The present research arose out of a librarian's use of visual mapping as a method to address students' need to find context at the start of their research journey. As students explained their research query at the reference desk, I, the librarian, used a visual map to record the conversation around students' research topics. This enabled me to analyze complex topics and their inter-relationships so that I could better understand the types of resources that would be helpful. Throughout this process, students elaborated and defined relationships between concepts that we recorded on the map. The external representation of unfamiliar ideas allowed the student and I to identify connections between ideas and their relationship to resources. These experiences led to the research described in this chapter. Visual maps are known to support learning, but the systematic use of them during a reference conference is infrequent.

Students usually develop a research focus through discussion with faculty members who supervise their theses or dissertations. A meta-analysis of graduate student search behavior confirms that they begin research on the web and consult their faculty advisors before seeking further assistance. This initiated a collaborative approach in which an academic librarian and a professor at a faculty of education decided to examine how visual maps and collaborative dialogue could extend student thinking when students were first narrowing their topic. Previous experiences of both the librarian and professor confirmed that graduate students in education often struggle with formulating research questions, searching the research literature, and developing.
coherent research proposals. The previous educational experience of some students has not equipped them to meet these demands as the field of education accepts students from many different disciplines with varied educational experiences.

THE CURRENT PARADOX OF REFERENCE SERVICES

A decade ago, Cheryl LaGuardia alerted us to a paradigm shift in reference question complexity stating that reference questions were becoming "more complex, more time-consuming, and larger in scope."\(^2\) One reason for this increasing complexity is access to the online information environment, where information tools and their interfaces are constantly changing.\(^3\) The technical demands of using and managing online resources also increases users' need for support.\(^4\) We know that traditional face-to-face reference transactions are decreasing. Reference transactions are information consultations in which library staff recommend, interpret, evaluate, and/or use information resources to help others to meet particular information needs.\(^5\) For example, numbers in American research libraries dropped by 65 percent from 1991 to 2011.\(^6\) In an e-mail message in September 2013, the Canadian Association of Research Libraries reported a 28.5 percent decline over the past decade from 2001 to 2011.\(^7\) It is not surprising that easy remote access to full-text databases, e-books, and discovery tools, in conjunction with extensive web resources, have contributed to the steady decline of reference questions in academic institutions.

However, reference services are also evolving in ways that are unanticipated. Could we have predicted that making enormous amounts of information accessible to students would result in diminishing research capabilities? Current research\(^8\) has exposed a range of shortcomings in student search behavior that underscores the need to develop information-literacy competencies that include strategic selection of research tools determined by the information need rather than the simplest search portal at hand. A compelling study from Project Information Literacy revealed that students graduating into the workforce attempt to solve information problems on the job using superficial search strategies.\(^9\) Students who have spent their postsecondary years searching Google and equivalent library search platforms may have little experience with a range of research tools.

Graduate students face more significant challenges. Lack of experience with discipline-specific information tools coupled with the expectation of automatic location of resources using a "discovery" layer poses problems for complex research tasks. A discovery tool simultaneously searches an institution's library catalog and journal articles for metadata and online full text and returns results in a single interface. LaGuardia confirms that library discovery search platforms that mimic Google's simple interface reaffirm the need for reference and information instruction.\(^10\) These interfaces enable the simultaneous searching of much of the full text of online academic resources held by an institution. In practice, discovery layers provide only superficial searching because they do not expose the underlying information structures from which the materials have been harvested. We cannot know what is missing nor are we prompted to think systematically through the choices that offer alternate perspectives to our query. It is paradoxical that in an age of ubiquitous information, research is harder than ever.\(^11\) Researching a topic is about more than finding a few articles based on the nearest match to search terms. For students to become critical readers of information, we need to teach them how to seek information written from multiple perspectives. Reference transactions offer one method for attending to this issue.

In academic communities, keeping up with changing information tools is a daunting task, but it falls within the purview of the reference librarian. Reference librarians possess a broad view of the resource landscape and know how information is constructed, packaged, and disseminated. This knowledge gives a huge advantage in designing search strategies. If we think aloud while working with students, we can demonstrate how complex questions require the sifting and compilation of various forms and types of information. John Fritch and Scott Mandemack describe this as a multifaceted mini-instruction session where librarians help to:

- develop the topic idea, lay out the structure of information (catalogs, indexes, Web sites . . . etc.), explain and differentiate between types of information, provide an overview of general search strategies, demonstrate the use of a particular database, explain the interface, lead users in their search, direct them to where they can retrieve the materials found, and guide them in presenting their information clearly and appropriately.\(^12\)

