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Melissa Clark

Stephen F. Austin State University, clarkm4@sfasu.edu

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Recommended Citation

Clark, M.R. (2018). Fostering creative thinking and reflexive evaluation in searching: Instructional scaffolding and the zone of proximal development in information literacy acquisition, In M.K. Oberlies & J.L. Mattson (Eds.), *Framing Information Literacy: Teaching Grounded in Theory, Pedagogy, and Practice* (pp. 285-298). Chicago, IL: ACRL.

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Fostering Creative Thinking and Reflexive Evaluation in Searching:

Instructional Scaffolding and the Zone of Proximal Development in Information Literacy Acquisition

Melissa Clark

Student Engagement Librarian
Stephen F. Austin State University

ACRL Information Literacy Frame: Searching as Strategic Exploration

Discipline: Social Sciences

Subjects: History; Architecture; Building Technology; Interdisciplinary

Learning Theory: Social Development Theory (Vygotsky)

Pedagogy: Scaffolding

Instructional Strategy: Zone of Proximal Development

Special Populations: Universal Design; Undergraduate Students

Searching for information, which is not as easy as many students believe, requires creativity, formative evaluation, and persistence. Cultivating proficient and expert searches requires more than the vicarious and enactive

experiences described by Bandura¹ that are frequently employed in traditional library instruction: students need to be supported and coached in working in their Zone of Proximal Development (ZPD), which stimulates learning.²

South Dakota State University is a large public university that offers undergraduate degrees in a variety of disciplines and research-intensive graduate programs primarily in the STEM fields.³ In 2010, the University created a new program in Architecture, which is currently seeking accreditation from the National Architectural Accrediting Board.⁴ I began working with the Department of Architecture as bibliographer and subject librarian in 2011, and during one of the preliminary accreditation visits, the visiting team indicated that information literacy instruction in the history of architecture courses would be beneficial to our students.

I began working with the course I designed this lesson for, Architecture 241 Building History I, in 2013. Each year I have worked closely with the instructor to identify features that have or have not worked well and make adjustments to improve student learning. The Avery Index to Architectural Periodicals (Avery Index) is essential for students' second assignment for the course, and I began meeting with the class to discuss effective searching of this database in 2015. This initial instruction session was a traditional demonstration and lecture on the database, with little opportunity for students to practice searching and reflect on their learning. Students' body language indicated that they were either bored or overwhelmed, and I resolved to improve this lesson the following year.

I realized that the students had a number of unmet needs that hampered their ability to learn. Processing and internalizing information requires students to interact with each other and with me, and that was not occurring on a regular basis. They also lacked control over their searching (e.g., to select their own keywords and limiters), which is necessary for them to have room to explore and grow. Finally, they needed coaching to develop the metacognitive skills necessary to adequately and effectively approach searching as strategic exploration. All three of these issues are addressed by Vygotsky's Social Development Theory.

Learning Theory and Pedagogy: Vygotsky's Social Development and Scaffolding

Vygotsky posits that mental development (i.e., learning) occurs through social interaction and imitation: students are able to accomplish more by collaborating with a peer or adult than they can by themselves, and this is how students learn. Anything students can accomplish with help, but not on their own, is part of their ZPD.⁵ Scaffolding, which can take a number of forms,⁶ allows the instructor to support student learning by focusing their attention, preventing needless frustration, and demonstrating successful completion of the task.⁷

ACRL Information Literacy Frame: Search as Strategic Exploration

In this case, the students' assignment required them to identify an article in the Avery Index about a structure created through each of the five construction processes they study throughout the semester: carving, stacking, casting, framing, and skinning space. Because this terminology is rarely used in the professional literature contained in the Avery Index, this assignment is not particularly easy and requires careful brainstorming for keywords, thoughtful adjustments to the search strategy, recursive and persistent searching, and conscientious selection of articles that meet the requirements. For these reasons, I decided that the Searching as Strategic Exploration information literacy frame⁸ was critical for my students to be successful. This frame emphasizes the iterative nature of searching and the necessity of persistence, as well as the need for creativity and flexible thinking.

