day-to-day interactions.

While there are many benefits to shifting the way we deliver library resources and create discovery contexts, the methods students use to discover and learn new search tools within a disintermediated environment has not been studied. A disintermediated search environment removes the perceived undesirable hurdle of personal contact, and instead provides a search experience purporting to be as easy to navigate as Google. However, our anecdotal experiences with students suggested these disintermediated search environments did not fully deliver on this claim. A related problem is that students have been observed struggling to choose quality sources even within the simple Google search environment.[2]

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A common feature of many library sessions is the externally imposed nature of the information need, as the process of teaching students how to use at least one of the library's databases is often done to fulfill a specific class research requirement, and students are positioned in such a way that they must make guesses as to what their instructor is requiring. For most students this is either their first interaction with the particular database being taught or the demonstrated methods of searching within the database are new to them. As a result, students spend the library session attempting to navigate an unfamiliar search environment in a setting similar to an observational laboratory study. While instruction librarians use a variety of excellent pedagogical methods to make the search process feel more natural, this does not remove the variable of unfamiliarity. As both instruction librarians and researchers, we suspected this classroom scenario paralleled students' solo searching experiences when they encounter the library's website and try to use the library databases they find there. However, outside of the classroom environment, students receive variable levels of online instructional cues and, moreover, are not always willing to avail themselves of online instructions and help features.

This study presents findings from structured observations of students' searching behaviors when asked to use a pre-determined set of databases in a disintermediated environment (such as a library website) to find scholarly sources. The goal of this study is to describe various ways undergraduate students approach the research processes related to database selection and source evaluation. Within these broader questions, we examine several sub-themes: what criteria do students use to select a database from a particular set of recommended databases (such as those found on a course or subject page); what visual cues and aspects of database descriptions do students use in a disintermediated environment; and how do they determine the authority of the sources they choose within an unfamiliar tool? We then suggest several practical ways to help students select research tools both via our websites and in library instruction sessions.

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Review of the Literature

The way students approach search tools is situated within the larger picture of how they manage the academic research process. Past research into aspects of the undergraduate research process have provided helpful insights into a range of hurdles students face, from navigating the research paper assignment to interpreting the peer-reviewed literature to evaluating which sources to choose from a results list. Robert Detmering and Anna Marie Johnson describe students' interaction with the typical research paper assignment as a "political endeavor" involving negotiation between faculty expectations and perceptions of the research process and the students' own nascent understanding of it.[3] Differences between faculty and student understanding of the research process result in confusion when it comes to actually carrying out research for assignments, as faculty often have vague learning goals for research projects and are most interested in teaching students to join the conversation of a particular discipline, even though students seldom feel a strong connection to their discipline during their undergraduate experience.[4]

Detmering and Johnson further illustrate students' lack of connection to the literature of a particular discipline through the use of students' own written narratives.[5] Student participants voiced that one of their biggest barriers is the disconnect between the typical research paper assignment, which requires the use of peer-reviewed literature, and their novice understanding of the subject domain and the peer-reviewed literature genre. Not only is there dissonance between students' and faculty's disciplinary grounding, but also between traditional college-age students' and faculty's cognitive ability to approach the research process. Gloria Leckie discusses the impact developmental stages have on the differences between students' and faculty's preferences for guidelines, students' lack of a conscious recognition of a "personal information seeking strategy," and students' inexperience with troubleshooting their research problems. Leckie suggests higher levels of faculty involvement are needed to explicitly teach and scaffold the research process in such a way that students can be more engaged in their own research development.[6]

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Students' ability to evaluate the quality of sources is another much-researched and important component of the research process. In efforts to design better instructional programs and search interfaces, researchers have repeatedly found that students do not apply the best (according to classroom faculty and librarians) evaluation criteria to the sources they choose, but instead are more likely to choose sources based on convenience, accessibility, or understandability, even after receiving library instruction.[7]

Most library instructors feel their task in instruction settings is to enable students to find and use information effectively in both their current and future situations. However, within the library research landscape it can be easy to report a false dichotomy that pits

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undergraduate novice searching behavior on one side and faculty or librarian expert searching behavior on the other side, providing little to no nuance as to differences among students' class status.[8] So, what happens when more a more nuanced approach is taken, and the development of student research behavior is examined across the journey from first year to senior, without the end goal of achieving librarian-style expert researching status? One way to begin to answer this question is by looking at educational psychology-based developmental theories that discuss the ways students begin to appreciate their own abilities to understand and process information.