Reference librarians might think of themselves as conduits to the many channels of information that are invisible to most—the specialized databases and rare collections that provide detailed information and cannot be retrieved without plunging into deeper and deeper layers of knowledge. Initial information searches scan surface documents, but as learning about a subject intensifies, the search changes; terms, word combinations, perspective shifts, and research approaches change as learning happens. Anne M. Fields discusses these types of questions as "ill-structured problems . . . with indefinite starting points, multiple and arguable solutions, and unclear maps for finding one's way through information."\(^13\) Fields also notes that research involves strengths in two domains: subject knowledge and information-literacy knowledge.\(^14\) Subject domain expertise includes a knowledge base that is highly structured and well organized, and information-literacy domain knowledge involves the ability to distinguish patterns of information needs.
A shared feature of expertise in both domains is the ability to categorize problems and identify relationships between concepts and subconcepts. Novice researchers are at a disadvantage on both fronts because they are only developing their understanding of the area of research while having to search for literature on it at the same time.

A study of graduate students' search behavior indicates that their strategies are both random and organized. They are random during the initial stages of research when they are isolating a topic focus, looking for background information, and determining an overall search strategy. It is at this point, when students are trying to find context in both their subject and information-literacy domains, that reference help can be especially useful. In a meta-analysis, Amy Catalano notes that graduate students overrate their searching abilities, especially in basic search skills. The research by Alison Head and Michael Eisenberg reveals that students graduate from their first degree with a common set of research challenges around finding context within their topic area. We suggest that new graduate students bring the same research deficiencies as they enter a Master's-level program. The first step of finding context occurs when students are gathering background information and tappign into complex information landscapes, which students find to be the most difficult part of the research process. Selecting and narrowing a topic is part of "big picture context" and finding and accessing relevant information is part of "information-gathering context." Given the amount of information accessible to students, it is surprising that this poses the greatest challenge. Identifying starting points and background information mirrors the first step in a reference transaction. To find context in terms of developing a topic, librarians need to help students develop deeper understanding of research extant in the field. This involves teaching students how to locate and analyze information that will contribute to their understanding. As students establish context, they are better able to refine their research focus. The two areas are complementary and symbiotic and as such should be addressed during a reference consultation.

Various systems that visually represent information, such as graphic organizers, flow charts, and concept maps, have demonstrated their benefit in supporting learning. Concept maps represent ideas in multiple ways with images as well as words, illustrating the conceptual links that underpin complex topics and serving as "a scaffold to help organize knowledge and structure it." At the postgraduate level, David Hay investigated concept mapping as an instructional tool and as a method to assess the quality of learning. Concept mapping allows for "the sharing of 'expert' knowledge and understanding among teachers and learners. When individuals are asked to draw maps on the same topic at different stages of learning, changes in learning can be made visible." In this study, we used a free form of visual mapping rather than a traditional concept map, which has a hierarchical structure and requires formal naming of relationships. Our purpose was to focus on the representation of ideas through spontaneous conversation as it would take place during a reference consultation.

Collaborative dialogue allows individuals to engage in reciprocal meaning-making through a directed discussion of a topic that can result in the co-construction of knowledge. The dialogue can extend and clarify ideas and may enhance an understanding of the inter-relationships among them through an extended focused discussion. This iterative process encourages the revision of ideas. Thinking aloud, in which individuals speak aloud the thoughts going through their mind while engaging in a task, allows access to their working memory, that is, what they are thinking about at that moment. This technique has been used extensively in research about problem solving through the analysis of verbal protocols. The collaborative construction of a concept map results in a map that shows the underlying structure of a topic and deeper understanding of the topic by the participants. The co-construction of a concept map leads to a cognitively productive interaction among group members.

METHODOLOGY FOR THE STUDY ON DIALOGIC MAPPING

Our study proposed that collaborative dialogue and visual mapping recasts reference transactions into academic conversations. Graduate students typically take a research-methods course early on in their program with a final assignment of writing a thesis proposal. The researchers, a librarian-faculty team in a faculty of education, theorized that the co-construction of a visual map would enhance the initial conceptualization of the research topic and help focus the literature review. Drawing on these approaches we investigated the following research question: How does collaborative dialogue between a graduate student and a librarian-faculty team extend student thinking while the student constructs a visual map of his or her thesis topic?

