Computers and Composition 75 (2025) 102914

Contents lists available at ScienceDirect

Computers and Composition

journal homepage: www.elsevier.com/locate/compcom

Cultivating networked literacy: Second language writers and the development of online source evaluation strategies

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ARTICLE INFO

Keywords:
Writing from sources
Online source evaluation
Digital literacy
Research writing
Second language writing

ABSTRACT

The internet contains a wealth of informational resources. To use online information sources effectively, though, writers must know how to evaluate their credibility. This article reports on an effort to enhance source evaluation skill among a group of second language writers. Researchers used interviews, authentic writing tasks and screen-recording to chart the source use and evaluation practices of participants before and after their first year of university. In the interim, participants were introduced to online research skills including lateral reading, a popular source evaluation technique. We found that when asked to engage in research writing, these writers consistently turned to non-academic sources, especially online news sites and for-profit companies. They deployed seven types of source evaluation strategy and over the course of the study, as a group, traded weaker strategies for stronger ones. These findings provide a glimpse of the current online information ecosystem, as well as a framework to help teachers and researchers better understand how novice writers make choices in networked space. They suggest that the pedagogy offered was a limited success and provide guidance as to how it might be improved.

1. Introduction

The romantic notion of the writer alone at a desk, transferring ideas from mind to page, has never captured the reality of much composing activity. Whether at work or school, composition often involves drawing not just from internal information stores, but from external sources. Sources include texts, and increasingly, non-textual artifacts such as videos and infographics (Kocatepe, 2021). The ability to write effectively from sources, as Cumming et al. (2016) put it, is a "fundamental academic literacy skill" and a mandated learning outcome across higher education (Grabe & Zhang, 2013; CWPA, 2014).

Writing from sources is a complex activity that engages numerous sub-skills including the ability to find, evaluate, understand and synthesize information (Plakans, 2010; Sala-Bubare & Castello, 2023; Yang & Shi, 2003). The first two of these sub-skills have traditionally received less attention than the second two. In Cumming et. al's (2016) review of the writing-from-sources literature between 1993 and 2013, for instance, the evaluation of source material is not counted among major research foci. Indeed, only one of the studies cited (Wiley et al., 2009) mentions evaluation in the title.

In the past decade, much has changed. The spread of internet access, then broadband internet, social media and smart phones, has led to a steady increase in information availability. In turn, scholars have called for the use of more varied information sources, particularly online sources, in student writing (Purdy & Walker, 2012). Engagement with online sources can prepare students for

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https://doi.org/10.1016/j.compcom.2025.102914

writing in the workplace (Singer, 2019) and help cultivate essential digital literacy skills (Craig, 2017). For novice or second-language (L2) writers, in particular, online sources, often designed for popular audiences, can serve as gateways to complex ideas that would otherwise be inaccessible (Overstreet, 2021).

This shifting landscape makes source evaluation more important than ever. To effectively utilize online sources writers must be able to discern what they are reading (or watching or listening to), who created it, whether the content is accurate and whether it satisfies their information needs. They must do so quickly and in complex digital environments. Too little is known about this process. Research is needed to better understand how writers evaluate online sources, how evaluation skills develop, and how teachers can help students make better choices. Fortunately, in response to concerns about online misinformation, recent years have witnessed a boom in information literacy research. The present study sought both to better understand student source evaluation practices and, drawing on recent insights, help cultivate more effective practices.

Researchers interviewed 10 Arab L2 writers, once near the beginning of their first year at an English as a Medium of Instruction (EMI) university and once near the end. In the interim, participants were taught online research skills, including lateral reading (Wineburg & McGrew, 2019). This popular source evaluation technique involves using networked affordances to investigate sources before sustained reading. In each round, participants were asked about their digital information habits and the evaluation strategies used when engaging online information. They also completed a pair of highly authentic research writing tasks, the composition of which was tracked via screen-recording. Participants were then interviewed again and, using stimulated recall, asked about their source selection. This pre- and post-task design allowed insight into what students knew about source evaluation as well as what they did, and how both knowledge and practice changed after a year of university study. We identified seven source evaluation strategies. In the second round, participants used lateral reading more and weak evaluation strategies less. These findings suggest that our pedagogy had lingering impact. They also suggest how it might be improved.

2. Literature review

Writing from sources is a material practice, shaped by the available tools. Scholars have often studied source evaluation while researching the use of internet search tools. Our project was informed by this literature, as well as research on the development of evaluation skills, our specific student population, and information literacy pedagogy.

2.1. Source evaluation and internet search

The online information environment is complex. During goal-driven information search, such as that associated with writing from sources, internet users rely on "heuristic cues" to decide which sources to engage (Salmerón et al., 2018). Heuristic cues may be *epistemic*, related to the reliability or credibility of a source, or *non-epistemic*, related to factors such as relevance or ease of access (List et al., 2016). Attention to epistemic factors is associated with better learning outcomes (Wiley et al., 2009). Studies consistently show, however, that unless prompted, information seekers pay little attention to epistemic cues. Student information seekers know that attention to the circumstances of a document's production is important and have considerable knowledge about different types of sources (Paul et al., 2017). Still, when engaged in online information search, they typically do not consider factors such as the identity and motivation of a source's author, why a certain document was produced, or the existence of quality-control mechanisms (List et al., 2016).

When asked to conduct epistemic investigation students often perform poorly. For instance, Wineburg and McGrew (2019) asked undergraduates at an elite American university to judge the credibility of certain internet sources. These students largely considered superficial factors, such as website design. As a result, only 20 % of participants were able to uncover that an otherwise respectable-looking site was maintained by malicious actors.

Scholars have also examined online source evaluation within the writing process. In the 2000s, for instance, just as the internet was becoming ubiquitous, Paul Stapleton and Pavlina Radia published a series of articles exploring the source evaluation habits of undergraduate L2 writers. Their work captures a moment of transition. While pre-internet students could be expected to mainly draw information from academic sources, often collected via library research, Stapleton (2003) found undergraduates citing online news sites, advocacy organizations and for-profit companies. Radia & Stapleton (2008) argued that these "unconventional sources" could be a powerful learning resource, but also expose students to misinformation and manipulation.

In line with Paul et al. (2017), Stapleton (2003) found that undergraduate writers displayed "a reasonable intuitive knowledge" about the relative quality of unconventional sources (p. 186). However, they often "appeared to compromise their integrity" and cite low-quality sources (p. 186). He noted the tendency of writers to select sources that appeared early in search results, and have difficulty identifying internet genres, for example, mistaking personal webpages for university-sponsored content. Writers were also unable to recognize ideologically charged or biased content (see Radia & Stapleton, 2008).

Along similar lines, Bakke (2020) argued that contemporary internet users have "implicit trust in algorithms" and thus tend to offload source evaluation to search engines (p. 2). Bakke observed seven adult L1 writers as they searched for information on health-related topics. Despite a general belief that ranking did not influence their source selection, these writers consistently selected top-ranked search results. They named familiarity as the most common reason for selecting a given source, generally equating recognition with credibility. As with writers in earlier studies, participants were also willing to use less than completely reliable sources if those sources suited their needs.

