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Combining SIFT and the Information Needs, Types, and Qualities Approaches: A Framework-Informed Strategy for Information Literacy Instruction

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Combining SIFT and the Information Needs, Types, and Qualities Approaches: A Framework-Informed Strategy for Information Literacy Instruction

Abstract
Increasingly, librarians are encouraged to deliver information literacy sessions that go beyond finding and using traditional scholarly sources. They are asked to cover a wider range of the information ecosystem and develop students' capacity to critically engage with Google and the open web. In this study, we incorporated these learning objectives in an introductory computational thinking course, combining two information literacy pedagogies. For evaluating sources, we used Mike Caulfield's SIFT technique (Stop, Investigate the source, Find better coverage; Trace claims to the original source); for resource discovery, Lane Wilkinson's Information Needs, Types and Qualities lesson. We adapted Wilkinson's worksheet, asked students to apply the SIFT technique to their chosen sources, and added a reflection component where students documented their research process. We conducted a content analysis of the assignment responses and coded evidence of students demonstrating knowledge practices and dispositions of two frames from the *ACRL Framework*, Authority is Constructed and Contextual and Searching as Strategic Exploration. Our analysis showed that students responded well to learning the SIFT technique, particularly at investigating sources; furthermore, Wilkinson's pedagogy for source discovery encouraged students to use a wide variety of research tools. The reflection component further revealed evidence of students' research processes and metacognition. We found this unit to be an effective means of assessing these *Framework* concepts, and argue that it can be applied to other topics and disciplines.

De plus en plus, les bibliothécaires sont encouragés à offrir des séances de maîtrise de l'information qui vont au-delà de la recherche et de l'utilisation des sources savantes traditionnelles. Ils sont invités à couvrir un éventail plus large de l'écosystème de l'information et à développer la capacité des étudiants à s'engager de manière critique avec Google et le Web ouvert. Dans cette étude, nous avons intégré ces objectifs d'apprentissage dans un cours d'introduction à la pensée computationnelle, combinant deux pédagogies de la maîtrise de l'information. Pour évaluer les sources, nous avons utilisé la technique SIFT de Mike Caulfield (Arrêter, Enquêter sur la source, Trouver une meilleure couverture ; Retracer les revendications jusqu'à la source d'origine ; pour la découverte des ressources, la leçon Besoins d'information, types et qualités de Lane Wilkinson. Nous avons adapté la feuille de travail de Wilkinson, demandé aux élèves de appliquer la technique SIFT à leurs sources choisies, et ajouté une composante de réflexion où les étudiants ont documenté leur processus de recherche. Nous avons effectué une analyse de contenu des réponses aux devoirs et des preuves codées des étudiants démontrant des pratiques de connaissances et des dispositions de deux cadres du cadre ACRL, L'autorité est Construit et Contextuel et Recherche en Tant Qu'exploration Stratégique. Notre analyse a montré que les étudiants ont bien réagi à l'apprentissage de la technique SIFT, en particulier lors de la recherche de sources, et la pédagogie de Wilkinson pour la découverte de sources a encouragé les étudiants à utiliser une grande variété d'outils de recherche. des processus de recherche des étudiants. Je considère que cette unité est un moyen efficace d'évaluer ces concepts du cadre et je soutiens qu'elle peut être appliquée à d'autres sujets et disciplines.

Keywords
information literacy, *ACRL Framework*, bibliographic research, SIFT method, source evaluation, assessment; maîtrise de l'information, cadre de l'ACRL, recherche bibliographique, technique SIFT, évaluation des sources, évaluation

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> Just think of the way that within a mere two decades, billions of people have come to entrust the Google search algorithm with one of the most important tasks of all: searching for relevant and trustworthy information. We no longer search for information. Instead, we google. And as we increasingly rely on Google for answers, so our ability to search for information by ourselves diminishes (Harari, 2018, p. 54).

Noah Yuval Harari's provocative statement challenges the university community to reflect on their own information literacy programs. To what extent do their students rely on Google as their primary search tool? How do their students find and evaluate information sources? If their students' ability to search for information has diminished, what are they doing about it? Furthermore, since Google remains a widely used and effective (yet problematic) research tool, how do educators expect students to critically engage with Google and the wider information ecosystem?

Historically, library research workshops have downplayed Google and sources found on the open web (Head & Eisenberg, 2010; Wilkinson, 2017). Instead, librarians teach students how to find scholarly sources for their research paper assignments using the library catalogue and subject databases. However, this approach has been criticized for supporting the false assumption that students should only ever engage with academic sources, particularly peer reviewed journal articles (Jankowski et al., 2018). In addition to developing students' skills for success in research assignments, librarians can and should be given time to incorporate discussion of the wider information ecosystem, which includes Google and its search algorithm, non-academic sources, the open web, and social media (Berg, 2016; Fister, 2021). To counter Harari's polemic that Google searches constitute the "truth," (Harari, 2018, p. 54) we need to foster critical engagement with a wide range of information sources and develop students' metacognition about the research process itself.

This paper interrogates Harari's claim that information literacy skills are in decline, while also presenting a strategy for information literacy instruction that supplements students' use of Google. Our unit combines two approaches for finding and evaluating information sources: Lane Wilkinson's Information Needs, Types, and Qualities strategy, and Mike Caulfield's SIFT method. These approaches are grounded by concepts described in the *Framework for Information Literacy for Higher Educatio*n (hereafter referred to simply as the *Framework* or the *ACRL Framework*). The paper is organized as follows: we first provide an overview of the *Framework*, followed by a discussion of previous research on *Framework*-based instruction and assessment. We then describe the strategies we adapted from Wilkinson and Caulfield and how we implemented the information literacy unit. Finally, we analyze students' assignment responses and discuss the implications. Our results indicate that our unit could be an important step forward in expanding students' awareness of the information ecosystem and building their information literacy skills.