Five graduate students in education (four females and one male) participated in the study. The second author was the thesis supervisor for these students. All had completed their course work in a Master's program but were at different stages in developing their thesis proposal at the time of data collection. Each graduate student was individually audio- and videotaped while constructing a map of their research topic. Students were asked to independently draw a visual map of their research topic while thinking aloud to explain their ideas to us. We then began a dialogue in which we prompted each student to explain and expand the map through questioning and commenting on the map. These prompts led to a variety of additions and changes being made to the map in response to the dialogue. Videotaping recorded the dynamic evolution of the map. Videotape coding is an iterative process of
analysis to develop and refine a coding scheme that enables analysis of the effects of the dialogue on the conceptualization of the research topic. After the mapping experience, students were asked to respond by e-mail to a short survey on the value of the mapping exercise.

Analysis and Interpretation of the Visual Maps

Analysis of the data involved multiple stages:

1. The audio component of the sessions was transcribed verbatim.
2. The video was viewed and every change to the map was annotated in the transcript.
3. For each change, the dialogue was examined for possible prompts that triggered the change. These were identified, defined, and coded. Resulting categories were “clarifying” and “knowledge prompts.”
4. Conversations about the research journey were identified and categorized according to the stage within the research process. These were later grouped into three categories: (1) questions, (2) research methods and design, and (3) information gathering and evaluation as part of the literature review.
5. Prompts that triggered a change on the map relating to a specific aspect of the research journey were identified.
6. Initial student maps were compared to maps resulting from dialogue with the researchers.
7. Students were surveyed for their feedback on the value of the mapping exercise.

Table 9.1. Examples of Clarifying and Knowledge Prompts

<table>
<thead>
<tr>
<th>Examples of Clarifying Prompts</th>
<th>Examples of Knowledge Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are your research questions?</td>
<td>Offering advice on more specific things:</td>
</tr>
<tr>
<td>What is the context for this study?</td>
<td>Is X also one of your research questions?</td>
</tr>
<tr>
<td>What is a suitable research method?</td>
<td>Would knowing more about X help with the context of the study?</td>
</tr>
<tr>
<td>What do you know about this research method?</td>
<td>Did you think of gathering data on ...?</td>
</tr>
<tr>
<td>What terms are used to identify ...?</td>
<td>Did you think of connecting ...?</td>
</tr>
<tr>
<td>How does concept X relate to concept Y?</td>
<td>Did you think of including X in the literature review?</td>
</tr>
<tr>
<td>What is the relationship between ...?</td>
<td>Did you think of gathering information or data on this aspect?</td>
</tr>
<tr>
<td>How will you include this in the literature review?</td>
<td>You need to include X in the ethical review process.</td>
</tr>
<tr>
<td>What other types of information do you need for the literature review?</td>
<td>Did you think of comparing information from other disciplines?</td>
</tr>
<tr>
<td>How will you order sections in the literature review?</td>
<td></td>
</tr>
</tbody>
</table>

After reading and coding transcripts individually for prompts, we developed definitions for the two main types. Clarifying prompts occurred when researchers asked questions to unravel the verbal description or visual representation given by the student. Knowledge prompts occurred when researchers offered information to students to extend their thinking or analysis. Examples of the two types are presented in Table 9.1. These are similar to questions raised during a traditional reference interview; however, they extend the discussion beyond sources and location of information to include research design and methods.

Figure 9.1 provides a picture of student A’s independent map and figure 9.2 provides a map following the dialogue.

Student A’s research topic was “Application of Word Prediction Software for Learning Disabled Students.” She initially created a map with eight key topics, three subtopics, and five links connecting topics. She added an additional new fifteen topics, twenty-six new subtopics, and eight new links during the dialogue. Examples of prompts leading to a change on the constructed map follow.

1. In response to a clarifying prompt, “Will you be evaluating the software too?,” during the collaborative dialogue, student A added two subtopics—“software criteria” and “evaluation”—above Word Q, the name of the software program to be used in the study.
2. In response to the clarifying prompt, “Is there anything in your broad research question that you don’t have?,” student A replied, “How the writing process happens,” and the researcher further prompted, “So... something on the writing process,” and student A added “writing process for average students” underneath the topic heading “Cognitive Load Theory.”
3. In response to a knowledge prompt, “You’d have to give a historical trajectory as to why you’re investigating this,” student A added two subtopics: “previous approaches” and “historical context.”
4. A knowledge prompt about the need for defining the term learning disabilities resulted in student A adding Canadian/U.S./UK with a note to compare definitions.
The increased number of topics and subtopics on the co-constructed map reveals a deeper understanding of the research problem and its interrelationships. Differences between individual and collaboratively constructed maps in terms of numbers of key topics, subtopics, and links resulting from the conversation are presented in Table 9.2.