Educational psychologists refer to the various models and theories about developmental stages of understanding as personal epistemologies.[9] There are several personal epistemology models that can inform library instructors' thinking about how students approach information literacy questions. One of these is the Reflective Judgment Model. This model describes seven stages people progress through as they learn to deal with "ill-structured problems," that is, questions or issues that do not have a simple answer.[10] The seven stages are grouped into three broad levels: Pre-Reflective Thinking (stages 1–3); Quasi-Reflective Thinking (stages 4–5); and Reflective Thinking (stages 6–7). Pre-Reflective Thinkers see knowledge as something concrete and knowable. They may accept that there are some questions without answers, but they believe it is just a matter of time before concrete truths are discovered. Quasi-reflective thinkers understand there may be multiple answers to complex questions, but they lack the skills they need to evaluate those answers, so they think all answers are equally valid. Reflective thinkers understand there are multiple perspectives on topics, and there are accepted standards they can use to navigate competing claims. First-year students typically display characteristics found at the higher end of the Pre-Reflective Thinking stage or the lower end of Quasi-Reflective Thinking; most students do not consistently engage in Reflective Thinking until after they graduate.

To receive a ranking using this model, participants take part in a semi-structured interview in which they are asked to respond to open-ended questions, such as their opinion about the safety of food additives. Interviewers use follow up questions like "Can you ever know for sure that your point of view is correct?" to determine how participants grapple with issues of knowledge creation. The interview transcripts are then scored by trained, independent raters. It is rare in this model that someone would actually score a 7. In the Reflective Judgment Model there is always room for improvement rather than an expectation that someone will reach an expert status.[11]

A somewhat different approach was suggested by Barbara Hofer who created the Personal Epistemological Theories Model.[12] Hofer, an educational psychologist, illustrated this model by posing a typical information literacy task to her participants—performing a search while thinking aloud. She suggests that the use of personal epistemology theories is beneficial, even if the problems addressed do not exactly match the "ill-structured problem" construct suggested by Patricia King and Karen Kitchener.[13] These theories can be useful for observing how students approach the process of knowledge building when working on an unfamiliar topic or learning how students regulate their thinking, a situation that more closely matches what happens in a library instruction session. Her model has four components, and rather than being stage-like in nature, she found

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that each of these components interacted and overlapped with each other during the search process.

Little research in the field of librarianship has drawn upon personal epistemology models—with one important exception. Ethelene Whitmire conducted research with college seniors to see how well several personal epistemology models (including the Reflective Judgment Model) mapped onto Carol Kuhlthau's ISP (Information Search Process) model.[14] She found that epistemological beliefs affected five of Kuhlthau's six stages (all but the first stage—task initiation), thereby demonstrating a strong overlap between the process of information seeking and the processes involved in developing a personal understanding of knowledge. Students who had lower personal epistemological rankings were less engaged in the topic selection and pre-focus exploration phases and relied primarily on their instructors' search and source suggestions. In contrast, students with higher epistemological rankings used a range of search strategies and techniques to find sources (including asking librarians for assistance), were more flexible in solving roadblocks they encountered, and felt their knowledge base was sufficient to evaluate the information they found.

While many researchers have examined students' searching decisions when faced with choosing sources, or when given the opportunity to search any database of their choosing (including Google), few have examined what students do when presented with a narrow range of pre-selected scholarly database options.[15] The narrower range of options more closely matches what happens in a typical library instruction session, where librarians recommend specific library research tools to students or on a website, where selected databases for a course are grouped together. Examining specific search tool selection is crucial as libraries and librarians try to make the most of the databases and discovery services we pay for and attempt to get students connected to the most appropriate tools for their research projects.[16]

Methods

Data Collection

To test our assumptions about how students choose from a list of pre-selected sources and interact with search tools designed to provide a gateway to academic research, we began by creating a simple web page using our course page content management system (Library à la Carte™), which contained search boxes from three different content providers: Google Scholar, Serial Solutions' Summon (locally known as 1Search), and Web of Science®. Each search box was identified by name along with a brief description of the database (see Figure 1). These databases were chosen because the content they contain is multidisciplinary, each contains scholarly content, and each has a different way of identifying whether the content is peer-reviewed.

Next, with the incentive of a $10 gift certificate to the campus retail food locations, we recruited twenty undergraduate participants to carry out searches using this simplified search page. The study observing the students' tool selection process was conducted during the first month of the fall 2011 term, so first-year students who participated had little background knowledge of the institution.

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Figure 1. The search page students used to being looking for a topic. 1Search is the local configuration of Serial Solutions' Summon product.

Participant Demographics

Participants for this study were drawn from students who were in the library during the recruitment period, yet gender representation was fairly even with nine males and eleven females. Because many students at our university graduate in six years, participants' academic standing skewed toward the upper-division classes. Four of the participants identified themselves as first-year students, two as sophomores, seven as juniors, and seven as seniors. Participants came from a wide range of disciplines, representing six of the eleven colleges that confer undergraduate degrees. Two participants were from the College of Public Health & Human Sciences, three each were from Agriculture, Business, and Science respectively, five were from Engineering, and six were from Liberal Arts (some participants belonged to more than one college).