The ACRL Framework

In 2016, The Association of College and Research Libraries (ACRL), an influential association of North American academic librarians, moved away from the premise that information literacy consists of a checklist of discrete and measurable sills. Instead, they posit that it involves understanding of six overlapping core concepts, called frames. They published this position in the *ACRL Framework for Information Literacy for Higher Education* (Association of College & Research Libraries, 2016). These conceptual frames are: Authority Is Constructed and Contextual;

Information Creation as a Process; Information Has Value; Research as Inquiry; Scholarship as Conversation; and Searching as Strategic Exploration. Each frame includes examples of "knowledge practices" and "dispositions" of both novice and expert researchers, thus acknowledging that information literacy is a cognitive journey for university students.

This cognitive journey is explicitly stated in the *Framework* by referencing Meyer and Land's notion of threshold concepts (Meyer & Land, 2003). They conceptualize that disciplinary knowledge involves crossing into a "portal, opening up a new and previously inaccessible way of thinking about something. It represents a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress" (Meyer & Land, 2003, p. 412). In the context of information literacy and the *Framework*, when students fully understand a frame, they have a newfound grasp of the nuances and complexities of the information ecosystem.

Additionally, the *Framework* emphasizes the importance of metacognition, described as "critical self reflection" (ACRL, 2016). Metacognition provides students with a measure of control over their search processes (Livingston, 2003). The *Framework* is thus adaptable in a rapidly changing information ecosystem; it emphasizes context, and argues that researchers are not merely information consumers, but potentially creators as well. The *Framework* provides an intellectual grounding for librarians to move beyond subject database demonstrations and lessons in search syntax, and opens opportunities to discuss the wider information landscape and students' place in it.

Teaching and Assessing the *Framework*

The *Framework* has been widely discussed in Library and Information Science (LIS) literature since it was published in 2016, but no single approach has emerged as the predominant way to teach it and assess students' competencies of various frames. The *Framework* does not prescribe specific lesson plans or learning outcomes to assess mastery of the Frames; instead, librarians are expected to develop curriculum that fits context-specific instructional needs. There are abundant resources online available for educators searching for learning activities: ACRL supports the *ACRL Framework for Information Literacy Sandbox* (Association of College & Research Libraries, n.d.), which offers a wide variety of practical suggestions on how to implement the *Framework.* The *Community of Online Research Assignments (CORA)* is another repository of learning objects for information literacy instruction. Regarding assessment, Oakleaf (2014) and Hosier (2017) posited early suggestions in creating *Framework*-based learning outcomes, which could be graded. Oakleaf suggested the structure, "The student will be able to + ACTIVE VERB" (p. 512), mapped to knowledge practices and dispositions of specific frames. Hosier developed learning outcomes for the frame Scholarship as Conversation using multiple choice questions on an online tutorial. Julien et al. (2020) compiled case studies of collaborations between librarians and course instructors who had successfully implemented *Framework* principles. This compilation includes Steele et al.'s (2020) rubric for the Searching as Strategic Exploration frame; they also found that assigning research and writing logs facilitated assessment of the frames Information Has Value, Research as Inquiry, and Searching as Strategic Exploration.

The *Framework* also stresses the importance of critical self-reflection, a facet of information literacy that researchers have only recently begun to assess. Hostetler et al. (2018) notes that metacognition tools have not traditionally been integrated into information literacy instruction. McCoy (2022) agrees, and stresses the interconnectedness of metacognition with searching, finding, and evaluating sources. She implements a short metacognition assessment survey after information literacy instruction sessions. Others have created comprehensive metacognition survey instruments (Catalano, 2017; Robertson et al., 2022) or used eye tracking technology Zhou (2023).

Our research team has also investigated methods of teaching and assessing select *Framework* competencies (Hendrigan et al., 2020a; Hendrigan et al., 2020b; Hendrigan et al., 2022). In fact, this is the research team's fourth iteration of *Framework*-based information literacy units. We started this work in 2017, the year after the *Framework* was published, with a simple in-class presentation and assignment on the Authority is Constructed and Contextual frame. In 2018, we studied students' competencies in this frame as well as the Scholarship as Conversation frame. We retained our focus on Authority is Constructed and Contextual in 2019 but swapped the Scholarship as Conversation for the Searching as Strategic Exploration frame in 2020 and 2021, which aligns with the preponderance of information literacy workshops that cover the skills of finding and evaluating sources (Head & Eisenberg, 2009). Students' responses in these assignments indicated that we assessed them without providing adequate pre-assignment instruction in source evaluation and searching strategies. In our most recent iteration of the information literacy unit, we also wanted to develop an assignment that probed students' research processes, and stimulate metacognition as part of the assignment itself, rather than prompting it in a separate activity.

We discovered two promising pedagogies in the literature to adapt for our unit. First, Mike Caulfield focuses on source evaluation, which fits with the Authority is Constructed and Contextual frame. He developed a strategy called SIFT (Caulfield, 2017), an acronym that stands for Stop; Investigate the source, Find better coverage, and Trace claims to the original source. SIFT is gaining attention in librarian and academic circles (Bull et al., 2021; Fielding, 2019) and has been adapted and tested in both university and high school settings (Brodsky et al., 2021; Pavlounis et al., 2021). SIFT has replaced strategies such as the CRAAP evaluation test, which involves checking a source based on its Currency, Relevancy, Authority, Accuracy, and Purpose (Blakeslee, 2004). In response to growing criticism of the CRAAP test and other checklists where researchers evaluate sources using the close reading technique (Fielding, 2019; Wilkinson, 2017) we decided to use the SIFT method. SIFT was influenced by Wineburg and McGrew's study (2017) reporting that professional fact checkers, who employ a technique of lateral reading, were the fastest and most effective web content evaluators in their study population. In contrast to the CRAAP test, lateral reading and the SIFT technique directs researchers away from a source and instead, focuses their evaluation process on what external sources say about the source in question.