2.2. Development of evaluation skills

Longitudinal change in source evaluation ability has also been studied. Warwick et al. (2009) followed a group of information management undergraduates over the first two years of college. These students gained knowledge about the types of information sources available and how to use them in coursework. At the same time, however, they tended to avoid complex information during search activity. Rather than developing new, more sophisticated search and evaluation techniques, they consistently sought to adapt existing skills, what the researchers labeled "strategic satisficing" (Warwick et al., 2009, p. 2408). Only when forced by more complex assignments did students break with existing patterns.

Thompson, et. al (2013) also followed a group of undergraduates, using interviews to examine how their selection and use of sources changed over their first year of college. These students mainly considered non-epistemic factors, particularly relevance and ease of use, when selecting sources. Over the course of the year, they began to use academic sources more frequently and increasingly included task demands in their evaluation process. The researchers also noted a move away from the use of sources solely to support the writer's own opinion.

2.3. Similar student populations

The current project involved Arab college students between the ages of 17 and 20, studying in the United Arab Emirates (UAE). Compared to L1 writers, L2 writers, such as our participants, face additional source evaluation challenges, both because of language issues and "culture-specific assumptions about academic rigor, authority, and bias" (Radia & Stapleton, 2008, p. 10). Several studies have observed similar student populations. Kocatepe (2021), for instance, used screen recording to examine the internet search practices of a group of female Emirati writers. Relevance was identified as their primary source selection criteria, though many of the students also considered source credibility. All told, half of the study participants claimed to use the presence of an author and publication date, as well as source URL, as epistemic heuristic cues. As in Stapleton (2003), participants misidentified internet genres. Source evaluation practices were also shaped by local epistemic beliefs. These writers, for instance, put great faith in websites featuring the image of the Emirati flag or founder, believing that the UAE government, in such cases, would ensure only the publication of correct information.

Our study participants were members of the generational cohort known as "Gen Z." Born between 1997 and 2012, members of this cohort grew up with networked technologies. As a result, they engage in unique information practices. Hassoun, et. al (2023) found that contemporary young people tend to look for social cues as to what online information to believe. They may, for instance, check the comment section of an article or video for clues to its legitimacy. Relatedly, they may turn to epistemic authorities, such as friends, family or online influencers, for guidance. They may also seek to validate information by confirming that it appears across multiple documents, a process called "corroboration" (Paul et al., 2017). For some contemporary internet users, corroboration may replace conventional forms of source evaluation.

2.4. Information literacy

As online information access has proliferated, the spread of misinformation—and how to prevent it— has become a growing concern (Miller & Leon, 2017). In terms of source evaluation, information literacy pedagogies have often adopted a so-called "checklist approach," asking students to consider a variety of epistemic factors before using a source. Checklist approaches have been criticized for being unwieldy and not tailored to the unique demands of the contemporary internet. Forzani (2020), for instance, argues that checklists be replaced with a three-tiered, hierarchical model that asks readers to assess the context, authority and informational content of each source. This model, she argues, can help readers construct understanding in a more systematic fashion. Singer (2019) also challenges the checklist approach, arguing that readers, in order to use online information properly, need to understand the context surrounding that information. She presents a heuristic to help students evaluate each source's rhetorical situation. This heuristic asks readers to consider factors such as the genre and purpose of and audience for informational output.

Lateral reading has also been presented as an alternative to checklists. Wineburg and McGrew (2019) observed that when performing source evaluation, professional fact-checkers, rather than carefully studying a target source, immediately left the target source. They opened new web browser tabs and searched for what other sources said about the source at issue. In essence, they used networked affordances to better understand what they were reading. This sort of lateral movement is important because malicious actors can easily pose as objective information sources. They may manipulate readers by striking a reasoned tone, having professional design and obtaining non-profit status, marked by a ".org" URL. Unfortunately, conventional information literacy approaches often teach students to use these easily gameable "weak signals" as heuristic cues (Caulfield & Wineburg, 2023). To avoid being tricked, these researchers argue, students must be taught to "get off the page."

The information literacy pedagogy forwarded by Wineburg, McGrew and colleagues has been shown to improve source evaluation outcomes across a range of student populations (Barzilai et al., 2023; Brodsky et al., 2021). Within writing studies, the approach has been championed by Carillo and Horning (2022). As detailed in the next section, during their first semester of university, the participants in our study were introduced to lateral reading.

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To summarize, the general consensus is that undergraduate students, though possessing source knowledge, tend not to consider source reliability and credibility when conducting online research. They focus instead on non-epistemic concerns. When students do conduct epistemic evaluation they often perform poorly. With this in mind, the current study sought to investigate the online source

use and evaluation activity of a group of Arab college students. We sought to determine both what they knew about sourcing and what they did in practice, as well as how theory and practice changed with time and dedicated instruction. We were particularly interested in our participants' use of networked source evaluation strategies such as lateral reading. Our research questions were as follows:

1. What sources do a group of Arab L2 writers cite during a research writing task?
2. What strategies do these writers report using when evaluating sources?
3. What strategies do they actually use?
4. How do their source evaluation strategies change after instruction in lateral reading?

3. Methodology

3.1. Context

The current study was part of a larger project tracking the impact of EMI education on literacy practices. It took place at a science and technology college in Abu Dhabi, UAE. Twenty first-year college students initially enrolled. Study participants engaged in interviews and a research writing task in the third week of their first semester of college (September) and after their second semester (June). During the academic year, participants took a standardized course of study that involved science and math courses, as well as a two-semester first-year composition (FYC) sequence. Assignments in the FYC sequence included research essays, a technical report and various multimodal projects. A detailed discussion of the FYC curriculum can be found in [redacted] (2023). Ten students completed both phases of data collection and are the subjects of the current study.

3.2. Intervention

A stated goal of the FYC curriculum was the development of information literacy skills. Instruction was informed by research in writing studies that argues for the full embrace of digital and networked affordances (Purdy & Walker, 2012; Overstreet, 2021). Rather than relying solely on academic sources, students were encouraged to draw on a wide range of resources, including non-textual genres, to satisfy their information needs. The overall goal was to help students develop the ability to learn from the internet. This ability might be used for academic purposes, as well as to facilitate "everyday instances of research" (Craig, 2017, p. 37).

Starting in the fifth week of the first semester, students learned about different types of sources (e.g. academic vs. unconventional), as well as how to conduct online research. Students were shown how to use Google Scholar for academic research and Google for unconventional or popular source research. The search engine interfaces were explored and discussed, and search techniques, including the use of Boolean modifiers such as quotation marks, were modeled. The interfaces of popular online information resources such as YouTube and Wikipedia were also explored.

Following Singer (2019), our source evaluation pedagogy stressed the importance of context. Sources, we believe, are not innately good or bad; instead, they are either useful or not useful for a given purpose. To make this determination, a reader needs to know about the context in which information is presented. To help students think about context, our pedagogy asked that, before engaging a source, students consider the identity of the author or creator and their purpose for posting information online. These simple questions, we figured, work to reveal potential biases and thus inform how a source might be used. Students were taught to discover this information via lateral reading (Carillo and Horning, 2022).