Database Selection

After consenting to be part of this Institutional Review Board-approved study, participants were presented with a copy of a task, which was also read aloud to them. The scenario they were given directed them to prepare a speech for an introductory communications class at this university. The assignment requirements specified that the speech must contain evidence from at least three outside sources and must incorporate sources

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an academic audience would find convincing and authoritative. To ensure that students could successfully find sources once they chose a tool, we provided five pre-selected topics from which to choose. The topic choices were *tsunami early warning*, *medical school admissions*, *solar development*, *traffic congestion*, and *urban woodlands*. While this was not a naturalistic form of topic generation, all of the students were easily able to choose a topic from this list that they were willing to explore during the task.

Participants were asked to use a think-aloud procedure while carrying out the searches, and prompts from the researchers were occasionally used to elicit participant thinking during the search process. Participants were asked to demonstrate their search process for twenty minutes, even if they were not able to find all of the sources they needed for their speech during this time. During the search process, participants' screen movements were recorded using the screen capture software Camtasia®. Two researchers were present at each search session; one researcher acted as the recorder and took notes based on the participants' observations, the second researcher acted as the facilitator and directed the participant through the search task.

To begin their search, students were directed to the simple search web page (see Figure 1). Three versions of this web page were created so that the order of the search boxes could be rotated to measure whether participants simply chose the first search box on the page. Participants were asked to begin their search on this simple search page and then to use as many of the three search entry points as they liked. In ascending order, participants chose to search in Summon (eight participants), Google Scholar (eleven participants) and Web of Science (eleven participants) (see Table 1). Five participants chose Summon first, seven chose Google Scholar first and eight chose Web of Science first (see Table 1). The order of the search box on the page did not appear to affect database selection.

Many of the participants who chose Google Scholar first chose it because of the Google brand name, or simply because they confused it with the regular Google search.

Participants may have been more likely to begin searching in Web of Science because of the nature of the pre-selected topics, which tended to have a scientific element, and participants quickly noticed "science" in the title of the database. Many of the participants who chose Google Scholar first chose it because of the Google brand name, or simply because they confused it with the regular Google search. Participants who chose Summon first reported previous experience using this database.

At the end of the twenty-minute search session, several follow-up questions were asked, including whether they would have changed their process if they had been given a scenario that specifically required "peer-reviewed journal articles," as opposed to "sources an academic audience would find appropriate." Participants were also surveyed about their previous use of the three databases in this study: eight out of twenty had previously used both Summon and Google Scholar, but only one out of twenty had previously used Web of Science (see Table 1).

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Table 1.

Number of participants who had previously used Summon, Google Scholar, or Web of Science, which databases participants chose to search in first, and the overall number of times the databases were selected.

	Previously Used the Database	First Database Selected.	Number of Times Database was Selected
Summon	8	5	8
Google Scholar	8	7	11
Web of Science	1	8	11

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Qualitative Analysis and Generalizability]

To identify patterns and themes, qualitative analysis of the interview transcripts was conducted, using the computer assisted qualitative data analysis software package QSR's NVivo 9. Each researcher independently coded a sample of transcripts, and grouped the codes into themes. All three researchers then met to compare notes and create a single coding scheme for all of the transcripts. First, consensus was reached about the broader themes, and then the individual codes were assigned to specific groups. The broader themes were reduced to more specific themes, and includes/excludes statements were developed to determine when those codes would be used. All three researchers then used this scheme to code every transcript.

The smaller sample sizes associated with qualitative studies merit discussion as to how these results can be generalized to different contexts. William Firestone offers a useful framework for discussing generalizability in qualitative research. He suggests that generalizability should never be treated as a given, even in quantitative studies. Instead, the claim that "my results can be generalized" should always be understood as an argument the author needs to construct and defend. In this study, we suggest using case-to-case translation as a method for generalizing to other contexts. The key to this form of generalizability lies in the reader's assessment of whether a particular finding would transfer to his or her context. To facilitate this, the author must provide "a rich, detailed, thick description of the case."[17] In this article, we use personas to provide this thick description for helping the reader choose what results can be transferred to their context.