Secondly, Lane Wilkinson provides a strategy for finding sources which we associate with the Searching as Strategic Exploration frame. His lesson "Information Needs, Types, and Qualities" (Wilkinson, 2016) has been downloaded from the *Community of Online Research Assignments* database more than 3000 times (*Community of Online Research Assignments*, n.d.). He proposes a structured approach to literature searches by information need and source type: background, current events, statistics, opinions, and research. His assignment requires students to search for a wide range of sources, both popular and scholarly, and recommends that instructors:

> [T]urn searching into evaluating. Show [how] Google works and how results are manipulated. Show them things like the 'site:' tag. Talk about truth and fairness in reporting. Talk about media ethics. Talk about consistency across multiple sources. Examine how different sources cover the same event. Again, it's not about asking "is this

> article credible?" It's about getting students to ask "given the source of this article, and given the way the issue is reported elsewhere, can I trust what I'm reading?" (Wilkinson, 2017)

Wilkinson agrees with recommendations to focus on research processes in information literacy instruction (Wilkinson, 2017; Head & Eisenberg, 2009; Caulfield, 2017), and Fister's passionate urge (2021) for educators to discuss information platforms in addition to search strategies.

We combined Wilkinson and Caulfield's methods in our fourth attempt to teach and assess *Framework* concepts. We looked for evidence of students' understanding of two frames: Authority is Constructed and Contextual and Searching as Strategic Exploration. We wanted to see how students employed the SIFT method, how they assessed the credibility of authors and publications, and their search processes. We were also interested in their feedback regarding the assignment as a whole, since the research topic itself, on the influence of Google and Big Data on our daily lives, inserts a layer of metacognition on the whole exercise. Ultimately, we challenge Harari's statement that research merely consists of Googling, while also acknowledging that Google and the open we are widely used and acceptable in certain contexts.

Background

This research took place at Simon Fraser University, a comprehensive Canadian university with over 23,000 full-time equivalent students enrolled. We created and piloted the revised unit for CMPT 115, Exploring Computer Science, , delivered remotely and synchronously in summer and fall terms in 2021. This course, designed for students who are *not* Computing Science majors, exposes students to basic programming principles, explores fundamental ideas in computer science, and examines the impact of computational thinking and computers on modern society. Thirty-seven students were enrolled in the spring term and thirty-one in the fall. They came from a wide variety of backgrounds, including Business, Fine Arts, Criminology, Labour Studies, Biology, Health Science, and Psychology. They ranged from their first semester of their studies to their sixteenth.

The assignment was mandatory and graded. We obtained approval from our Research Ethics Board to analyze the assignment responses [#20180123]; the consent form was part of the assignment. A teaching assistant graded the assignments, and if the student consented, a member of the research team downloaded and de-identified their work. Between the two classes, thirty-eight students consented for a participation rate of 55.9 percent.

Broadly speaking, we used Wilkinson's strategy and worksheet for students' literature searches, and Caulfield's SIFT strategy for evaluating sources. Wilkinson's approach involves finding sources on their topic from five different categories of "information needs:" background information, current events, opinions, statistics, and research. While most library instruction sessions teach students to find *types* of information (eg, books or articles) (Head & Eisenberg, 2009), Wilkinson's approach prioritizes resource content over format. We made one important modification to Wilkinson's worksheet involving source evaluation, however. While Wilkinson is not a strong advocate of evaluation checklists (Wilkinson, 2017) nevertheless his worksheet included the 'CRAAP test' evaluation technique. We substituted this for SIFT.

The information literacy unit is summarized as follows (see Appendix A for the complete unit.) It began with a reading from Noah Yuval Harari's book, *21 Lessons for the 21st Century*

(Harari, 2018), a passage that aligns with the course goals on the social implications of computing. Harari contends that Google and big data algorithms have caused a decline in our ability to conduct research and make decisions. Borrowing from Wilkinson, we asked students to compile a bibliography of 5 different item types (Background, News, Statistics, Opinion, and Research) on one of the claims related to the Harari passage. Specifically, these claims were:

1. Google has diminished our ability to search for information
2. Google's top search results are "the truth"
3. AI will eventually make better major life decisions (eg who you marry, what you study) than you would have made yourself
4. Big data algorithms: they have lots of glitches, but we have no better alternative.

These topics reinforce the course's learning goals related to algorithms and big data, but they also allow them to interact with, and reflect on, these concepts personally. Students were required to employ Caulfield's SIFT method on the sources as an evaluation method. Finally, they wrote a 200-500 word reflection passage on their research process describing how they chose one or two of their sources, which the research team used for assessment and analysis

We emphasized the learning objects using both a flipped classroom approach and a live presentation. Prior to completing the worksheet, students completed online tutorials in Canvas, the university's learning management system, on the SIFT method and how to find sources categorized by Wilkinson's five information needs. We had built short modules that covered the learning objects, accompanied by non-graded quizzes reinforcing the material. After the students completed the tutorials, the librarian gave a 50-minute presentation covering the concepts from the tutorials and demonstrated different approaches to find and evaluate sources in the different information need categories.

Assignment Assessment and Analysis

The library uses the Primo federated search interface, which searches and retrieves information resources from a variety of resource types, including monographs, journals, and content from some (but not all) subject databases. We asked students to be explicit about their search tools when they documented their search processes and indicate when they deliberately chose a subject database or the library catalogue.

To assess the assignment, we adapted Steele et al.'s rubric (2020) and switched the research log for a reflection passage. Our assessment rubric is found in Appendix B. Initially, in 2020, we focused our assessment on the reflection passage and simply graded the bibliography for completion. However, that decision resulted in our inability to correct misunderstandings in students' source choices. For example, one student wrote that the ScienceDirect platform was unsuitable in the academic context because it contained advertisements and sensationalized images; this student determined that an article from *Vice* magazine was a better choice. This response required further probing to better understand the context of this response, and letting the student know that Elsevier is generally accepted as a suitable academic publisher, free of advertising. In the second term, we added "appropriate source" as a grading criterion and provided feedback to students when we had concerns or questions about the sources they used.