The above evaluation method was chosen for a number of reasons. First, like Caulfield and Wineburg (2023), we believe that conventional evaluation heuristics tend to place too much emphasis on superficial elements. As a result, students may reject useful, but unconventional sources, while being too credulous of sources with traditionally "good" features. Second, our method is cognitively efficient. It doesn't ask students to memorize a long list of questions. Instead, it simply asks them to think about what they are reading and if they don't know, "get off the page" and find out. It is thus inline with the primary justification for lateral reading as proposed by Wineburg and McGrew (2019).

All told, part of two first-semester FYC course meetings were devoted to learning source evaluation skills. First, the instructor gave a short lecture and demonstration of how lateral reading might be used to investigate the identity and motives of a source. Students then completed a homework assignment in which they were asked to find three unconventional sources related to a topic of interest and, for each, fill out a research log template (Fluk, 2015). The template asked students to provide source information, as well as speculate about the author's purpose for posting information (Appendix A). The template was designed to scaffold student interaction with sources, prompting systematic investigative behavior. In the next class, the instructor led a discussion of several completed research logs. Later in the semester, students wrote a 1000-word essay that required substantial online research. The essay involved making a data-driven argument in response to a claim about a scientific or technical topic. As part of the research process, students were again asked to fill out several research log templates. To motivate epistemic evaluation, instructors made clear that they would consider source quality when grading the final essays. In their second semester FYC course, students reviewed the research techniques learned the previous semester and again undertook several assignments requiring online research, including a 1500-word technical report. In no other course during the observation period did participants learn about or conduct online research.

3.3. Participants

Study participants were recruited via an email invitation sent to all students enrolled in the FYC classes of the author and a research

collaborator. They were all native Arab speakers educated in the UAE and at the time of the study, first-year university students. They displayed various levels of English proficiency, but on the whole, were advanced-intermediate to advanced users of English. All participants had studied English for over 10 years, with nine out of 10 having been educated in EMI environments since primary school. Eight of the participants were engineering majors, while one each majored in chemistry and computer science. During the observation period, however, they had little exposure to discipline-specific practices, as first-year instruction at this institution was standardized. All participants reported frequent use of digital media and the internet, and identified English as their primary media and internet language.

3.4. Data collection

After receiving approval from the university ethics committee and informed consent from the participants, the author and a collaborator conducted pre-task interviews in the third week of the participants' first semester of college. To avoid bias, the author did not interview students enrolled in his own classes. In the pre-task interview, a researcher explained the project and provided logistical information about the writing task. They asked participants about their education and literacy histories, digital media use and online information habits. Participants were specifically asked the following: *When evaluating a source or piece of content, what do you look for?* The researcher then asked follow-up questions as needed to solicit elaboration. After the pre-task interview, participants were emailed the prompt for the writing task (discussed in detail below). They were given one week to complete the task. If not completed after five days, the researchers sent a reminder email.

Study participants completed the writing task on their own time and with their own tools. They recorded their computer screens with Scre.io, a Google Chrome extension. After completing the writing task, participants uploaded their screen recordings to a secure link and emailed the researchers their text. A post-task interview was then conducted. In the post-task interview participants were asked about their conception of the task, their research and writing process, and their source selection and use. They were asked to explain what sources they used for the project and why each was selected. They were specifically asked the following: *You had to use sources for this project. What sources did you use? How did you go about deciding what sources to use?* The post-task interview also included stimulated recall (Gass & Mackey, 2000). Participants watched short segments of their screen recordings and explained their choices in regard to source use and evaluation. In each interview, researchers identified and asked each participant to explain in detail how they went about selecting at least one cited source. All interviews were conducted individually, in English, via MS Teams. The pre-task interviews lasted, on average, one hour, and the post-task interviews, 45 min.

The second round of data collection took place immediately after the participants' second semester of college. In the second pre-task interview, participants were asked about their college experiences and any perceived change to their writing skill or processes over the course of the year. Other than that, the data collection procedure was the same as described above. The exact same questions regarding source use were asked. Ten out of 20 initial participants completed both rounds of the study. They were paid approximately 30 USD and received a certificate of appreciation.

3.5. Task design

Four similarly structured writing prompts were used in the study (Appendix B). Each prompt asked the writer to research an unfamiliar topic, explain that topic, then make an evidence-supported argument. Participants wrote about a different topic in each round. The topics were non-discipline specific. The prompts were also piloted to ensure that, on the whole, participants would not have pre-existing knowledge of the topic to be discussed. The task thus required them to learn using the internet.

The prompts were modeled after the widely used Collegiate Learning Assessment (CLA) (Klein et al., 2007). Rather than providing a library of source material to draw from, however, as in the CLA, the task required participants to justify their claims with information they found themselves. The prompt stated that the writer could support their claims with any source they deemed "useful and reliable." A specific genre or citation style was not stipulated, however, participants were asked to identify the source of all information used. To provide a degree of standardization the prompt contained a suggested time limit (one to three hours) and word count (500 to 1000).

3.5. Data analysis

Interview transcripts constitute the primary data for this study. Video data was used to supplement analysis of the interview data but was not formally coded. The texts produced by the participants were reviewed to identify the number and type of citations but were not otherwise analyzed.

3.5.1. Interview data

To code the interview data, researchers first transcribed the interview recordings, then proofread each transcript. The author then conducted several rounds of iterative coding (Maxwell, 2013) to identify themes related to online information practices. In regard to source evaluation strategies, a special coding procedure was used. We understand a "strategy" as a goal-directed behavior operating on the mesoscopic-level of human activity (Spinuzzi, 2002). During analysis, strategies can be revealed both directly, through references to behavior (e.g. "I always check the author of a source"), and indirectly, through references to beliefs that suggest certain behaviors (e.g. "To know if a source is credible, you have to know who the author is"). To identify a shared set of source evaluation strategies, the author first labeled source-related behaviors and beliefs with subcodes. These subcodes were then combined to create categories, the labels of which were informed by the source evaluation literature. Seven categories, sufficient to cover all subcodes, ultimately

emerged. These categories are detailed below. A full list of subcodes and categories, along with examples of data thus coded, can be found in Appendix C.

In explaining their source use and evaluation practices participants could either reference epistemic or non-epistemic factors. For instance, a writer might say "professional design indicates a source is reliable" (epistemic) or "I use whatever source is easiest to understand" (non-epistemic). The first six categories of source evaluation strategy in our coding scheme denote consideration of epistemic factors. In other words, they denote times in the interviews when participants, in response to questions about how they evaluate sources or why they chose to use certain sources, referred to factors or techniques that show consideration of source credibility. The seventh category, *Non-Epistemic*, denotes times they referred to factors apart from source credibility, such as topic relevance or ease of access.

Though all epistemic heuristics can be useful, our six epistemic categories form a rough hierarchy from most to least reliable. *Networked* source evaluation strategies refer to the use of lateral reading, defined here as investigation of either an author or publisher through the use of networked affordances, particularly internet search. As discussed above, such behavior has been shown to improve evaluation outcomes. *Corroboration* refers to efforts to corroborate information across sources. The presence of a claim in multiple sites may work to verify the truth of the claim and by association the credibility of a source issuing the claim. Corroboration's effectiveness as an online source evaluation strategy has yet to be explored, but in offline environments, corroboration has been shown to be a hallmark of expert readers (Wineburg, 1991).