The active learning activity, which forms the core of the lesson, begins with an initial search of the database for articles on one of the construction techniques students have studied. Students are then asked to evaluate the search results and indicate whether the actual results matched the results they expected. This guided reflection is intended to encourage students to start questioning their approach to searching, and the following questions, which ask how successful they believe the search to have been and whether any of the first ten articles meets the requirements for their assignment, require students to subjectively and objectively evaluate their belief in their

searching abilities. Confronted by the inadequacies of their searches, the typical student should be receptive to new ideas and ready to learn.

Working together as a group, students' goal is to find an article in the Avery Index that meets the requirements of their assignment (see figure 22.1). Due to differences in preparation for the task, students excel at different steps. Perhaps two are skilled in selecting keywords and a third is adept at identifying and correcting problems with the search. The first two students help the third accomplish the first step in the process, during which s/he learns from them, and s/he then helps the first two accomplish the second step, through which they learn from him/her. In this way, the students pool their knowledge and experience and the entire group achieves their goal together. Scaffolding at each step along the way supports students not yet expert in the necessary knowledge practices and still developing the relevant dispositions.⁹

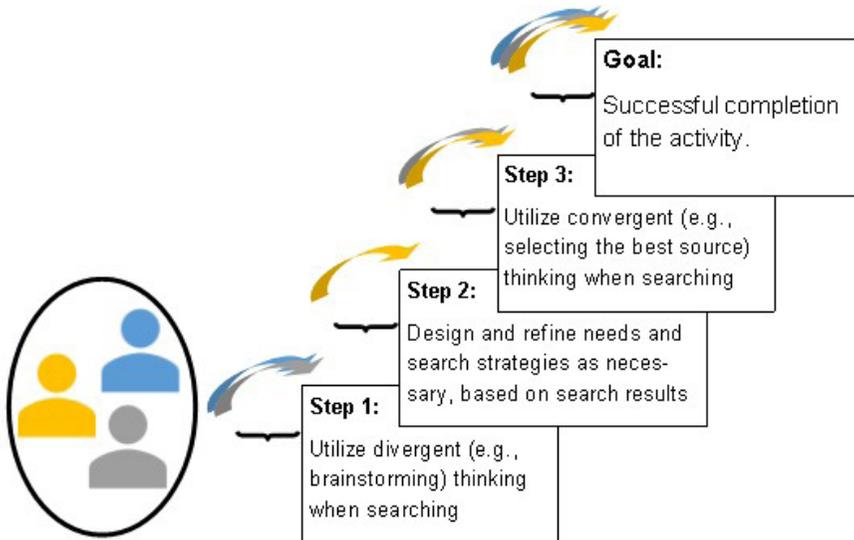


Figure 22.1. Diagram of a group working together to reach their goal with the help of scaffolding.

Lesson Plan

Learner Analysis

- The typical student is an undergraduate in their second year of study, although the lesson can easily be adapted for more advanced

students by increasing the difficulty of the activity. Due to their experience with Google and other search engines, the typical student is likely to believe that s/he already knows how to search effectively—and in some situations, they may be correct.

- Because this assignment was originally designed for an undergraduate group that knows each other well and is accustomed to working together in groups, adapting this activity to a different population may require close attention to group dynamics. When working with a group that has not developed this sort of rapport, the librarian should take care to draw out shy or passive students, calm energetic and excitable students without discouraging their interest, and curb aggressive and negative students while interacting with each group.
- Due to the typical student's belief that s/he already knows how to search, learning could be limited by students' indifferent attitude and inattention. Although this is a significant limitation, the instructor can convert it into an opportunity to improve learning by confronting and dispelling this belief.

Orienting Context and Prerequisites

- Before participating in this lesson, students should have been introduced to the assignment by their instructor and encouraged to think about how they will complete it in a previous class period. Their understanding of the relevance of the lesson forms the basis of their motivation to learn, especially after they realize that their current level of knowledge is not sufficient to complete the assignment.
- Ideally, students have basic information searching skills from attending a freshman-level library instruction session, but that is not required.