After the assignment was marked, we conducted a qualitative content analysis (Schreier, 2014) on the worksheet's reflection passage. We examined how students employed the SIFT technique, what criteria they used to evaluate sources, and their search processes. Following Eva et al. (2021), we coded for attributes listed as knowledge practices and dispositions of the relevant Frames in the *Framework*. Our codebook included the following categories: credibility criteria mentioned, search strategies/tools employed, and search perseverance behaviour. We also coded students' sentiments to get an overall impression of how well the unit was received. To conduct the qualitative analysis, two members of the research team read and coded samples of submissions individually, then discussed how we interpreted and applied the codes to the samples. We resolved differences in codes applied by mutual agreement. One member then coded the remainder of the submissions.

Findings

Our study combined SIFT with Wilkinson's search strategy; we added a reflection exercise to analyze and assess how students employed these strategies during the research process. We divide our findings into four categories: Employment of the SIFT method; Analysis through Authority Is Constructed and Contextual frame; Analysis through Searching as Strategic Exploration frame; and Sentiment Analysis.

Employment of SIFT Method

We conducted a content analysis of the reflection passage to examine how students employed the SIFT method. Most students (84.2%) in the study population completed the "Investigate the source" component of SIFT, and documented how they did so. Fewer students (47.4%) mentioned finding better coverage or tracing claims to the original source. Among those who tried finding better coverage or tracing claims, some were successful while others were not. Students' source investigation involved researching both the authors and the publications, including information about their publication record, reach, affiliations, and impact factor:

> I did an open web search on both the publisher (using Wikipedia and a website I am familiar with, mediabiasfactcheck.com) to determine that the publisher was reputable. Additionally, I open web searched for the author of the article, and found that she was a reputable and knowledgable [sic] journalist who has extensively written about the intersection between technology, privacy, and society, ... (#7, Summer 2021)

> Upon finding an article from the results I checked the credibility of the journal and it's [sic] impact score. (#11, Summer 2021)

Many students found the SIFT method useful in their research process, and expressed relief in learning this quick and effective strategy:

> It was also quite fascinating, doing a more thorough look at my sources with the SIFT methods. In previous courses, I only went in-depth when it was a source I didn't immediately trust, but I'm glad it's a skill I have now. It's really useful, being able to check right away if something is peer-reviewed or being able to track down a biography for an article's author. While most of my sources I'd picked straight from their original

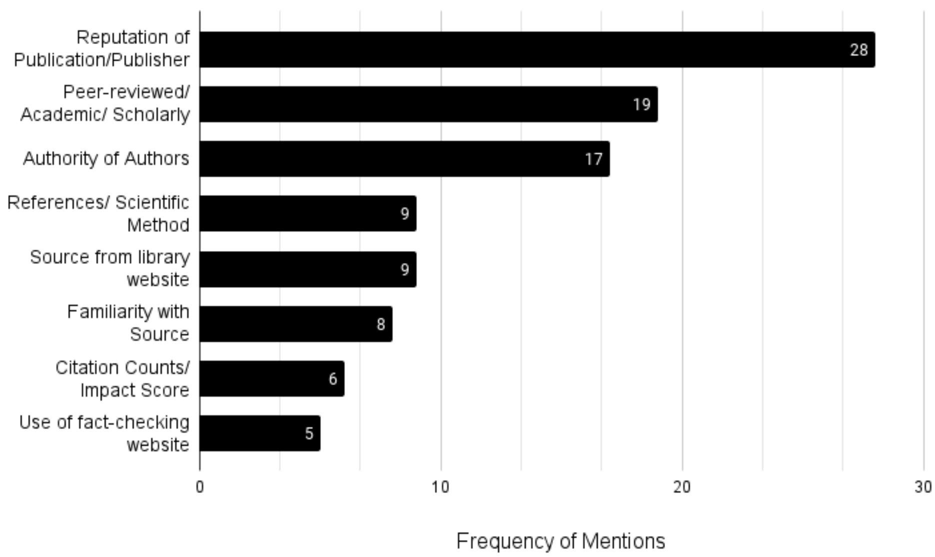
> publication, those where I didn't--my News and Research pieces--brought me a sort of excitement, tracing the claim back to their original publications. (#4, Fall 2021)

Authority Is Constructed and Contextual Frame

We also assessed students' competencies in this frame by coding how they applied the SIFT technique to their sources. Figure 1 shows the range of indicators of authority students used to determine the credibility of both authors and publications. Using the reflection passage as our data source, we counted the frequency of criteria mentioned. Common indicators students used include the reputation of the publication and/or publisher, authority of the authors, and whether the source was peer reviewed. They also used tools such as fact-checking websites, citation counts, and journal impact scores. Sources obtained from the library website or tutorials were other indicators of credibility. However, we also noticed that some students evaluated the credibility of the sources purely based on their familiarity with the source.