The third category, *CAP*, short for currency, authority and purpose, denotes non-networked consideration of the currency of the information in a source, the identity of the author or the author's purpose for posting information. This sort of analysis is encouraged by conventional information literacy approaches, such as the widely used "CRAAP" checklist.[1] Though CAP factors are important to consider, without leaving the target source via lateral reading, such analysis may leave an information seeker open to manipulation, making *CAP* a positive, but insufficient evaluation strategy. *Known* refers to the use of official, popular or familiar information sources. *Social* refers to the use of social cues or epistemic authorities to determine credibility, such as checking the comments section of an article or asking a friend for advice. Known and social evaluation strategies can lead to positive outcomes but are context dependent. If the sources with which one is familiar or one's social contacts are not reliable, proper evaluation can not occur using these techniques.

The sixth and final epistemic category, *Weak*, denotes the use of epistemic strategies that have been shown to lead to negative evaluation outcomes. These include reliance on "gut feelings" or "logic," as well as reference to design, URL or source names or titles as bestowing credibility. These "weak signals" can easily be manipulated and thus say little about actual credibility (Breakstone et al., 2021; Wineburg & McGrew, 2019). This category also includes consideration of a source's position on an internet search results page, which may be a mark of relevance, but not credibility (Bakke, 2020).

To identify changes between rounds, after the categories were created and all interview data coded, the data for each participant was reviewed and the number of discrete strategies used, based on sub-code, calculated. For example, if a participant mentioned reliance on "design" and "title" as credibility markers, they would receive a score of two in the *Weak* category (as two subcodes in that category were present). If they mentioned "design" twice and "familiarity" once, they would receive a score of one in the *Weak* category and one in the *Known* category. Participants were assigned scores for each of the seven categories. Separate scores were calculated for the pre-task and post-task interviews. The former, in which participants were asked how they evaluated sources in the abstract, indicate what evaluation strategies were available to these students—the "tools in their toolboxes." The latter, in which participants explained how they selected sources during the writing task, revealed what strategies they actually used under given task conditions.

Two reliability checks were performed. First, 30 days after the initial analysis, the author recoded 20 % of the data using the study's system of sub-codes. 94 % of the data (17 out of 18 references) were coded the same, indicating a high degree of consistency. The author reevaluated the one inconsistent result and determined that the original code was correct. Also, as discussed below, upon analysis, large changes in *Networked* and *Weak* scores were detected between rounds. To confirm these changes were not a result of coder error, the author reviewed all data labeled with *Networked* and *Weak* sub-codes. The author also reviewed the first-round data, looking for statements that should be labeled with *Networked* sub-codes, and the second-round data, looking for statements that should be labeled with *Weak* sub-codes. No errors or mislabeled statements were found.

3.5.2. Video and text data

During the post-task interviews, video data was used to prompt stimulated recall. After coding the interview data, the author also reviewed the video data for insights into participants' source use and evaluation practices. As part of a previous study ([redacted]), each video had been extensively coded, with all mesoscopic-level actions labeled and their relationships visualized. This allowed the author to easily locate relevant segments.

The author also reviewed the texts produced by the participants and identified the number and types of sources cited. To categorize the unconventional sources, the author drew on the categorization system used in Stapleton (2003). However, in light of the changed nature of the internet and participants' specific citation patterns, this system had to be somewhat modified. Source type was determined by examining the specific document cited, the website on which it appeared and by investigating the author and website via lateral reading. Five types of source were identified (Table 1).

[1] https://library.csuchico.edu/sites/default/files/craap-test.pdf

Table 1
Source taxonomy.

Type of Source	Definition
Academic	Peer-reviewed academic articles; originally published in academic journals but may be found elsewhere.
News	Content created or hosted by organizations whose primary business is the distribution of journalistic information.
NGO	Content created or hosted by non-governmental organizations, including research, professional and advocacy organizations.
Government	Content created or hosted by governments.
Company	Content created or hosted by for-profit companies.

4. Findings

4.1. Sources cited

Overall, participants cited 49 sources in round one and 50 in round two. All were in English. In round one, all were primarily textual. In round two, participants cited three non-textual sources: two videos and an infographic. As shown in Fig. 1, in both rounds the majority of sources cited were unconventional as defined by Radia & Stapleton (2008). The number of academic sources cited dropped slightly between rounds. This drop occurred despite more dedicated academic search. Video data revealed that during round one, only one out of the ten participants conducted a dedicated academic literature search. During round two, five participants did so.

Participants faced a number of obstacles accessing relevant academic material. Two students reported struggling to access pay-walled journal articles. Other students expressed difficulty understanding the content of academic articles, both because of general density ("too many words") and the use of technical vocabulary.

The number of for-profit companies cited increased between rounds; indeed, companies were the most cited type of source in round two (Fig. 1). Participants cited human resources companies on management strategies, software companies on cryptocurrency, and a therapist's office regarding treatment of anxiety and depression. Resources cited were often webpages contained in "blog" or "newsroom" sections on corporate websites (Fig. 2). These pages, designed to look like blog posts or news articles, contain information on topics related to the company's operations interspersed with links to access the company's products or services (Fig. 3). Students likely encountered, and thus cited, these sources frequently because of the dynamics of contemporary internet search. Web content of this sort is designed to appear in response to common search queries, a form of marketing known as search engine optimization (SEO) (Caulfield & Wineburg, 2023).

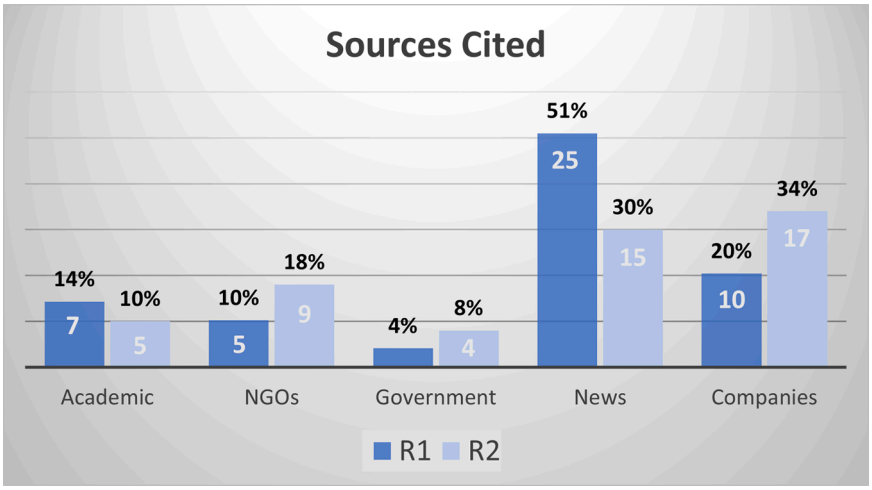

Fig. 1. Source cited in rounds 1 and 2.