Persona Creation

Personas have been defined as a "hypothetical user archetype," or as a fictitious composite-reflecting a particular user audience or group, but based on input from real users.[18] Fairly typical user groups, such as undergraduates, graduate students, and faculty, have been previously used as personas by libraries for web design projects.[19] Jack Maness and others used personas to clarify what different user groups, such as older faculty members with technical concerns or younger graduate students seeking collaboration and promotion opportunities, might want from an institutional repository.[20] Analyzing qualitative findings in terms of personas can help describe a rich setting within the library environment, thereby making it easier to transfer both findings and their meaning to other libraries.[21] Similarly, educational psychologists employ this style of description, although not identified as the use of personas, to provide context and meaning for the models they present.[22]

To begin creating the personas in this study, the descriptive codes for our participants were examined for differences. One of the clearest differences was academic standing. Next, participants were divided into two groups: lower-division undergraduates (freshman and sophomores) and upper-division undergraduates (juniors and seniors). When examining the descriptive codes for search behaviors and tool selection choices, as well as the analytical codes assigned when analyzing the transcripts, clear patterns began to develop in the way groups of participants chose particular databases, determined authority and credibility, and approached the research process. Three searcher type personas emerged from this process, and as is typical with the creation of personas, they were each assigned a name and an identity to help understand them more deeply (see Table 2). These identities will be discussed in more detail in the findings section.

Findings and Discussion

Persona Characteristics

To better understand these students' research processes and, more specifically, to make sense of their database selection choices by demonstrating the commonalities and differences among various types of users, personas were developed based on our participants' behaviors. In addition to creating the typical persona identity, which includes a name, some demographic information, and behavioral tendencies, we have also chosen to clarify the different research behaviors associated with each person by using a metaphor. The articulation we chose was based on cooking, as

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Table 2.

Persona attributes and suggested actions for providing targeted library instruction about database selection and use both in the classroom and on the library website.

Persona & Cooking Metaphor .	Attributes	Actions in classroom	Actions on the website	Number of participants in category
Anthony, Company Dinner Cook	• Simple to no search strategy • Knowledge of scholarly behavior is limited • Lacks conceptual understanding needed to appropriately evaluate sources • Very focused on mechanics of assignment • Plugs information into a predetermined outline	• Work on developing a basic search strategy • Emphasize what scholarly / peer-reviewed sources are and why this is important • Highlight steps to evaluating sources • Work with instructors to develop assignments that incorporate source evaluation • Discuss source types	• Provide brief but detailed database descriptions • Create links to other databases that are similar	5
Ryan, Comfort Food Cook	• Strong sense of the familiar / Returns to known sources • Exhausts a source	• Show techniques for improving his search strategies within the		8

	before going on to a new source • Knows about advanced search functions but does not always use them effectively • More flexible search process	databases he already knows well • Demonstrate how to find databases with similar scope and content • Teach transferability of skills from one database to another • Use advanced search features to get the most out of a database search	• Use terminology in description that emphasize use (for scholarly research) rather than content (indexes 500 journals) • Provide links to resources that provide quality background information	
Sophie, Fusion Cuisine Cook	• Has established search strategies • Flexible search patterns • Uses new tools more readily	• Continue developing metacognitive skills • Demonstrate organization and search management features • Offer mentoring opportunities		7
All	• Want background information • Want authoritative information but outsource evaluation process to the database • Tension between their information-seeking needs and what the instructor wants	• Incorporate search for background information and how to identify reliable background sources into class or course website • Emphasize source evaluation by explaining how databases work and can or cannot be used to locate the best source • Work with instructors to develop assignments that alleviate this tension		20

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this is a shared experience for many people. The three cooking models we chose are the "Company Dinner" cook, who can only successfully cook one meal, the "Comfort Food" cook, who has a solid but limited repertoire, and the "Fusion Cuisine" cook, who can successfully create a range of meals with a variety of ingredients. Both the identity and the metaphor for each of the three personas are described in more detail below.

Persona 1: Anthony, the "Company Dinner" Cook [C head]

Anthony is a first-year engineering major who has not yet used the library. He chooses Google Scholar to begin his searches and is not yet familiar with the process of scholarly peer-review. Anthony is a searcher who "doesn't know what he doesn't know" and as a result is paradoxically confident when approaching a task he has some previous familiarity with, such as gathering research for a speech.[23] He has a plan for neatly fitting the research he finds into an outline he has generated before embarking on the search process. However, for researching at the academic level, Anthony lacks depth and flexibility. Anthony is still primarily involved in pre-reflective thinking, believing that knowledge is absolutely certain or only temporarily uncertain.[24] As a "company dinner" cook, Anthony knows how to make only one meal (in case company comes over).[25] He has a limited set of cooking utensils, only shops when company is coming, buys exactly what he needs, and follows his recipe to the letter. He has always received positive reinforcement on his dinners (or research papers), so he has no reason to believe he is not an excellent cook (or researcher).