Figure 1

Indicators Used to Assess Credibility of Sources



The most prevalent authority indicator (73.7%) was the reputation of the publication or publisher which includes its accolades, history, and affiliations. Often, students used multiple indicators to assess the credibility of the source:

> I searched for the magazine on Wikipedia and determined that it is a respected monthly American business magazine that was named magazine of the year in 2014 by the American Society of Magazine Editors. Mark Sullivan the author is an award-win[n]ing journalist who covers topics such as emerging technology, large tech companies and misinformation among others. After this search, I was confident that the article was from a credible source." (#10, Summer 2021)

> I used Access Science to find the background source, which was a recommended Wikipedia alternative in the information literacy module. Additionally, Access Science is run by McGraw Hill, a popular education provider that I have used before. To further support the credibility, the two authors, Dr. Gupta and Dr. Mata-Toledo are experienced in the field of computer science working and teaching." (#3, Summer 2021)

Students also seem to have developed greater awareness of the need to critically assess the sources they use:

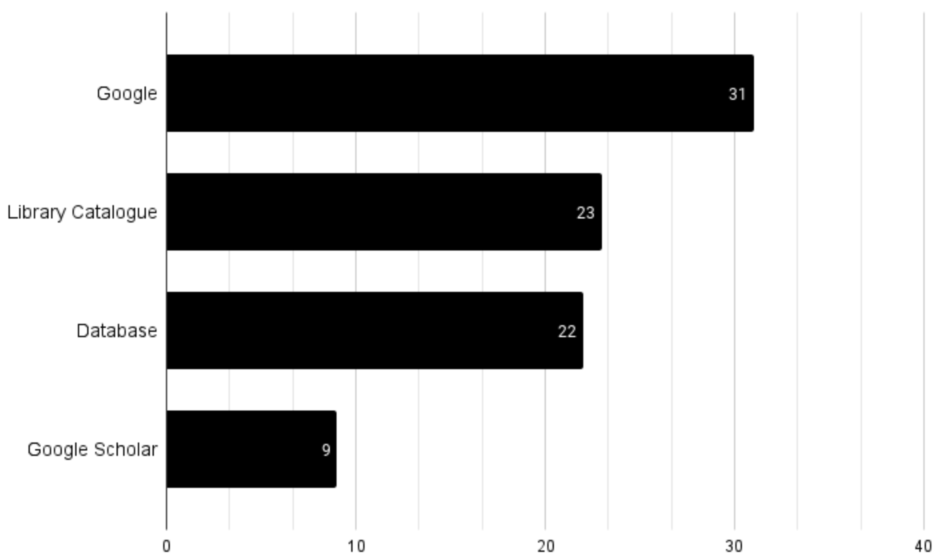
> This exercise was useful because it gave me a reminder about the importance of verifying claims and not blindly agreeing with text. It was a good way to hone my skills to ensure that I could discern credible sources from non-credible ones. (#7, Fall 2021)

> Although I know about the NYT [New York Times], I still did my research into its credibility. I learnt that many times, criticism has been raised towards the paper when covering political issues for misrepresentation, but, I didn't find much in the way of normal reporting. (#5, Summer 2021)

Searching as Strategic Exploration Frame

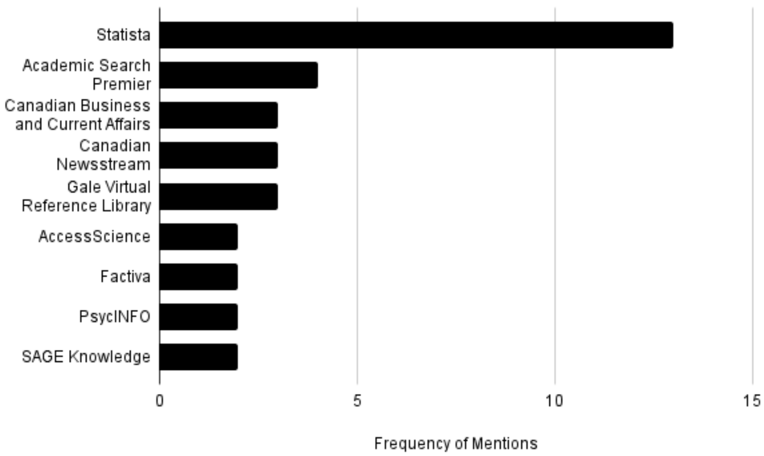
We present our findings of students' search tools and databases used in Figures 2 and 3, and search strategies in Figure 4.

Figure 2
Search Tools Used



https://doi.org/10.5206/cjsotlrcacea.2024.2.15558

Figure 3
Databases Used



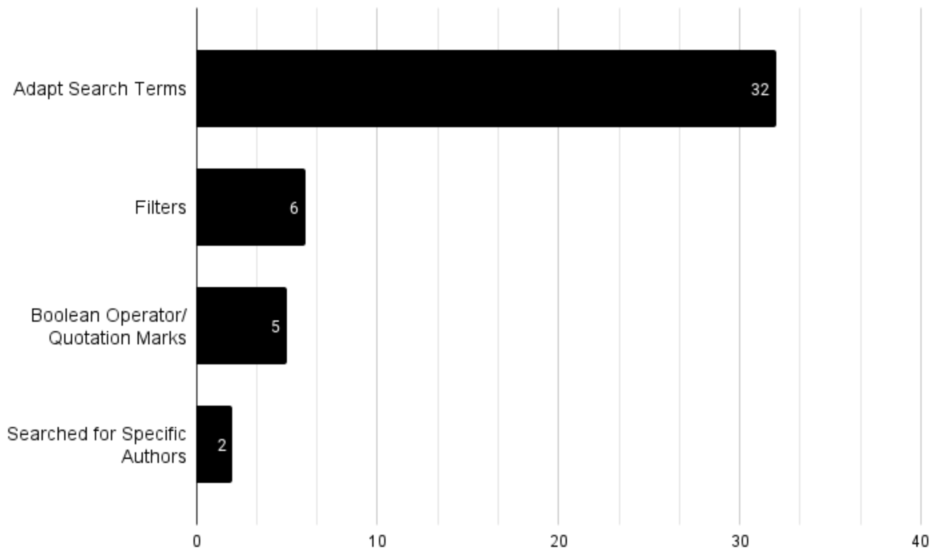
The most common resource that students consulted was Google, followed by the library catalogue, subject databases and Google Scholar. Google was rarely the sole search tool documented; 87% of students used Google in conjunction with other resources.