Instructional Context

- The ideal context for this lesson is a classroom designed for active learning. Between five and seven semicircular tables appropriately sized for small groups of three to five students and equipped with a computer and large-screen monitor would be situated around the

room. The large-screen monitor is positioned along the flat side of the table so that all group members are able to gather around and see. An instructor station, projector, and whiteboards are also ideal for the session's introduction, discussion, and conclusion.

- However, this lesson can be employed in a less-than-optimal space. Every group needs a computer with internet access to complete the active learning activity but the shape and configuration of the tables and size of the monitor can vary. Smaller monitors will require limiting group size to two or three students in order to ensure everyone can participate. The presence of an instructor station, projector, and whiteboards is optional.
- Prior to the session, the librarian should be in close communication with the course instructor to ensure that students have been introduced to the assignment and that the librarian is aware of the assignment's requirements. The librarian needs to build the active learning activity in an online form or survey program that utilizes skip logic (e.g., Google Forms, QuestionPro).¹⁰ The instructions and questions will need to be customized to the institution, course, and assignment, and screenshots may be added to clarify instructions and reinforce the library's brand.

Learning Outcomes and Activities

Learning Outcomes

1. Students will be able to apply divergent thinking, such as brainstorming, to searching in order to select more effective, context-specific keywords for searching.
2. Students will be able to demonstrate the metacognitive skills needed for students to automatically and critically evaluate their search results, diagnose problems with their search strategy, and construct an effective search strategy.
3. Students will be able to apply convergent thinking to searching in order to select the best article(s) for their assignment.

Learning Activities

1. Introduction (*5–15 minutes, essential*)
 - Students are presented with the session's learning objectives, emphasizing relevance to their assignment.

- Students review brainstorming appropriate keywords for the construction processes included in the assignment, which they learned for a previous assignment.
 - This section is required but may be brief if time is short.
2. Online Active Learning Activity (*LO1–3, 25–35 minutes, essential*)
- Working in groups, students complete an activity that provides instructional scaffolding for divergent and convergent thinking and the development of metacognitive skills necessary for reflection and assessment. See the appendix for an example that can be adapted.
 - Adaptations to this activity may include (1) inserting criteria to help students identify problems with their results, (2) including additional information on how to brainstorm better keywords and, if time permits, (3) adding multiple cycles of evaluating and improving the search, or (4) asking students to work on searching for a second or third construction process.
 - If students have questions, the librarian should be available to provide help as needed.
 - As the activity draws to a close, students should be encouraged to submit any unanswered questions for their peers or the librarian to address during either class discussion.
3. Discussion of students' search experience during the activity (*LO1–2, 15–20 minutes, essential*)
- Students turn from their groups back to a full-class discussion and each group takes turns describing how they searched and what they learned.
 - Topics of special attention should be keywords that did or did not work well, why certain keywords did or did not work well, how they changed their search to increase its efficacy, problems not related to keyword choice that they experienced, and any remaining questions they have.
 - Important topics should be noted on the whiteboard, if available, as they come up in discussion.
 - This section is required but may be shortened if necessary. Reiterating and discussing students' metacognitive processing during the activity is crucial to their development

of those skills, and so an effort should be made to preserve sufficient time for this activity.

4. Conclusion (5–10 minutes)
 - Students review the learning objectives for the session and verify whether or not each has been addressed during the session.
 - Students should be prompted for any remaining questions and reminded that they can contact the librarian for help if they develop question later on.
 - This section is required but may be brief if time is short.

Assessment

Assessment Goals

- Determine how students' perception of their search success changes over the course of the activity and whether their estimation matches a quantitative measure of the search's success, which indicates students' learning of metacognitive skills.
- Determine whether students are able to identify and articulate the problems with an ineffective search and use that knowledge to formulate a better search strategy, which will often take the form of improved keyword selection. This indicates students' learning of search skills, including divergent and convergent thinking.
- Determine whether students were able to successfully complete their assignment.

Formative Assessment Tools

- As the librarian circulates and interacts with the groups, s/he identifies common problems, students struggling to understand, and groups struggling to work together.
- Common problems may be addressed during the active learning activity by pulling the class back together for a one- or two-minute explanation or during the class discussion.
- The librarian may choose to spend more time working with groups where students are struggling to understand and/or work together as a group.