Persona 2: Ryan, the Comfort Food Cook]

Ryan is a junior sociology major who is somewhat uncomfortable using the library. He chooses Summon to begin his search because he saw it demonstrated in the library, and he has some ideas, based on instructor recommendations, about how to find peer-reviewed literature. Ryan is a searcher who always starts with a familiar database that has been recommended to him, although he is sometimes willing to try a new database if his preferred database is not giving him the results he wants. He likes to use Summon because he remembers some of the tips he was given for using this database, but he is still not comfortable when trying new tools on his own. Ryan's research process is less rigid than Anthony's, but this is in part because he has not thought through his process in any depth. Ryan is just beginning the transition to quasi-reflective thinking, but he is still more comfortable with the idea of knowledge as absolute rather than ambiguous and context dependent.[26] As a comfort food cook, Ryan knows how to make six to ten meals based on the meals he watched his parents make; he owns the standard cooking utensils, but nothing too complex. Ryan shops for a wider variety of options, maintains a basic pantry, and can make some simple substitutions to a recipe if necessary.

Persona 3: Sophie, the Fusion Cuisine Cook

Sophie is a junior biology major who is more familiar with the library. She chooses to search in the Web of Science because she wants a scholarly database focused on her research topic. Sophie is willing to try new search tools, to adapt her research process, or to troubleshoot a search that is not working. Due to her familiarity with the library,

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she has gained some perspective on what services she can expect to find and how to locate the resources she needs. Sophie is able to employ some quasi-reflective thinking, and is beginning to view knowledge as ambiguous and context dependent.[27] As a fusion cuisine cook, Sophie is able to make a variety of foods from her well-stocked pantry and has many cooking implements to perform some of the specialized techniques needed to prepare a meal. She is a flexible cook and does not need to follow an exact recipe.

In the following sections, the personas will be used as a lens through which to interpret the findings from our observations of database selection, source evaluation, and overall student searching behavior.

Factors Involved in Database Selection

Two factors are key to our personas in selecting a database: familiarity with the source, and specific terms in the database description that catch their attention relative to the task at hand. Anthony (the Company Dinner Cook), in particular, uses previous experience and name recognition as a decision point. While he may not be familiar with Google Scholar, he definitely recognizes Google and is immediately attracted to the source based on the name alone. When selecting a database, Anthony states, "I know Google... I'm going to stick with Google because I won't feel comfortable using something I'm not used to using." He is less interested in the actual database description as a guide for making a decision.

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Ryan (the Comfort Food Cook)'s tool of choice is Summon, perhaps because he has been introduced to it in a library instruction session or by a faculty member, or because he has discovered it serendipitously via the library website where it is prominently displayed on the home page. Unlike Anthony, who most likely will stay with a tool he knows, Ryan may expand into other less well-known databases, using the brief description and the assignment criteria to guide his decision. Because Ryan is better able to transfer the skills he has learned using one database, he is less hesitant than Anthony to move in another direction when necessary, but he does not have a high level of confidence in starting with a completely new database. He states, "So I'm not familiar with Google Scholar, but I have done the 1Search [Summon] one so I will start there, and I'll see what the others have to offer if I can't find anything there." He is drawn to the Web of Science database as his next choice because of the description, which he feels is "nicer than 1Search [Summon]." He states, "Web of Science seems a little more—mostly articles, a lot of teachers require more scholarly based articles. I like that it says articles here in the description." His choice is based on the description at hand, and he believes this database will lead him to the type of sources that will help him to complete this specific assignment.

Sophie, the Fusion Cuisine Cook, has enough experience to be confident in her ability to use another, unfamiliar tool. While familiarity plays a role in her decision-making

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process, she is more interested in selecting a database that will help her to complete the assignment, and she uses the description of the database rather than her familiarity with the tool as her guide. Sophie examines the words in the description to make her initial selection. She has a preference for the Web of Science based on the terms she sees in the title of the database, as well as the brief description accompanying it. Like the other personas, she does not use a more detailed description, such as a separate print handout, in her decision-making process. She notes that Web of Science "looks like it would be good. Because of the Web of Knowledge" and "I like that it [Web of Science] says articles here from the description." She demonstrates her sophistication and experience by connecting the assignment criteria and the database description almost immediately.

As for database selection based on a provided description, certain terms attract the attention of the personas. These terms include *peer-review*, *scholarly*, and *articles*. The personas did not find a general or broad description of an unfamiliar database particularly helpful and, in fact, the brief tagline provided with the database is sometimes a reason not to select a particular source. The description of Summon on our library website read, "Search for books, articles, and more." The phrase "and more" in particular was confusing as it did not indicate to the participants what "and more" could be. Although it was not specified in the assignment, the personas emphasize finding articles in their search because experience has taught them that articles are more acceptable to instructors than books. The inclusion of books in the description and the vague term "articles" is not quite enough to signal to them what they will actually find in the database, even though Summon certainly can be a viable source for locating scholarly articles. The description provided with Web of Science, the database these personas are the least familiar with, includes the word "scholarly." Web of Science was used as frequently as the other databases in this study (see table 1) based in large part on the relevant connection the participants drew between the database title and the description provided, and the assignment task they were given.