> Overall I would say I found this exercise helpful, it helped me get a feel for other databases that the library catalogue offers. I've done quite a lot of research papers for other courses but I only used the business and political science database so this exercise was great to [help] me get a feel for the other resources the library has to offer. (#15, Summer 2021)

> I used the SFU library catalogue to gain access [to] the Statista Database. I found it to be extremely helpful when trying to get some statistics or raw number data compared to google or other search engines. (#15, Summer 2021)

As successful searching often involves iterative searches based on initial results, we also examined how students revised their searches (see Figure 4.) Most students (*n*=32) experimented with different search terms. Students also used filters, Boolean operators and quotation marks as part of their search strategies.

Figure 4
Search Strategies Used



We also looked for evidence of students' search perseverance, checking their capacity to refine their search strategies when necessary. In their reflection logs, 79% of the students acknowledged their failed search attempts and 63% documented their iterative searches. Some of the refinement strategies include adapting the terms used in the search, use of additional filters or using alternative resources:

> The most challenging part of the assignment was figuring out what keywords to use. Much of the searche[s] that come up on google under 'search algorithm' are blogs or ad companies explaining SEO results for marketing purposes. I had to narrow my search to include 'the truth' or 'problems with google search algorithm' to find more academic sources through Google. The library's database made it very easy to find academic articles, but for anything more basic like simple background information or news articles it was a bit more of a challenge. (#17, Summer 2021)

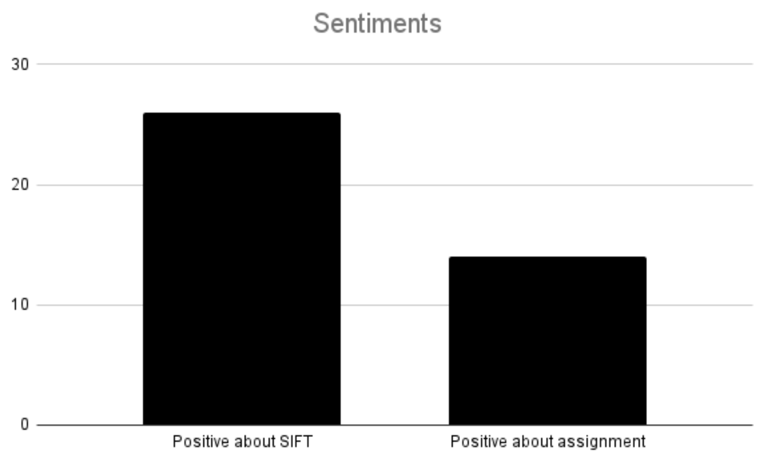
> The other source I feel fits here is the New York Times article on the recent changes to how google will display information having to do with slander and other such problems. I had to make a few searches and scroll through the news section a few times before I came to an article from the "Search Engine Journal". Here, the SIFT method came handy as before, I would have simply used this website as my source, but, the article wasn't an original. It was simply an article about a NYT original. So, I stopped reading that article and traced the claims to the original, which was significantly more exhaustive and gave me better context behind the Google changes. (#5, Summer 2021)

Student #5 demonstrates how the SIFT method can be used to find resources in addition to evaluating them.

Sentiments

One of the prompts in the reflection assignment queried students' perceptions of the assignment. We asked, "Was the SIFT method useful? Was the assignment useful?" We qualitatively analyzed their responses and documented them in Figure 5. Twenty-six students made positive comments about SIFT and fourteen were explicitly positive about the assignment. We were surprised that none of the students in the sample expressed any negative or neutral sentiments toward the assignment or SIFT.

Figure 5
Sentiment Analysis



Positive About SIFT and the Assignment:

Some students expressed engagement with both the SIFT method and the unit overall, including the topic of the literature search.

> All the SIFT methods proved useful. Investigating my sources made me more cautious of the sources I'm using, being able to eliminate questionable ones even if they make claims relevant to the topic. STOP made me think through how I can better improve my search and made me consider narrowing or broadening my search. Finally, finding better coverage meant I viewed various sources and compared their claims, and think about their biases and possible agendas. (#6, Summer 2021)

> This exercise was very useful and honestly, I wish I was taught it far in advance of my third year in university... It would have made much of my previous academic endeavors easier. (#17, Summer 2021)

> To be honest, I was really interested in this topic from the get-go. As a university student in 2021, I must confess that Google has been a lifeline in some situations. I wanted to know what scholars thought…was [Google] negatively affecting me in the long run…Another interesting feature of this bibliography assignment is that it showed how different people

> defined intelligence differently--whether it's the ability to seek out information, or retain it for later, and which skill is more important in the long run. I can't help but wonder if Harari considered this--are there more important skills than searching for information? What about once we've obtained it? (#4, Fall 2021)

Discussion

Our research examined Caulfield and Wilkinson's research and evaluation strategies through the lens of two ACRL frames. More ambitiously, we also wanted students to learn about the information ecosystem, Google, and reflect on their own research processes. We wanted to test Harari's assertion that people no longer know how to use search tools other than Google. Where other studies (Brodsky et al., 2021; Pavlounis et al., 2021) largely isolated the SIFT evaluation from the search process, our combined approach is well suited for undergraduate students from a wide variety of disciplines. Ultimately, these skills can be transferred to other courses and research situations outside the university setting and will influence a wide variety of decisions that we make as engaged citizens in a participatory democracy.

Our results confirm that the SIFT method can be useful in developing students' capacity to evaluate and find sources. SIFT's processes—investigating sources, finding better coverage, and tracing claims—link to the knowledge practices and dispositions of both the Authority Is Constructed and Contextual and Searching as Strategic Exploration frames, prompting students to query authors' authority and publications' reputations, and employ mindful and deliberate search strategies for resource discovery. SIFT discourages simplistic approaches to assessing content, such as the scholarly versus popular trope. Additionally, SIFT fosters "informed skepticism," a disposition listed in the Authority Is Constructed and Contextual frame. We saw students conducting quick background checks on major publishers such as the New York Times and Springer. The SIFT method facilitates learning the nuances of authority and familiarizes students with publication types for different purposes, including academic, commercial, and non-profit publishers.