Summative Assessment Tools

- The primary summative assessment tool is the active learning activity, during which students enter and submit their responses (see appendix). This tool addresses the first two assessment goals.
 - ▷ After the session, data gathered via this tool should be analyzed.
 - ▷ If the lesson is successful, analysis of the data collected should indicate an initial drop in students' estimation of their search success followed by an upward trend in the following search cycles.
 - ▷ Analysis should also reveal increasing correlation of students' subjective estimation of their success with the objective measure of its success as they learn how to effectively and accurately evaluate their search.
 - ▷ Students' explanations of weaknesses in their search and choice of effective keywords should improve, and more groups should report finding an article that fits the assignment requirements over the course of the activity.
- The secondary summative assessment tool is a review and analysis of students' final assignment submitted to their instructor. This tool addresses the third assessment goal.
 - ▷ During the planning stage of the session, the librarian should request that the instructor forward him/her copies of the students' final assignments with identifying information redacted.
 - ▷ After receiving these assignments, the librarian should identify the group's overall success rate at identifying articles relevant to the five construction processes.
 - ▷ An ideal success rate is 1 (i.e., 100 percent correct) but that is not often achieved. The librarian should set his/her own definition of success; however, if s/he has the opportunity to teach the same lesson in successive semesters or years, the rate of success should be expected to increase over time as the librarian refines the lesson and their teaching skills.

Appendix 22A

Active Learning Activity for Architecture 241

Introduction to the Avery Index. This activity is designed to help you become familiar with the Avery Index to Architectural Periodicals and improve your search skills so that you can complete your second assignment, and assignments in later Architecture courses, more efficiently.

Section 1. Getting Started

- What is the Avery Index? How is it different from other databases?
 - ▷ Open-ended text entry
- How did you find your answer for the previous question?
 - ▷ Open-ended text entry
- *Go to Section 2.*

Section 2. Accessing the Avery Index

- There are multiple ways to access the Avery Index, one of which is to visit the Architecture Research Guide (<http://libguides.sdstate.edu/architecture>) and use the quick search box at the top of the page.

[Screenshot of Avery Index search box on the Architecture Guide.]

- Choose one of the construction processes you have been studying (i.e., carving, stacking, casting, framing, and skinning space) and try to find articles about it in the Avery Index.
- What search terms did you use?
 - ▷ Open-ended text entry
- Did you find what you expected?
 - ▷ Multiple choice (select one) with the options “Yes” and “No”
 - ▷ *If “Yes” is selected, go to Section 4. If “No” is selected, go to Section 3.*

Section 3. Discrepancies

- How did your search results differ from what you expected to find?
 - ▷ Open-ended text entry
- What do you think is the reason behind this difference?
 - ▷ Open-ended text entry

- *Go to Section 4.*

Section 4. Evaluating Your Results

- How successful do you think your search was?
 - ▷ Five-point Likert scale ranging from “Not At All Successful” to “Very Successful”
- Do any of the first ten articles in your results list meet the requirements for your assignment?
 - ▷ Multiple choice (select one) with the options “Yes” and “No”
- *Go to Section 5.*

Section 5. Improving Your Search

- No matter how successful your first search was, it could almost certainly be better—nothing is ever perfect!
- What can you do to improve your search results?
 - ▷ Open-ended text entry
 - ▷ Tip: Think back to what you learned about searching ARTstor. Improving your search may require some brainstorming and experimentation with the database.
- Try out your ideas for an improved search in the Avery Index.
- Were your search results better this time?
 - ▷ Multiple choice (select one) with the options “Yes,” “No,” and “No better or worse”
 - ▷ *If “Yes” is selected, go to Section 8. If “No” or “No better or worse” is selected, go to Section 6.*

Section 6. Evaluating Your Results, Part 2

- How successful do you think your search was this time?
 - ▷ Five-point Likert scale ranging from “Not At All Successful” to “Very Successful”
- How were your search results different from your first search?
 - ▷ Open-ended text entry
- What do you think is the reason behind this difference?
 - ▷ Open-ended text entry
- *Go to Section 7.*

Section 7. Improving Your Search, Part 2

- What else could you do to improve your search? If you get stuck, ask for help.

