Searching for multiple sources in L2 writing processes: A case study of search strategies used by an undergraduate student

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Abstract: Existing studies of source use in L2 writing in natural settings tended to be product-oriented and seldom investigated students' search strategies. This study adopted the process perspective and examined in detail a fourth-year undergraduate's search strategies in L2 writing processes. Data were triangulated by screen recording, keystroke logging, stimulated recall interview and textual analysis. The results showed the student's use of a variety of search strategies, including selecting Bing to perform a search, entering focused keywords, setting time range of search results, mapping out an outline and locating multiple sources. The results indicate the student writer's advanced level of search abilities, thereupon providing further insights for researchers and teachers.

1. Introduction

Source use in writing is now a significant area of research in the field of second language writing. Part of the research focused on students' choices and decisions when reading and integrating sources into their writing ([1], [2]). Relevant scholarship examined students' use of reading strategies (e.g., [3], [4], [5]) and source integration strategies (e.g., [6], [7], [8]). In recent years, more attention has been paid to students' perceptions of the difficulties and challenges (e.g., [9], [10], [11], [7]) and instruction that may be of benefit (e.g., [12], [13], [14]).

These studies have shed light on students' abilities and practices when writing from sources either in controlled conditions or in natural settings. However, few studies took the process perspective and gave thorough investigations into students' strategies for source use in L2 writing in natural settings ([15, 16]), which are supposed to differ from that in controlled conditions ([3], [11]). Particularly, little is known about how students dynamically manage the processes of source searching. Insights into students' coping strategies for search processes will be useful to give guidance and support for their development in source use abilities. To this end, the current study explored in detail an undergraduate student's strategy use when searching for multiple sources to write a short essay in a natural setting.

2. Strategies for source use in L2 writing in natural settings

A line of studies probed into students' interaction with and integration of self-selected sources for writing assignments in undergraduate disciplinary courses (e.g., [16], [7], [8]), and graduate

dissertations (e.g., [3], [11]). In most of these natural studies, students were required to read and use multiple self-selected sources to write an essay of more than 1000 words over a few days or weeks. Natural studies of individual students have observed that participants' approaches, strategies and practices for multiple source use differed significantly from that in controlled studies ([3], [16]). As McCulloch (2013) noted, such differences may be due to the extent of required source consultation, task type, the length and complexity of written product and time available for task completion.

Only a few studies focused on students' strategies for the processes of source searching, reading and integrating in comprehensive ways. For example, Li and Casanave (2012) investigated two first year undergraduates' strategy use when writing from sources. Their study found that participants tended to search and select sources uncritically, seldom got involved with diligent reading and relied on patchwriting to integrate content from sources into their writing. Nguyen and Buckingham (2019) explored 6 international master's students' approaches to and strategies for source searching, reading and integrating. Their findings revealed participants' reliance on various electronic tools to facilitate their source searching, reading and integrating. In addition, the study also showed that participants mostly used paraphrasing and avoided summarizing when integrating content from sources into their writing.

The above studies provided profound insights into students' coping strategies when writing from sources. They also have significant implications for the development of instruction to help students improve source use in L2 writing. However, only a limited number of studies investigated students' deployment of strategies to deal with source searching in L2 writing in natural settings ([11], [16]). To extend the understanding, the current study tracked an undergraduate's search strategies. The research questions in the study is: What search strategies did the writer use?

3. Method

This was a case study of an undergraduate students' search strategies across her L2 writing process in a natural setting.

3.1 Participant

The participant in this study, Yu, was one of the volunteers responding to our call for participants in the study. We selected her on the basis of her L2 writing proficiency. Yu was 21 years old and had learned English for 14 years. She was a fourth-year English major from a key university in China.

Yu received distinction grades for most of the writing assignments and was one of the best students in her class. She passed both TEM-4 and TEM-8 and scored 7 on the IELTS writing component.