Credibility, Peer Review, and Authority

This study asked participants to work on an assignment in which they needed to find sources for a speech. When considering what sources would actually be required for this type of deliverable, the personas' motivation to put a high degree of effort into finding scholarly/peer-reviewed sources was limited. As the personas determine the acceptability of a source for a speech, they use a combination of the assignment criteria, past experience with similar assignments, the credibility of the source, and the effort required relative to the assignment. It should be noted that while Anthony, Ryan, and Sophie all profess a desire for "credible sources," the criteria actually employed to determine credibility is superficial. Words in the title, the content of the snippets or abstracts, the author(s)' credentials, and the presence of graphs and charts may play a small role, but for the most part credibility is based on a vague sense of the source "looking good" or acceptable. The actual content in the source and the personas' ability to understand and incorporate this content into the assignment is most important.

While Anthony, the Company Dinner Cook, professes to value credibility, the actual source he uses is less important than the ability of his audience to understand the infor-

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mation he gathers from it. Because he already has a fairly definitive outline for his speech in mind before even beginning to gather sources, he is often looking for bits of information to plug into his outline. If the ideas he finds fit his outline and are coming from a source that appears to be credible or scholarly, this is just an added bonus. Anthony has the least defined process of evaluation. His choice of sources is heavily influenced by his interpretation of the assignment, which he does not fully understand, and his sense of the audience he is to address. While the assignment may stipulate finding information an audience would consider "authoritative," he looks for information "average people" like him can understand. However, sometimes he may determine the legitimacy of a source based primarily on the layout and design, rather than on the quality of the content. Looking at a source, he says, "I'd use this because it has authors and the source; it's detailed; it looks more legitimate than Wikipedia or something."

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Ryan, the Comfort Food Cook, also states a desire for credible sources, but he is more likely to make evaluations based on a gut feeling of what "sounds authoritative," a determination he makes mostly by looking at the title or authors. He may use the abstract and the presence of graphs and charts to determine credibility and usefulness but rarely goes beyond that. He recognizes, however, that he is unlikely to spend a lot of time on determining credibility as "teachers don't look too specifically, as long as it's cited correctly, and it looks like it's good quality information, it's generally acceptable."

Sophie, the Fusion Cuisine Cook, believes her speech will be more convincing if it has scholarly sources. She looks for statistics, data, and other "hard evidence" to determine source credibility. She recognizes she may need to do more evaluation than simply deciding the source "looks good"—although in practice her process is similar to Ryan's. She is also more likely to have had a direct interaction with instructors who have guided her to appropriate sources or who have given her search tips. Instructor approval and input is important to her.

All three personas rely heavily on the database itself to make the determination of whether a source is acceptable. Even Ryan and Sophie, who know more about the library databases than Anthony does, place a great deal of trust in the databases to bring back scholarly information. Ryan tends to use a known database, such as EBSCOhost's Academic Search Premier (typically referred to by students simply as "EBSCOhost" or "EBSCO"), where he has successfully located scholarly or peer-reviewed materials in the past. Ryan is aware that the library databases can lead him to scholarly sources. He states, "I prefer to use the website for the OSU Library. Articles seem to be more academic and related to topics." Specifically, he will "usually use EBSCOhost, I've used that quite a bit, that's usually where I start if it needs to be accredited or something like that."

Sophie, the Fusion Cuisine Cook, does not necessarily have a specific database in mind for locating scholarly materials, but she believes that sources provided by the library will meet this criteria. However, she is aware that not all databases are created

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equal regarding scholarly content. She notes, "Depending on the database I am in, they generally are scholarly or peer-reviewed so I don't have to worry about it." The name of the database Web of Knowledge (or Web of Science) inspires confidence. She states, "Since I know that this is Web of Knowledge, I'm not too worried about who wrote this. It's a database for scholarly journals. I'm not concerned that it's like Wikipedia or something like that."

The assignment given to the participants in this study purposely did not specify they needed to find "peer-reviewed" journal articles, but rather sources they would consider appropriate for an academic audience. While credibility plays a role in a student's decision to use a certain source, peer-reviewed status is not necessarily a deciding factor, in part because students' understanding of the peer-review process, and scholarly works in general, is often vague at best.[28] Anthony does not know what peer-review means, or how this might impact the way he searches or selects sources. Ryan is more knowledgeable about the process and would use a database that he knows from previous experience will provide him with scholarly sources. In his case, EBSCOhost is the familiar choice. He states, "EBSCO, I would expect peer-reviewed stuff there. I feel like EBSCO has more of a guarantee that there will be peer-reviewed journals." Sophie's experience leads her to believe that those sources the library provides are, overall, scholarly. She knows what the peer-review process is and expects the library databases to provide her with peer-reviewed sources. However, she does not take the time to verify the sources she finds are in fact peer-reviewed; the database name and the provider (the library) are validation enough for her. Interestingly, although Summon has the option of checking a box to limit a search to peer-reviewed articles, none of our participants used it to refine their selection of sources.