Table 9.2. Key Topics, Subtopics, and Links in the Visual Maps

<table>
<thead>
<tr>
<th>Individual Map</th>
<th>Collaborative Map</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student</strong></td>
<td><strong>Key Topics</strong></td>
</tr>
<tr>
<td>Student A</td>
<td>8</td>
</tr>
<tr>
<td>Student B</td>
<td>4</td>
</tr>
<tr>
<td>Student C</td>
<td>4</td>
</tr>
<tr>
<td>Student D</td>
<td>5</td>
</tr>
<tr>
<td>Student E</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 9.3 shows the number and type of prompts from the researchers leading to a change on the map over the course of each hour-long session. Clarifying prompts accounted for 37 percent and knowledge prompts accounted for 63 percent of the total. Not all changes to the visual map were in response to a prompt, as some were self-generated by the student. As this
was a dialogue, some prompts involved several exchanges between the researchers and student before a change in the visual map occurred.

Table 9.3. Number and Type of Researcher Prompts

<table>
<thead>
<tr>
<th>Student</th>
<th>Clarifying Prompts</th>
<th>Knowledge Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Student B</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Student C</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Student D</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Student E</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>33 (37%)</td>
<td>57 (63%)</td>
</tr>
</tbody>
</table>

Stages of the research process or journey were defined following the outline in an introductory research-methods text: research purpose—research question—study design—resource selection—evaluation of resources—literature review. Table 9.4 shows the number of times a change was made to the map that addressed a specific component of the research journey in response to either a clarifying or knowledge prompt. It was difficult to code a piece of extended dialogue as focusing on a single aspect of the research process. For that reason, we collapsed the categories into the following three areas: discussion around the research purpose and questions (Q), research design and methods (M), and aspects of the literature review (LR) that included potential sources of information. Prompts made by the researchers that elicited changes on the map relating to the research journey are included in table 9.4.

Table 9.4. Prompts That Triggered Changes to the Map Involving the Research Journey

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>0Q 6M 10LR 1Q 7M 8LR 1Q 13M 18LR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student B</td>
<td>3Q 3M 0LR 0Q 4M 4LR 3Q 7M 4LR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student C</td>
<td>2Q 0M 1LR 3Q 8M 3LR 5Q 8M 4LR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student D</td>
<td>0Q 2M 1LR 1Q 4M 3LR 1Q 6M 4LR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student E</td>
<td>3Q 2LR 3Q 8M 0LR 3Q 11M 2LR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5Q 14M 14LR 8Q 31M 18LR 13Q 45M 32LR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(14%) (50%) (36%)

Abbreviations: Q: research purpose and questions—M: research design and method—LR: literature review and sources.

Changes to the map were broadly matched to stages of the research journey. Study design and methods accounted for 50 percent of changes, 36 percent related to the literature review and identification of information, and 14 percent pertained to research purpose and study questions. Traditional reference work does not usually focus on research design and methods. The standard definition of reference transactions emphasizes finding, managing, and evaluating information sources. It may not occur to librarians that discussion around research methods is appropriate in the context of a reference query. Librarians who engage in research themselves can share their understanding of study design and how it informs the information-seeking process. Time constraints also pose a barrier to extending a reference interview to include more in-depth conversations about methodology.

To gauge students' perception of the mapping process, we asked the following question: Did the process of having a dialogue with us help? Table 9.5 shows student responses.

Table 9.5. Student Responses on the Usefulness of the Collaborative Dialogue

<table>
<thead>
<tr>
<th>Student</th>
<th>Student responses to the question: Did the process of having a dialogue with us help?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>Thinking through the possible research questions out loud. Answering the questions posed to me from both of you was helpful in forcing me to be concise, something I struggle with often in my thought processes. Demystified the literature review process and made it seem attainable rather than a mammoth task!</td>
</tr>
<tr>
<td>Student B</td>
<td>In response to how the exercise helped: The aspects of talking about each of my subtitles [subtopics].</td>
</tr>
<tr>
<td>Student C</td>
<td>The part that helped me most was the dialogue. For students headed to university, I think it helps prepare them to be more successful at independent learning and for other students it helps them understand concepts more thoroughly. The part of the dialogue that helped me the most was the persistent questioning about issues against which I had dug my heels. ... I think it'll be important for me to be able to justify the choices I have made and to help me anticipate questions in the future.</td>
</tr>
<tr>
<td>Student D</td>
<td>Discussing the topic, and justifying what is needed for research was helpful. The visualization helped me to group major concepts, and finally create an outline of how the research should feed into my literature review. Articulating my research plans was helpful ... to see what ideas I had a grasp on, and which needed further research. It also helped in generating new search criteria to find literature that I had previously had trouble finding.</td>
</tr>
</tbody>
</table>
| Student E| Having an opportunity to reflect and map out with professors (critical friends) the understandings which were foundational to my research was much needed at this point in my research. Yes this session was helpful because I could see how the ideas fit together. ... Time was spent reviewing the purpose, method etc. ... I will take the concept map and...
DISCUSSION AND IMPLICATIONS FOR REFERENCE PRACTICE