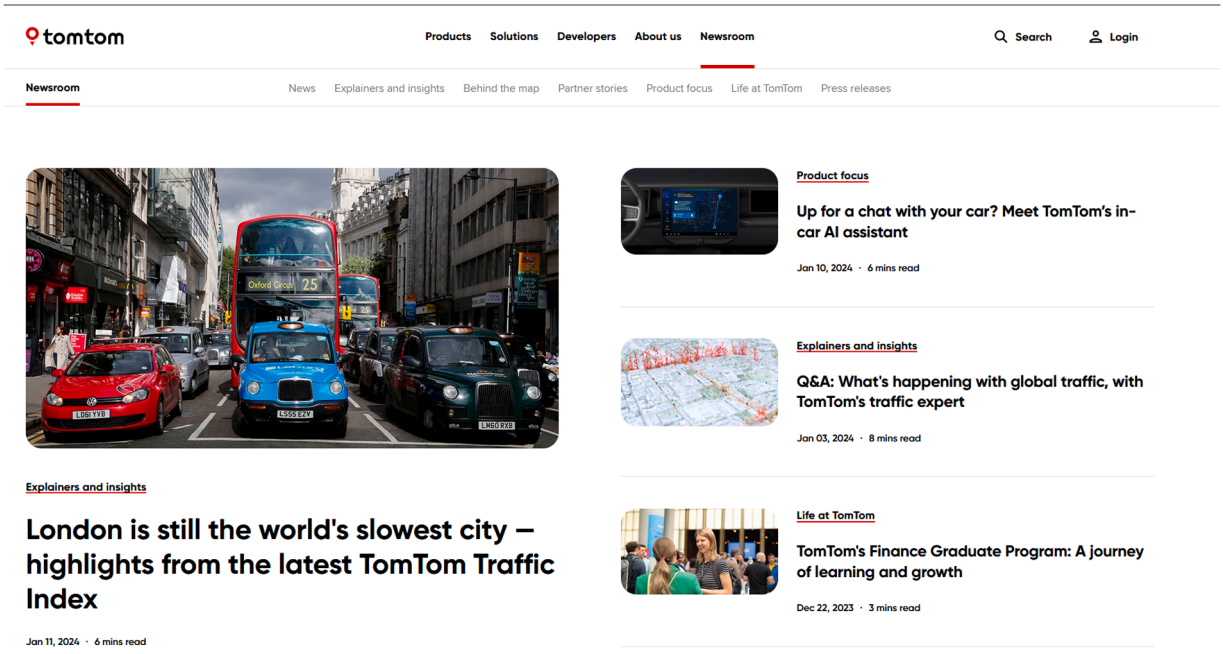

Fig. 2. Example of corporate website.

Fig. 3. Blog post on corporate website.

4.2. Source evaluation

This section first presents participants' reported source evaluation strategies. As explained above, this data was gathered from pre-task interviews. The section then discusses the strategies participants actually used on the study's writing task. This data was gathered from post-task interviews.

4.2.1. Reported strategies

Participants reported using a wide range of evaluation strategies. Table 2 indicates the number of strategies reported and used in each round ("strategies"), as well as the number of participants reporting and using each strategy ("users"). Fig. 4 visualizes the change in reported strategy use between rounds.

We found that, on the whole, participants did not receive systematic instruction in source evaluation prior to our study's intervention. Most had conducted research writing in high school that required utilizing online sources. About half reported that in furtherance of such assignments instructors had provided piecemeal advice about source quality or research tactics. This advice almost exclusively involved reliance on weak signals such as URL or design quality.

Despite having received little formal instruction in source evaluation, participants knew about and reported conducting various forms of epistemic evaluation. They were also familiar with "Gen Z" evaluation techniques such as corroboration and the use of social resources. Multiple participants expressed skepticism of information encountered online, along with the need to verify claims by looking at multiple sources. Almost half of the group reported engaging in corroboration when conducting online research. "If a certain piece of information [is] repetitive in several websites," one writer reported, "that's how I know… it's legit." Likewise, almost half reported using social evaluation techniques. Checking comments and view counts were identified as ways to judge the credibility of a source. Parents, siblings, teachers, online commentators and "the people who follow a source" were identified as capable of offering insight. Notably, participants reported having never been taught corroboration or social evaluation strategies. They developed these strategies on their own in response to the unique demands and affordances of networked space.

Reported use of collaboration and social evaluation strategies changed little between rounds. Reported use of networked techniques and reliance on weak signals, on the other hand, changed markedly. In round one, three out of ten students reported using networked strategies to evaluate sources. In round two this jumped to five, including three students who did not previously report using networked techniques. Participants recognized this change. For instance, one participant, referring to the act of investigating sources via Google search, stated "before college I definitely didn't do that." Others tied behavioral change to instruction in FYC. One participant, for instance, stated that she was now "really good at making sure like the information is accurate because [she'd] been given a lot of tools to help evaluate." Among these tools, she listed lateral reading.

Table 2
Source Evaluation Strategies.

	Strategies				Users			
	Reported		Used		Reported		Used	
	R1	R2	R1	R2	R1	R2	R1	R2
Networked	3	5	2	4	3	5	2	4
Corroboration	4	3	4	1	4	3	4	1
CAP	5	3	2	1	4	2	2	1
Known	4	3	7	3	4	3	6	3
Social	4	4	1	0	4	3	1	0
Weak	6	2	12	4	5	2	9	4
Non-Epistemic	0	3	8	8	0	2	6	7

Note: This table indicates the number of strategies reported and used in each round ("strategies"), as well as the number of participants who reported and used each strategy ("users"). These numbers may differ because scores are assigned based on subcode and each category of strategy, except for *Networked* and *Collaboration*, has multiple subcodes. (See Appendix C for index of subcodes.).

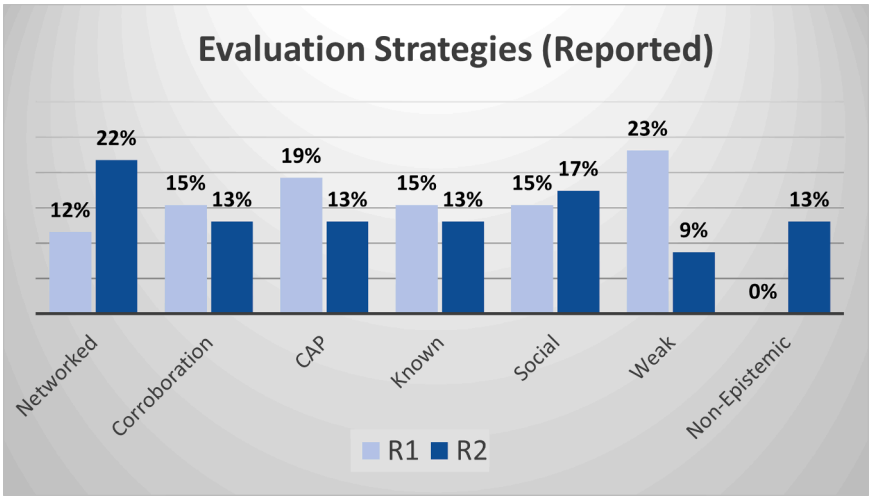

Fig. 4. Evaluation strategies reported in rounds 1 & 2.