The Research Process

Each of these three personas varied in their approach to research. The two elements of the research process standing out as unique in this study were the ability to be flexible and the ability to reflect or apply metacognitive skills. These two elements in particular help illustrate the differences in cognitive and developmental growth among the personas Anthony, Ryan, and Sophie.

These students' ability to adjust their approach or to try new things during a research task demonstrates some differences in our personas' sense of flexibility. Anthony, the Company Dinner Cook, has arrived from high school with a set of rules and procedures for completing tasks like researching for a speech. These procedures have served him well, and he makes no attempt to try new tools or to look beyond the outline-first/fill-in-with-sources-later strategy that has worked for him before. For example, he approaches the assignment with a formulaic set of rules: "since speech writing is a five paragraph thing…"

Ryan, the Comfort Food Cook, who seeks the familiar and comfortable, is similar to Anthony in that he is also comfortable with known processes. Even though he has been in college for a couple of years, he is still guided by the research strategies he learned in high school and refers back to them when approaching a familiar task. He states, "Generally with a speech you have a similar structure to a simple high school paper, three points, three sources makes sense."

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In contrast, Sophie, the Fusion Cuisine Cook, is highly flexible and is open to trying new databases and adjusting her ideas about her topic along the way. This flexibility is also demonstrated in her ability to adapt the search tools to varying tasks, such as a slightly different assignment or even some ideas about how to troubleshoot. She notes, "A lot of times, I'll start with an idea, and when I start doing the research it turns into something totally different."

The second element emerging as a difference among the three personas was that of metacognitive skills, which encompass the ability to use self-reflection to build strategies for resolving problems. This suite of skills is widely regarded as being at the heart of understanding how to learn, and as a result this concept is often incorporated into personal epistemology models.[29] Anthony exhibits no reflective or metacognitive activities. The closest Ryan comes to displaying reflective behaviors is when he acknowledges some of the differences among the databases and search engines and the purpose of these tools. In contrast, Sophie is able to think through other ways of approaching her topic or keywords and is able to realize when she runs into trouble during the research process. For example, she observes, "this is the longest process for me—is getting my resources figured out and knowing what I'm doing." The ability to think reflectively about the research process is crucial not only for producing quality academic work but also for assembling a suite of practices that will continue to serve students as they approach information gathering tasks both in their careers and personal lives.

Implications for Practice

Database Descriptions

Librarians design websites, teach, and work with faculty to help students successfully navigate the research landscape, even in the disintermediated environment where librarians may not appear overtly present. Our research indicates that students consider database titles and descriptive database information when selecting a tool, but only on a limited scale. Students seek key words or concepts in those database descriptions that match their understanding of what they need to successfully complete the assignment. In a disintermediated environment, in which students are often left to choose databases without any guidance from a librarian or instructor, the way libraries present their databases takes on more significance. Students try to quickly hone in on keywords in database titles or descriptions that let them know their choice is appropriate. However, these descriptions are often too generic to provide enough guidance to the students. When seeking credible sources, the personas in our study scanned for terms like "peer-reviewed" or "scholarly." The terminology employed to describe specific databases must reflect stu-

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dents' conceptions about what kinds of sources they need and the terminology instructors actually use in assignments. General descriptions such as "books, articles, and more" or "indexes, journals," while perhaps an accurate or pithy summary of the database, are often either too vague or use vocabulary that is library-centric. Providing targeted descriptions is especially important when students are seeking databases unfamiliar in content and scope. In our research, terms like "articles," "peer-review," and "scholarly" caught the students' attention. Similarly, Amy Fry and Linda Rich found certain terms helped students locate databases, but only because they had already learned those terms in class. When asked to find unknown databases, students in their study had significantly more difficulty.[30]

Using appropriate terminology in database descriptions improves students' willingness to explore new tools. For less experienced students like Anthony, the Company Dinner Cook, the database descriptions alone are usually not enough to entice him to try something new. Librarians developing database guides or pages need to consider the hesitancy of the less experienced student and should capitalize on the familiarity of some tools (for example, EBSCOhost databases) to guide students to other, perhaps more discipline-appropriate, tools. For Ryan, the Comfort Cook, and Sophie, the Fusion Cuisine Cook, who have more college-level research experience, specific terms in a description can draw them to a database, even if it is not in their current toolkit of useful resources. For example, the following widely used description of Google Scholar is fairly concise, yet signals the content included using terms relevant to students such as "scholarly literature" and "peer-reviewed paper": "Google Scholar enables you to search specifically for scholarly literature, including peer-reviewed papers, theses, books, preprints, abstracts, and technical reports from all broad areas of research." Links guiding students from the familiar to the unfamiliar, such as "if you liked this database, try this one," may help students expand their search horizons. In a disintermediated environment, clear definitions and relationships must be highlighted.