Our results also indicate that Wilkinson's Information Needs, Types and Qualities assignment is an effective method for students to further develop their knowledge practices and dispositions of the Searching as Strategic Exploration frame. His strategy addresses a lack of awareness of different sources and tools (Bloom & Deyrup, 2015), and requires students to investigate different types and collections of information, such as statistics, news items, and published research. Figure 2 shows that most students used Google in concert with other sources, such as the library catalogue and subject databases. We also see, in Figure 3, students using a wide variety of sources mentioned in the tutorials, such as Statista and Academic Search Premier. Wilkinson's process aligns with Head and Eisenberg's recommendation (2009) that students should approach topics from multiple points of view and counter their propensity to use a minimal number of search strategies during their research process.

We also looked for evidence of students' research flexibility and persistence, dispositions listed in the Searching as Strategic Exploration Frame. Many students commented on how difficult the assignment was due to the ubiquity of the terms, such as Google and intelligence. When their initial searches—often on Google—were unsuccessful, they adapted their search terms, applied filters, modified their search syntax, and chose different databases. This persistence contrasts with Bloom and Deyrup's study (2015), where students were quick to abandon topics when their searches did not provide adequate results. In our study, only 13% of students relied exclusively on

Google, and students generally demonstrated a high degree of flexibility when their initial searches retrieved disappointing results. Triangulating research logs with keystroke analysis, as Bloom and Deyrup did, would be worth investigating.

Caulfield and Wilkinson's approaches also acknowledge the importance of Google and the open web, topics that receive minimal attention in librarian-led instruction sessions (Head & Eisenberg, 2009). After all, librarians are typically invited into classes to provide instruction on library resources and collections, and normally have limited class time to do so. Adding learning objects that involve a broader understanding of the information ecosystem, which includes Google and the open web, is a challenge. Wilkinson and Caulfield's approach thus provides a pragmatic alternative to a "no Google" pedagogy. Wilkinson argues, "Google is not our enemy" (2017); indeed, he teaches news sources via Google or social media, in their naturalistic settings, rather than sending students to newspaper databases. Similarly, Caulfield's curriculum teaches students to leverage Google to evaluate sources, but also articulates how its results are commonly a source of misinformation (Caulfield, 2017).

Despite some difficulty researching the claims, the students found this exercise useful and even enjoyable, as evidenced in Figure 5. The positive sentiments support prior research where students received instruction that combined algorithms and information literacy (Head et al., 2020). We confirm that the topic of Google and the impact of algorithms on their research practices are relatable to students who have been using search engines their entire lives. We challenged them to research, and ultimately support or refute Harari's provocative claims on their own search and decision-making capacities. Students also appreciated the opportunity to expand their knowledge of different databases and learn the SIFT technique for source evaluation and discovery, which provides them with a feeling of agency over their own research capabilities.

Finally, we note that the reflection passage, where students recounted their search process, benefited both the students and the research team in multiple ways. First, the reflection passage provided the research team with a dataset that enabled assessment and analysis of students' search processes. For the most part, students' research processes remain a mystery to both librarians and course instructors. Without the reflection requirement, we can view only students' works cited list, the output of their search processes. This component of the unit confirms why research logs should be widely employed in information literacy instruction (Fluk, 2015).

Furthermore, the reflection passage required students to think about and articulate their own research strategies, and thereby stimulate metacognition. While other methods can be used to examine search processes and metacognition, such as keystroke analysis (Bloom & Deyrup, 2015; interviews (Head & Eisenberg, 2010), questionnaires (McCoy, 2022; Catalano, 2017; Robertson et al., 2022), and eye tracking software (Zhou, 2023), we felt it was important to query these cognitive processes within the assignment itself. An added advantage to our technique was its ease in implementation. While we did not specifically code for metacognition in this study, we noticed that students frequently made comments indicating an awareness of their own research habits and practices prior to and following the assignment. However, we realize that we could refine the reflection questions, particularly where we ask whether the SIFT method was useful. Instead, we should re-frame the question as, "How did you find the assignment useful?" or use a Likert scale.

Conclusion

This study provides an information literacy pedagogy that both acknowledges Google's role in research and incorporates a wide variety of library resources. Our approach is novel in several ways: with the *ACRL Framework* in mind, we combined Wilkinson's search and Caulfield's evaluation pedagogy, layered these strategies with a research reflection passage, and developed an assessment rubric. In addition to our instruction strategy, we chose a research topic on the information ecosystem and how algorithms and Big Data affect students themselves. This unit therefore provides a model for "proactive evaluation," (Bull et al., 2021) which fosters the ability for researchers to evaluate their sources, reflect on their search results, and consider what is missing. These knowledge practices and dispositions, to use the *Framework*'s terminology, are lifelong research skills.

This unit could be used in a multitude of settings across the university. Indeed, this approach is suitable for anyone who is not a subject expert on a topic. It acknowledges the utility of reading a wide variety of sources in the learning process and leverages the work of writers who source and translate subject experts. This fosters a holistic consideration of the information ecosystem and discourages binary thinking about good and bad sources. Furthermore, the unit, which includes a reflective passage and a structured bibliography of source types, facilitates feedback from the instructor on the students' research processes and chosen sources. If students demonstrate gaps or deficiencies in their research processes, such as a lack of awareness of a subject database, or a lack of knowledge for a search term that could result in better results, instructors can intervene.