There was also a large drop in reported reliance on weak signals of credibility. *Weak* went from being the most referenced category of evaluation strategy in round one, to the least referenced in round two (Fig. 4). All told, the number of students reporting reliance on weak signals dropped from nine to four. In round one, in a representative instance, a participant reported that the "design of the website" was "first of all" what he looked for when determining credibility. Reliable sources, he continued, are "highly designed" and "you can see a lot of money was spent on [them]." Another round-one participant reported that "shorter links" that "ended with org" were a sign that a "website is credible." Such statements were common in round one and rare in round two. As noted, multiple participants reported being taught in high school to use evaluation strategies that relied on weak signals. Participants largely ceased using these strategies, though, by the end of the first year of university.

4.2.2. *Actual strategies*

Our study design allowed us to compare participants' reported source evaluation practices with their actual practice during two acts of research writing. Though largely in agreement, the measures diverge in two areas. First, while use of social and CAP techniques, and to a lesser extent corroboration, were frequently reported, these techniques were not widely used during the writing tasks. Second, compared with reported behavior, in practice, participants were much more likely to justify source selection via non-epistemic criteria. All told, 80 % of participants referenced non-epistemic evaluation strategies at least once during discussion of the writing tasks.

In terms of longitudinal change, reported and actual measures correspond. Fig. 5 visualizes change in actual strategy use between rounds. Compared to round one, in round two, participants used networked strategies more often, and relied on weak signals of reliability less often, just as reported. They also used non-epistemic strategies more.

Perhaps relatedly, in round two participants displayed a more sophisticated understanding of the research process and the various roles sources might play within it. This is evidenced, for instance, by an increased ability to justify non-epistemic source selection. When reading "mainly to inform myself," one writer reported, she would engage "anything that could benefit [her]" without "looking really into the website." The sort of reading referenced often involved quickly scanning Google search results pages that contained algorithmically selected "snippets" of source information (Fig. 6). In such cases, the writer didn't consider the identity of the original source relevant. However, she recognized—and was comfortable with—her lack of epistemic consideration. Another writer, in response to a question about whether he thought a claim came from a subject matter expert said he didn't know, but that it wasn't important given the nature of the information sought. "It's a simple question," he said "What is cryptocurrency? I could have gone to the Wikipedia page." Notably, both these writers recognized the presence of misinformation online. They were both familiar with a range of source evaluation strategies, including lateral reading. They believed, however, that at certain points in the research process it was acceptable to set aside epistemic concerns. In round two, on the whole, study participants were better able to explain such decisions and how they related to task goals.

Participants also deployed a more sophisticated array of source evaluation strategies. As noted, reliance on weak signals dropped. At the same time, after being used by only two participants in round one, in round two, networked evaluation strategies were used by four participants, making them the most frequently used epistemic strategy. It is important to note, however, that use of networked evaluation techniques doesn't necessarily mean optimal use.

The case of a participant I will call "Bashira" is instructive. In round two, Bashira expressed a belief that her source evaluation skills had improved over the course of the year and credited this improvement, partially, to her use of lateral reading. Indeed, examination of the video data revealed that, in round two, she used Google search multiple times to investigate potential sources. Two out of three times, however, this resulted in her searching the name of the author associated with a corporate blog post. The goal was to check if the author was an expert on the subject on which they were writing, whether she "could depend on the information written by the writer," as Bashira put it. In round two, writers often used lateral reading to investigate authors on corporate sites in this manner.

These writers' source investigation practices might be considered less than optimal. As noted, information experts are adept at figuring out the context of online information (Singer, 2019; Wineburg & McGrew, 2019). Indeed, our pedagogy expressly sought to

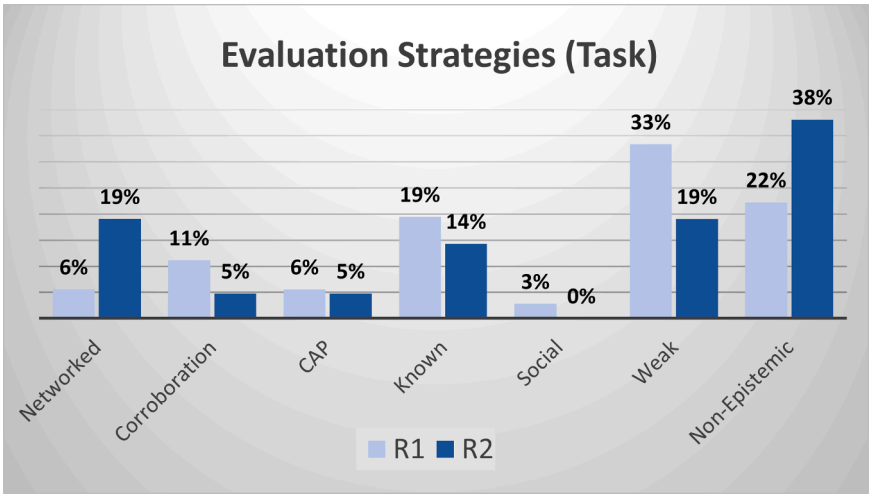

Fig. 5. Evaluation strategies actually used in rounds 1 & 2.

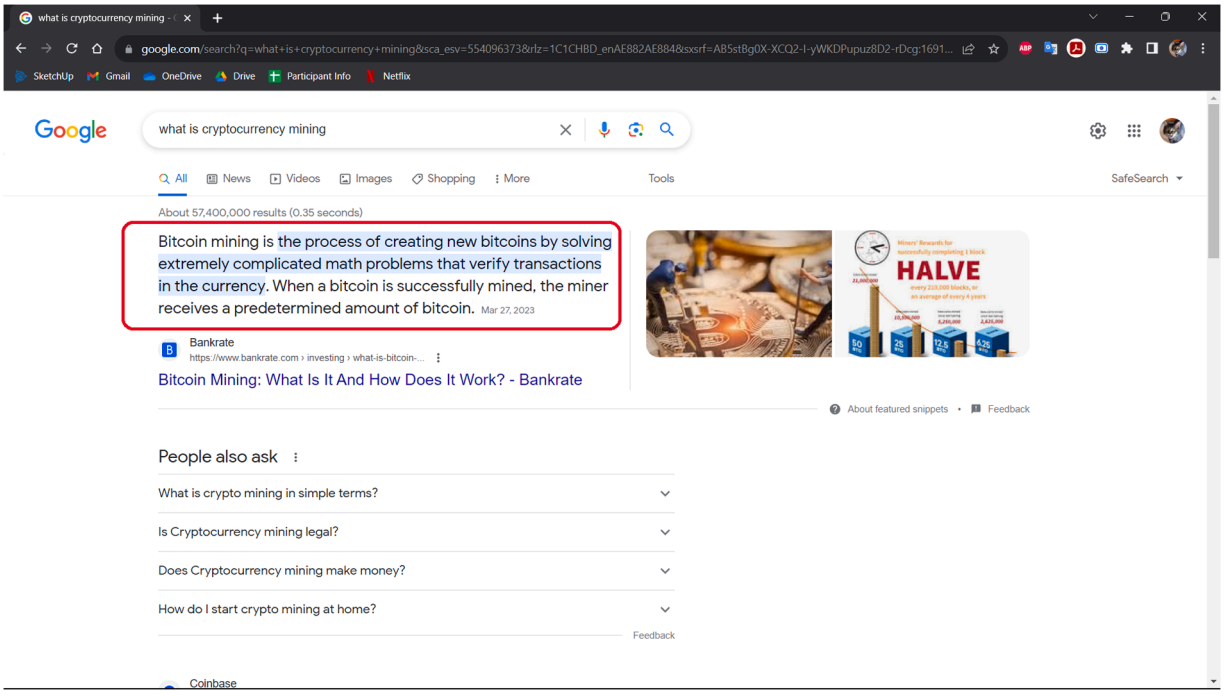

Fig. 6. Example of Google Snippet.

cultivate this ability. It appears to have been only partially successful. Though participants were quick to investigate individual authors, they largely ignored non-author related contextual factors. For instance, they spent little time researching who or what owned each website or thinking about how certain types of content might serve certain purposes. Some participants also appeared unable to distinguish corporate websites designed to look like news sources from actual journalistic enterprises. Lateral reading could be used to make this distinction, but because of a focus on authors and expertise, largely was not.