3.2 The writing task

We were mindful of the effect of topic familiarity. The writing topic chosen was one that students may have heard about in news but haven't been engaged in-depth. Results of previous pilot studies showed that participants did not have much prior knowledge on the topic and felt the need to search and use sources when writing the essay.

The writing task was expository and required at least 450 words. Task requirements were designed in accordance with English academic writing syllabus for fourth-year English majors in the university. The participant had unlimited time to complete the task and had access to sources to facilitate her writing.

3.3 Data collection and analysis

The data were collected through computer screen recording, keystroke logging, stimulated recall interview and the written product. While conducting the writing task in a classroom, the participant launched both a computer screen recording software EV Capture (Version 3.9.7) and a keystroke logging program Inputlog (Version 9.0) on her own laptop. Both were proved useful tools to unobtrusively provide complete and accurate accounts of all computer-based source use activities in previous research ([17], [18]). Right after the participant finished the writing task, she immediately contacted the first researcher to conduct a stimulated recall interview. In the interview, the participant shared her search strategies. The interview was audio recorded and subsequently transcribed.

Data collected from the stimulated recall interview was used to examine the participant's search strategies. Table 1 provides a detailed description of coding themes developed. The coding theme was informed by Plakans (2009a) and McCulloch (2013). Given the natural setting and the methods employed in the study, we deleted categories where the data seemed not to fit and added categories that had not been revealed by previous research. We then calculated the frequency of each category of strategies.

We also analyzed relevant source use data provided by keystroke logging and source use in the participant's essay. Both were used to triangulate the participant's stimulated recall interview.

Table 1: Coding scheme for stimulated recall interview data.

Search strategies	Definition	Example extracts from the interview
Selecting search engines	Selecting search engines when searching sources	I used Bing to search.
Selecting keywords	Formulating keywords to search	I was thinking to use the keyword "revelation" to search English sources.
Setting time range	Setting time to narrow down search results	In the following searches I set time range to focus on information about measures taken up last year.
Mapping out an outline	Drafting an outline and then using it to guide source searching	I began to plan. I then searched sources by referring to the outline made.
Locating a source	Clicking into a source from search results	I read titles and introductions of sources at the search result interface and clicked in those that I felt useful to my writing.

4. Results

Across the writing process, Yu developed distinct search strategies, as shown in Table 2.

Table 2 showed that Yu selected Bing as her default search engine and used it to perform all searches. Via Bing, she managed to search "a wealth of information in both languages" and therefore did not change to Baidu (a Chinese counterpart of Google) when searching for Chinese sources.

I get used to using Bing to search English sources. Generally speaking, when I search Chinese sources, I will use Baidu, for it can provide a comprehensive range of sources related. But when I found Bing could also provide relevant Chinese sources from official sites, I then did not switch to Baidu. (*Yu, stimulated recall*)

Table 2: Overview of frequency of Yu's search strategies

Search strategies	Frequency
Selecting Bing to perform a search	9
Entering focused keywords in both languages	7/2*
Keywords inspired by the task prompt	6
Keywords inspired by sources scanned previously	1
Keywords inspired by prior knowledge	2
Setting time range to narrow down search results	5
Mapping out an outline	1
Locating multiple sources	24
Searches performed when preparing for the task	8
Sources located when preparing for the task	14
Searches performed during writing	1
Sources located during writing	10

*Yu entered English keywords for 7 times and Chinese keywords for twice.

The second strategy was Yu's formulation and reformulation of focused keywords in both languages. She performed efficient and targeted searches using precise, specific and relevant keywords. As shown in Table 2, the selection of keywords was mostly inspired by the task prompt (6 times), while one keyword formulation was prompted by sources scanned and two by her prior knowledge. For example, the keywords "Measures taken in China", "China's fight against COVID-19" and "zhongguo kangyi pingjia (International comments on China's fight against COVID-19)" were all formulated by her reorganization of words that she underlined in the task prompt. Also, in the interview she mentioned that the keywords "China promote vaccine COVID-19" was inspired by sources scanned in previous source searching, while the keywords "WHO comments on China COVID-19" and "China COVID-19 revelation" were generated based on her previous knowledge and experience in writing opinion essays.