Demonstrate Relationships

Librarians have spent countless hours creating course or subject guides to help students locate and use the best possible sources for their research. However, there is some evidence that this approach is not entirely successful. Students, who are often unfamiliar with the notion of disciplines or the appropriate subjects under which their topic may fall, cannot always successfully connect their topic to the appropriate database (or subject guide), leading them to fall back on a resource that has brought them success in the past.[31] Likewise, course pages may list the most appropriate resources for a course, but infrequently include relational linking among the databases and explanations of why some databases may be better than others for a given task. Such linkages could help students transfer the knowledge they do have about databases to new tasks.

Capitalize on Familiarity

Brand name recognition or previous success with a tool is a key factor in the process of selecting an appropriate database. Students recognize some brands, usually those they have been exposed to in a class or have effectively used for personal searching, such as

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Google and, as a result, associate those brands with certain types of research and, more important, successful research.[32] Even if the selected database may not be appropriate to the task at hand, students prefer to return to the familiar tool, a phenomenon also demonstrated in other studies.[33]

For all the ease-of-use claims of databases and discovery tools, the ability to search successfully in a disintermediated environment still begins in the classroom. Databases demonstrated to students by a librarian or an instructor are more likely to be chosen as resources for future research. Students' desire to use familiar, previously successful, tools is not surprising and should not be dismissed. Librarians have little control over proprietary database interfaces and content, but can assist students in learning to transfer skills from one database to another, thereby making the choice to use a new database outside of the classroom setting less daunting. While previously unexplored database interfaces may not look the same, the skill set to use these tools effectively is similar. Being able to recognize these similarities, as well as the signposting databases use to signal what types of content they contain, may help encourage students like Ryan, the Comfort Food Cook, who are reasonably skilled, but not particularly adventurous, researchers, to stretch beyond their comfort zone.

Build Metacognitive and Evaluation Skills

In addition, librarians and instructors can be more explicit about either their own research processes or different stages of a research process, so students can incorporate a more overt evaluation of their own strategies into their work. Research assignments could require reflection upon the research process, either formally or informally, as a way to expand students' metacognitive skills.

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Librarians and teaching faculty must recognize the role databases themselves play in shaping students' appreciation of source quality. All three personas tend to rely heavily on the database itself, as a tool vetted and made available by the library, to determine what sources are acceptable. Librarians and instructors must help students build skills in evaluating information, whether located on the Internet or in databases, because research indicates publishers' descriptions of their databases often misidentify scholarly and peer-reviewed journals.[34]

Focus on High Impact Users

None of the three personas is a truly accomplished researcher. Each persona has strengths and weaknesses in their processes, therefore the approach used to guide them cannot be expected to resonate with all student researchers, across all academic levels. In designing websites or even in-person instructional activities, it may be necessary to focus on high impact groups rather than on a persona who, in the context of the situation, will be able to accomplish the assignment with the skills already in hand (see Table 2).

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Finally, part of our practice is to advocate for users. Librarians should work with database vendors to make sure users' needs are well-represented so vendors can create products that work well for students.

Conclusion

This research study sought to examine how students approach selecting library databases and evaluating sources, within an increasingly disintermediated context. Several sub-themes were also examined: what criteria do students use to select a database from a particular set of recommended databases; what visual cues and aspects of database descriptions do students use; and how do students determine the authority of the sources they choose within an unfamiliar tool? In concurrence with previous studies, this research found that students rely heavily on previous familiarity with particular databases when selecting a database to search. No particular visual cues, such as the listed order of databases, were found to have an impact on database selection, but database descriptions targeted at assignment criteria, such as those characterizing content as "peer-reviewed" or "scholarly," were key in guiding students' database choices. Finally, students primarily relied on a limited set of criteria, such as author affiliation or the inclusion of figures, to determine source acceptability, and instead of focusing on credibility, concentrated on finding content they could understand and translate to their audience.

In addition, the findings indicate students are familiar with and willing to engage in research in a disintermediated environment, but will make different decisions about which databases to use, will use a different set of considerations about which sources are appropriate for an academic audience, and will employ varying levels of troubleshooting and metacognitive processing, depending on their levels of research experience. Librarians can aid students in making research choices, by providing targeted and relevant descriptions of research tools; by capitalizing on the familiarity with other research tools to help students branch out to new tools; by emphasizing the transferability of the skills students learn in library instruction sessions; and by encouraging explicit conversations and reflection about the research process, so that students can develop deeper metacognitive skills to aid in problem solving. Future research could examine more closely how students' selection of sources, and their corresponding ability to evaluate these sources, changes over time in an increasingly disintermediated research environment.

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