5. Discussion

The above findings offer a glimpse of the information ecosystem students encounter when asked to conduct online research. They also provide a conceptual vocabulary to understand decision-making in such a space. The students in this study were taught how to conduct academic research. They were also taught, however, that non-academic sources are a legitimate form of knowledge. Unconventional sources are often easily accessible. In turn, when asked to make a claim about an unfamiliar topic and support their ideas with reference to reliable sources, popular news sites and for-profit companies were cited above all else. Information was also drawn not from sources directly, but from search results pages featuring decontextualized snippets. We can assume that other academic writers, when asked to engage in tasks that involve online research, will face a similar array of choices. In selecting among these choices, they will likely deploy some combination of the seven evaluation strategies identified. The taxonomy offered can thus be used by researchers to organize observed behaviors and by teachers to help student writers understand, and optimize, their practices.

Studies have found a lack of epistemic concern on the part of student writers (List et al., 2016; Thompson et al., 2013). Our findings tell a different story. Though topic relevance and ease of access were important factors in source selection, nearly all participants used some epistemic source evaluation strategies in each round. Indeed, only one participant out of ten failed to provide any epistemic justification for their source selection, doing so twice. Clearly, these students were aware of the variable quality of online information. They each had a repertoire of epistemic source evaluation strategies at their disposal and deployed these strategies during the observed writing tasks.

Among the strategies identified, corroboration and social strategies are perhaps most worthy of further attention. These techniques have been classified as alternatives to traditional sourcing methods (Paul et al., 2017). Participants reported familiarity with both techniques despite having never been taught such behavior. On the actual writing task, however, they were relatively little used. This might represent a missed opportunity. Writing scholars have long argued for the importance of connecting academic literacy to students' non-academic digital literacy practices (Purdy & Walker, 2012; Shepherd, 2018). In doing so, we can help students leverage what they already know to promote success in new contexts. With this in mind, further research might examine how corroboration and social evaluation strategies are used, and might be used, in the academic writing process. Writing teachers may also want to discuss these evaluation strategies with students to help activate latent knowledge.

The writers in this study attended an EMI institution and had broad exposure to English-language media and internet content. However, they were native Arab speakers, and thus, L2 writers. Since the pioneering work of Radia and Stapleton, the use and evaluation of online sources has been little studied in L2 writing. One notable exception, Kocatepe (2021), stressed how culturally specific beliefs

might shape engagement with online information. In the present study, we saw little direct evidence of culturally specific information habits. Our findings, however, were undoubtedly shaped by our participants' positionality. According to Hassoun, et al. (2023), members of Gen Z often have little interest in traditional journalism. The Arab world, in particular, is a challenging media environment, with both press censorship and media manipulation common (Al-Najjar, 2021). Taken together, these factors likely explain the inability of some of participants to distinguish corporate marketing from legitimate news. Simply put, they had little experience with the latter.

The primary goal of this study was to track the development of our participants' source evaluation abilities. We hoped to gauge the impact of an FYC sequence featuring instruction in online research skills and lateral reading. In this regard, the findings are consistent: in the second-round participants were more likely to use networked evaluation strategies. They were also much less likely to rely on weak signals of credibility. This trend is apparent in both the reported behaviors and task data. Moreover, at least three participants recognized changes in their research activities and attributed it to instruction received. To the extent that the use of networked strategies (vs. weak strategies) are more likely to result in positive source evaluation outcomes (Wineburg & McGrew, 2019), these changes seem to mark an increase in our participants' source evaluation abilities.

Perhaps paradoxically, in the second round, participants were also more likely to use non-epistemic strategies. There are two potential reasons for this increase. First, after two semesters of FYC, participants were more aware of and able to describe their research and writing practices. It is possible that increased awareness led to more honest evaluation. Relatedly, with experience participants might have grown more strategic in their source evaluation activity. They might have concluded that most sources forwarded by Google are reliable enough for most purposes, making constant epistemic consideration unnecessary. Though scholars such as Bakke (2020) have problematized the offloading of source evaluation in this manner, such behavior might be considered a useful environmental adaptation. Online reading and information search is highly cognitively demanding (Salmerón et al., 2018). Taking most information at face-value, while conducting in-depth investigation of key sources, may be an effective way to allocate cognitive resources.

Though participants seemingly gained from the pedagogy offered, there is room for further improvement. All told, these writers, by the end of their first year of college, occupied an intermediate stage between novice internet researchers and the information experts identified in studies such as Wineburg & McGrew (2019). They were capable of evaluating sources via various methods. They were also increasingly able to justify decisions not to evaluate sources. However, these writers largely focused their evaluative efforts on individual actors, seemingly unaware of the social and material structures that shape online information. Like the participants in Bakke (2020), they paid little attention to the workings of Google's search algorithm or how it might be manipulated. As in Stapleton (2003) and Kocatepe (2021), they often seemed not fully aware of what they were reading.

Our participants' focus on individual authors may be connected to a lack of genre awareness. They knew that an individual author's level of expertise could influence the information provided by a source; they didn't know, however, of other factors that also might be important, such as fact-checking procedures or freedom from state or corporate control. They thus focused on expertise. This dynamic helps explain the limited success of our pedagogy. Given time, lateral reading can help novice researchers develop evaluative standards. This process is not automatic, though. For the students in our study, development likely would have been expedited by dedicated instruction in the genres, actors and systems encountered online.

In light of these findings, we plan to modify our FYC curriculum. Students will still be asked to consider the identity of content creators and their purposes for posting information. Lateral reading will still be emphasized. Now, however, search engine optimization will be expressly discussed. Students will also be provided samples of key internet genres (e.g., online news report, page from corporate website). The function of each genre will be discussed, as well as how students might use that genre in knowledge work. The relationship between authors and publishers in each genre will also be discussed and students, when conducting source evaluation, will be encouraged to research the identity and motives of both parties. To these ends, we've created an updated research log template (Appendix D). The updated template asks students to consider how they might use each source. It also expressly distinguishes between authors and publishers, thus moving students to enact this distinction. Craig (2017) argues that writing teachers should work to promote a "network-specific information literacy," a communication skillset grounded in an up-to-date account of how information is "structured, promoted, and commodified within networks" (p.26). By emphasizing structural factors such as the impact of search algorithms and the dynamics behind website creation and ownership, this updated pedagogy will hopefully do a better job providing such an account. It should thus help students more effectively utilize networked source evaluation techniques.