It was worth noting that Yu entered English keywords for 7 times and Chinese keywords for twice. The difference showed her focus on searching for and in English sources for direct use in writing and her intention to learn knowledge and language from English sources.

I planned to search for English sources at the very beginning, so that I can use them in my writing in a more straightforward way. I also want to learn articles produced by foreign media. (*Yu, stimulated recall*)

Meanwhile, to make her searches more targeted, Yu was also aware of the importance of setting specific time range to perform targeted searches (5 times). Initially realizing that search results were "mostly about information produced recently", she then confined the time to last year to narrow down search results in following source searching.

Yu was not only strategic in selection of the search engine, keywords and time rang of search results, but also attentive to map out an outline to guide her source searching and reading. After carefully reading/rereading two sources searched and the task prompt, Yu developed a clear task interpretation and took down an outline for the body and conclusion paragraphs. In the outline, she pointed to the differences in measures taken during the spread of the pandemic and that when it was basically controlled and was ensured that her writing should focus more on the former as "the task prompt indicated". She also made it clear that the content of the third paragraph would include compliments made by WHO and countries from Southeastern Asia and the West. Then, she continued to search and locate sources that would support the main ideas of each paragraph listed in the outline. Therefore, her subsequent searches were particularly pertinent to measures taken during the spread of the pandemic and compliments made by WHO and government officials and

spokesmen from Southeastern Asian and Western countries.

Table 2 also showed that Yu searched and located more sources when preparing to the task than that during the writing process. To be well prepared for the writing, Yu performed 8 searches and searched out 14 sources when preparing for the task. By scanning and/or rescanning sources located during the stage, she got enough background information, learned "organizational structures of sources" and then selected sources to reread and use later in the writing. With the preparation, she felt "much confident" when putting pen to write.

5. Discussion

Research question one asked what search strategies the writer used. As the results showed, the writer employed the strategies of using Bing, predominantly entering English keywords, using an outline, setting time range of search results and locating multiple sources. These strategies helped her perform efficient, targeted and focused searches.

The writer's purposeful and predominant use of Bing and English keywords highlighted the great importance that she attached to English sources. Compared to her focus on English sources when searching, her searches for Chinese sources were less attentive and critical. The results therefore indicated her major intention to rely on English sources to facilitate her writing.

The writer's drawing up and using of an outline showed her complete understanding of task requirements and her attention to set goals to guide source searching. Her employment of the strategy thereupon suggested the interaction between source searching and task understanding when preparing the task. This provided a new understanding of how recursion occurred across different phases of L2 writing process, which were seldom documented in previous research of students' search strategies [11].

6. Conclusions

Drawing on screen recording, keystroke logging, stimulated recall interview and textual analysis, the present study described the writer's search strategies in L2 writing process. The results revealed that the writer deployed a complex set of search strategies to help her with the writing task. The findings of the study suggested the writer's advanced level of abilities to search for multiple sources.

The results of the research would help extend our understanding of source searching across the process of L2 writing, thereupon shedding further light on academic writing instruction. Teachers can give guidance for students on how to effectively search sources. One approach would be to help them familiar with functions of various search engines and the significance of appropriate and focused keywords. Students can also be encouraged to develop an awareness of the need to seek out authoritative, relevant and quality-ensured sources.

Given that the study was a case study of an undergraduate student in completing one type of writing task, it may preclude the generalizability of the research results. However, the study focused on source use from the process perspective and provided a detailed description of search strategies involved. To generate a fuller understanding of source use processes and strategies, future research can build on large cohorts of participants to trace their activities of source searching, reading and integrating when completing different types of writing assignments in natural settings.

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