We acknowledge that this entire unit is not appropriate for a one-shot instruction session common in university settings (Bowles-Terry, 2016). It includes multiple components: a reading, online tutorials, a librarian's presentation and an assignment. The instructor must have the capacity to commit a considerable amount of time and resources to this unit. However, the Principal Investigator has adapted the unit in other 100-level writing courses in the Faculty of Applied Sciences. In some courses, the PI had students complete the online tutorials, followed by a presentation on Caulfield's SIFT strategy and Lane Wilkinson's Information Needs, Types, and Qualities presentation. In two other courses, the librarian gave a similar SIFT/Information Needs, Types, and Qualities presentation, and the students completed the bibliography and reflection assignment. In each adaptation, the search examples aligned with course content on the social and ethical implications of technology.

We continue to refine the unit and hope to continue the research. Future studies could assess the data considering other aspects of the unit, including an analysis of the content of the bibliographies, and a study of the research assignments that followed this unit. We could also develop a coding schema for other knowledge practices and dispositions listed in the *Framework*, such as metacognition. Finally, we would like to more formally and deliberately solicit student feedback on the assignment, include a survey, and possibly triangulate student survey responses with their grades. We strongly believe that this approach benefits students and we will take opportunities to promote its continued adoption in other settings. We owe it to students to disprove Harari's simplistic claim that Google has supplanted all other research approaches.

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Appendix A
Assignment

Worksheet: SIFT + 5 Needs Worksheet[1]

For this assignment you are tasked to compile a bibliography of 5 different item types (Background, News, Statistics, Opinion, and Research) on one of the topics listed below and reflect on the research process.

TOPICS (choose one)

- **Google has diminished our ability to search for information (Harari p. 54)**
- **Google's top search results are "the truth" (Harari p. 54)**
- **AI will eventually make better major life decisions (eg who you marry, what you study) than you would have made yourself (Harari p. 56)**
- **Big Data algorithms: they have lots of glitches, but we have no better alternative. (Harari p. 53)**

Use this worksheet to keep track of the resources you find

1. For each information need, find a resource and write down the citation in APA style. For a reference on APA style, see: https://www.lib.sfu.ca/help/cite-write/citation-style-guides/apa
2. Fill in what type of source it is (e.g., book chapter, website, journal article, statistics source) and whether it can be considered scholarly
3. Check off which SIFT techniques you used to find the source
4. Optional: keep reflection notes
5. Write a reflection of your research process for one or two sources

TERMS DEFINED

Background: History and definitions, overview of topic
News: What's going on recently
Statistics: Raw data, survey
Opinion: Reasoned analysis
Research: Empirical research like surveys or clinical trials OR theoretical approaches
Source Types: books, encyclopedias, newspapers, news websites, magazines, essay websites, blogs, social media, government websites, non-profit websites, datasets, scholarly articles

TOPIC CHOSEN: ____

Info Need	Citation	Source Type	Scholarly (Y/N)	SIFT	Research process notes (useful for reflective passage below)
Background				□ STOP □ Investigate the source □ Find better coverage □ Trace claims, quotes, and media back to the original context	
News				□ STOP □ Investigate the source □ Find better coverage □ Trace claims, quotes, and media back to the original context	
Statistics				□ STOP □ Investigate the source □ Find better coverage □ Trace claims, quotes, and media back to the original context	
Opinion				□ STOP □ Investigate the source □ Find better coverage □ Trace claims, quotes, and media back to the original context	
Research				□ STOP □ Investigate the source □ Find better coverage □ Trace claims, quotes, and media back to the original context	

Reflective passage about research process

Write a reflective passage (200-300 words or maximum 500 words) **describing how you chose one or two of your sources**. Your passage should include responses to the following questions:

Which database(s) did you consult and which terms did you use?

How did your search evolve (in other words, what sources/tools were effective and which ones weren't? It's important to document your failures too!)

What did you learn about the sources when you employed the SIFT method? Was the SIFT method useful?

Why do you feel that you can trust the sources that you chose?

Did you find this exercise useful? If so, why?

Write your answer here:

Appendix B
Assessment Rubric

Criteria	Ratings			
Bibliography: Background source	**2 pts** **Appropriate source, correctly cited**	**1 pts** **Needs improvement**	**0 pts** **Not present or incorrect**	2 pts
Bibliography: Current event source	**2 pts** **Appropriate source, correctly cited**	**1 pts** **Needs improvement**	**0 pts** **Not present or incorrect**	2 pts
Bibliography: Statistics source	**2 pts** **Appropriate source, correctly cited**	**1 pts** **Needs improvement**	**0 pts** **Not present or incorrect**	2 pts
Bibliography: Opinion source	**2 pts** **Appropriate source, correctly cited**	**1 pts** **Needs improvement**	**0 pts** **Not present or incorrect**	2 pts
Bibliography: Research source	**2 pts** **Appropriate source, correctly cited**	**1 pts** **Needs improvement**	**0 pts** **Not present or incorrect**	2 pts
Reflection: Search Sources/Tools	**3 pts** **Exceeds Expectations** Student used subject databases to search for resources (in addition to other sources)	**2 pts** **Meets Expectations** Student used library catalogue to search for resources, and possibly other sources.	**1 pts** **Approaches Expectations** Student used only Google to search for resources.	3 pts

Reflection: Search Perseverance	**2 pts** **Meets Expectations** Student effectively refined search strategies and tools based on results. Failed search attempts were acknowledged.	**0 pts** **Approaches Expectations** No refinement of search strategies was articulated	2 pts
Reflection: Credibility of the Source	**2 pts** **Meets Expectations** Student explained why they could trust the source that they chose	**1 pts** **Approaches Expectations** Student mentions that they trust the source but does not explain why	2 pts
Reflection: Use of SIFT method	**2 pts** **Meets Expectations** Student explained how they used the SIFT method and whether it was useful to help them decide on their resources.	**1 pts** **Approaches Expectations** Student mentioned that they used the SIFT method.	2 pts
Reflection: Organization	**1 pts** **Meets Expectations** Reflection is presented in a coherent manner.	**0.5 pts** **Approaches Expectations** The coherence of the reflection can be improved.	1 pts