6. Conclusion

This study examined the online research practices of a group of Arab L2 writers and how said practices were impacted by an FYC sequence featuring instruction in online research and lateral reading. We found that both before and after a year of university study participants mainly drew information from non-academic sources, often online news sites and for-profit companies. Participants were aware of misinformation online and more often than not considered the reliability of the sources they used. We ultimately identified seven types of source evaluation strategy.

All told, the pedagogical intervention at the heart of this study was a limited success. Participants recognized the value of networked source evaluation, but often failed to use lateral reading to its full potential. Evidence indicates that these students might benefit from explicit instruction in the basics of online information literacy, such as the operation of search engines and the features, function and potential uses of common internet genres. We plan to update our pedagogy accordingly.

Our findings offer insight into student source use and evaluation practices. They also highlight the importance of incorporating online research skills into L2 writing instruction. In terms of information literacy, the participants in our study were largely self taught. Growing up online, they had developed a variety of source evaluation mechanisms; however, their ability to engage in goal-driven information search was still constrained by lack of experience and knowledge, a situation likely exacerbated by their unique

positionality. Access to high-quality information is necessary to function as both a writer and citizen. By providing a map of the online terrain and tools to critically engage online sources, writing teachers can help L2 writers develop literacy skills which, due to cultural and political factors, they may otherwise be denied.

It is important to note the limitations of our study. The study design measured if specific strategies were used by individual writers, not how often they were used nor the success of any specific evaluative action. Lacking a control group, our design also can't provide definite conclusions about pedagogical impact (Polio & Friedman, 2016). That said, we believe our findings can inform both the teaching and study of writing. The ability to learn from the internet is essential to success in school, work and life in general. The writing class is an apt place to cultivate this ability. The above pages document an ongoing attempt to do so. We hope that other writing teachers can learn from our efforts.

This publication is based upon work supported by the Khalifa University of Science and Technology under Award No. FSU-2020–10

CRediT authorship contribution statement

Matthew Overstreet: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Research Log Templates

Textual Sources

Research log template for **textual popular sources** (news articles, webpages, blog posts, etc.)

Title:	
Author:	
Name of publication or organization:	
Date published:	
Who or what is this source? What is their **purpose** for posting this information?	
Summary of what you learned from this source (40-80 words):	
1 or 2 sentences that you think might be important:	
URL:	

Non-Textual Sources

Research log template for **non-textual popular sources** (videos, podcasts, infographics, etc.)

Title:	
Creator:	
Date published:	
Who or what is this source? What is their **purpose** for posting this information?	
List of important words, ideas or phrases & the times they occur.	
Summary of what you learned from this source (40-80 words):	
1 or 2 sentences that you think might be important:	
URL:	

Appendix B. Sample Task Prompt

For this task you need to imagine that you have been hired as a student assistant to Dr. Ahmed [redacted], the senior vice president of student services at [redacted]. Your job is to conduct internet research and inform him about important school-related topics.

Dr Ahmed is an educated person, but doesn't know much about the topics he asks you to research, which means you will need to explain your findings carefully. Your response should contain enough detail to show that your ideas are well thought out and accurate. This will likely involve explaining not just *what* but also *how* and *why*. You should also consider potential counterarguments and alternate points of view.

The information you provide should come from internet research, not your own personal experience. You can use whatever sources you think are useful and reliable, but make sure to identify where you get your information, so Dr. Ahmed can learn more if he wishes.

You can present your response in whatever format and file type you think is best.

There is no time limit or required word count for this task, but most participants will spend one to three hours on the project and write 500 to 1000 words.

Email from Dr. Ahmed

Hello,

As you may know, littering is a big problem on our campus. My office has been asked to come up with a plan to reduce litter. I need you to explain why people litter and discuss some potential solutions. It has been suggested that we simply need to provide more trashcans. Do you think would solve the problem? Or should we consider another solution or set of solutions? Please research the topic and let me know what you think is best.

Thanks,
Ahmed

Please respond to Dr. Ahmed's request. When finished, send him your findings as an email attachment. His email address is [redacted]

Task Topics:

- Littering (sample)
- Student test anxiety
- Pedestrian safety on campus
- Environmental impact of cryptocurrency
- Retention of university employees

Appendix C. Source Evaluation Codes & Categories

Interview data was coded to identify strategies for evaluating the reliability of online information sources. Codes were then grouped into categories. Seven categories of source evaluation behavior ultimately emerged.

The table below lists the categories, associated subcodes and example data.

Category	Subcodes	Example Data
Networked	N/A	"I would go to Google and I would type like, is this website legit?" (Abas*, R2) I "check if the website has had any scandals recently or ever, in terms of information misuse or fake news." (Sayed, R2)
Corroboration	N/A	"…based like on consistency of information, I knew that those sources are credible." (Bashira, R1) "…if a certain piece of information, it's repetitive in several websites, that's how I know is it's legit." (Maryam, R2)
CAP	currency authority purpose	I would check "mainly the source and who wrote it, and I guess how new the information is." (Leila, R1) I saw the authors "were like HR people… so they are experts." (Myra, R1) I check "who wrote the article and the company." (Sayed, R1)
Known	official popular familiar	"Stick to studies, official news, official information." (Myra, R1) A source is reliable if it's "something like a well-known organization." (Emir, R2) "If it's an author I frequently see the name of I probably trust them more than an author I haven't seen before, like the name." (Sayed, R2).
Social	comments family teacher	"I usually check the comments to see what other people like think about it, because I personally can't tell if this is true or not." (Bashira, R1). "[I showed my brother a source and he told me] they're not professionals at what they're talking about." (Emir, R1) "My teacher gave us like a list. There is a website that are reliable and not reliable. (Hafa, R2)
Weak	feelings logic design title URL page rank	I used whichever sources "felt like they were… good sources." (Sayed, R2) "Sometimes you would have to use your logic to like understand whether something's fake or not." (Abu, R1) "It's first of all, from the design of the website. If it's highly designed, and you can see that a lot of money was spent on this website [you can trust it]." (Abas, R1) "I don't know how to explain if [a source seems] reliable, but like usually the name of the website, often organization." (Abu, R2) I stay within "the first page of the search because those are mostly reliable." (Maryam, R1)
Non-epistemic	relevance ease of access	I just used "the website that is easier to understand." (Hafa, R2) "I didn't really focus on is this is a reliable source or not." (Mariam, R2)

*All names are pseudonyms

Appendix D. Research Log Templates (Updated)

Textual Sources

Research log template for **textual popular sources** (news articles, webpages, blog posts, etc.)

Title:	
Author:	
Name of publication or organization:	
Date published:	
Who is the author? What is their job?	
Who or what is the publisher? Why did they allow this information to be posted on their website?	
Summary of what you learned from this source (40-80 words):	
How can you use this source in your research project?	
URL:	

Non-Textual Sources

Research log template for **non-textual popular sources** (videos, podcasts, infographics, etc.)

Title:	
Creator:	
Date published:	
Who or what is the content creator? Why did they post this content online?	
On what platform or website was the content posted? Why did they allow it to be posted?	
List of important words, ideas or phrases & the times they occur.	
Summary of what you learned from this source (40-80 words):	
How can you use this source in your research project?	
URL:	

Data availability

Data will be made available on request.

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