This study provides evidence that collaborative dialogue between graduate education students and a librarian-faculty team helped to extend student thinking. "Clarifying" and "knowledge prompts" were the two categories that triggered students to make additions to their map. Knowledge prompts accounted for 63 percent of the prompts, supporting the idea that the faculty-librarian team brought both subject and information-literacy domain expertise to the conversation, and this contributed to the students' generation of new ideas. The resulting maps included more key topics, subtopics, and interconnections between ideas than the student's initial map. This change reflects a deepening and an elaboration of the conceptualization of the research topic.

Survey results indicated that students found the questioning and think-aloud process useful in focusing ideas from different perspectives. The visualization helped to group, articulate, and develop new ideas. We surmise that the visual record allows students to find the "big picture context" by reducing the cognitive load inherent in verbal conversations. Student E captures this process when she notes that the exercise helped her see how "the ideas fit together" and "tie the question/method/data analysis together" (table 9.5).

Study findings have implications for reference and instructional services:

a. Visualization assists shared understanding and development of research ideas and the research process. Seeing relationships on paper reveals connections, gaps, and themes.

b. Dialogue where students are equal partners in the conversation provides a constructivist approach to learning, allowing for the free flow of questions and ideas.

c. Students may need to target the research design as much, if not more than, finding information sources. Research design is a new area for them. Discussion about methods helped to sculpt the research questions and narrow the sources for the literature review. Librarians can explore methods during a reference consultation by prompting for study population, the type of data that will be collected, and how to identify scholarly literature that uses similar research approaches. Research-methods databases, handbooks, and textbooks that describe qualitative and quantitative techniques should also be included in the conversation.

d. Librarians should explore the subject domain of the topic as much as the information resources through questioning and clarification. Both areas are critical for finding context during the research process.

e. Visual maps provide evidence of the value of the reference process as well as a clear record for the student of the scope of their topic. This record is also important in order to demonstrate the impact of reference service and the overall accountability of academic libraries.

f. Mapping can be used during formal instructional sessions as a means of capturing the evolving understanding of the topic and research strategies. This approach has been adopted in our introductory research methods course for graduate education students. Students are asked to map their existing research process at the start of a two-hour class. This includes the starting point for finding information resources and tactics they follow when they encounter barriers. Students then redraw the process at the end of the class to integrate changes they will consider for the future. This may include strategies for gathering gray literature, government documents, nongovernmental organizations, open-access materials, and related research in other fields.

Typical reference transactions jump quickly to the search for resources without helping students find the context they need for their research. Discussions that allow students to further articulate their questions are a productive way to broaden the evidence that students consider during this process. Increased discussions also position reference interactions as "a dialogue of equals wherein the librarian assumes the more empowering role of partner as opposed to information guru," as suggested by John Doherty. Specific questions, such as the prompts we identified, can trigger the elaboration and generation of new ideas. In our study, examples of clarifying prompts include:
What is missing from the literature?
What information gaps have you come across?
How will you bring these ideas together in the literature review?
How are these ideas related?
Should this be one of your research questions?
Will you be able to get access to the data/population you want?
Will you look for information that offers international perspectives?
What type of analysis will you use with your data?
What definition will you use for these concepts?

Examples of knowledge prompts include:
- Would knowing more about x help with the context of the study?
- Did you think of gathering data on . . . ?
- Did you think of connecting . . . ?
- Did you think of including x in the literature review?

James K. Elmborg theorizes that categories of questions could be used to structure the reference transaction, which he refers to as an “academic conference.” These questions are not about locating information, but are about self-reflection on what students understand of their topic. Our study confirms that specific prompts help students to unravel their topics. Dialogue plus visualization allows students to further unpack the research process so they are aware of their decisions and choices. This practice reduces the compelling desire to find information before the purpose for the information is fully understood. “Slow research” makes for a clearer focus and a more equitable exchange between librarians and students. Engaging in collaborative consultation is a powerful opportunity for students to articulate and co-construct their ideas, providing context in both subject and information-literacy domains.

NOTES


18. Ibid., 5.
19. Ibid., 6-9.
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Canadian Association of Research Libraries. E-mail communication October 3, 2013, stating the percentage decrease of reference questions between 2002 and 2011 at academic research libraries in Canada.