- ▷ Open-ended text entry
- Try out your ideas for an improved search in the Avery Index.
- *Go to Section 8.*

Section 8. Finding What You Need

- How successful do you think your search was this time?
 - ▷ Five-point Likert scale ranging from “Not At All Successful” to “Very Successful”
- Did you find an article that meets the requirements for Exercise 2?
 - ▷ Multiple choice (select one) with the options “Yes” and “No”
 - ▷ *If “Yes” is selected, go to Section 9. If “No” is selected, go to Section 10.*

Section 9. Great!

- Copy and paste the title of the article below.
 - ▷ Open-ended text entry
- If you run into problems in the future, though, don’t hesitate to ask.
- *Go to Section 11.*

Section 10. Keep Trying!

- Like most other things, database searching takes practice.
- If you continue having trouble finding what you need for your assignment, though, don’t hesitate to ask.
- *Go to Section 11.*

Section 11. Conclusion

- Now that you’ve had a bit of practice, how successful do you think your next search will be?
 - ▷ Five-point Likert scale ranging from “Not At All Successful” to “Very Successful”
- How comfortable do you feel about using the Avery Index in the future?
 - ▷ Five-point Likert scale ranging from “Not At All Comfortable” to “Very Comfortable”
- Is there anything else you would like to ask me about?
 - ▷ Open-ended text entry
- *Go to Submit.*

Notes

1. Albert Bandura, "Self-Efficacy: Toward a Unifying Theory of Behavioral Change," *Psychological Review* 84, no. 2 (1977): 191–215. doi:10.1037/0033-295X.84.2.191.
2. Ronald Miller, *Vygotsky in Perspective* (New York: Cambridge University Press, 2011).
3. Indiana University Center for Postsecondary Research, "Carnegie Classifications of Institutions of Higher Education: South Dakota State University," accessed November 14, 2016, <http://tinyurl.com/jy6tqes>.
4. South Dakota State University, "Department of Architecture: Accreditation," South Dakota State University, accessed November 14, 2016, <http://www.sdstate.edu/architecture/accreditation>.
5. L. S. Vygotsky, *The Collected Works of L.S. Vygotsky, Volume 5 Child Psychology*, trans. Marie Hall, ed. Robert Rieber (New York: Plenum Press, 1987), 202.
6. H. Rudolph Schaffer, "Joint Involvement Episodes as Context for Development," in *An Introduction to Vygotsky*, ed. Harry Daniels (New York: Routledge, 1996), 251–80. Originally published in *Childhood Social Development: Contemporary Perspectives*, ed. Harry McGurk, (Hillsdale, NJ: Lawrence Erlbaum, 1992), 270.
7. Rafael M. Díaz, Cynthia J. Neal, and Marina Amaya-Williams, "The Social Origins of Self-Regulation," in *Vygotsky and Education: Instructional Implications and Applications of Sociohistorical Psychology*, ed. Luis C. Moll (New York: Cambridge University Press, 1990), 139–40.
8. Association of College & Research Libraries, *Framework for Information Literacy for Higher Education*, Association of College & Research Libraries, accessed November 17, 2016, http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/infolit/Framework_ILHE.pdf.
9. Although Vygotsky's learning theories have not been extensively applied to information literacy instruction, some librarians have recently begun to utilize them. Navaz P. Bhavnagri and Veronica Bielat, "Faculty-Librarian Collaboration to Teach Research Skills: Electronic Symbiosis," *Reference Librarian* 43, no. 89–90 (2005): 121–38, doi: 10.1300/J120v43n89_09; Veronica Bielat and Navaz Peshotan Bhavnagri, "Vygotsky's Theory and Standards as Frameworks for Library Instruction in a Research Methods Course," in *Teaching Information Literacy Skills to Social Sciences Students and Practitioners: A Casebook of Applications*, ed. Douglas Cook and Natasha Cooper (Chicago: Association of College and Research Libraries, 2006), 116–33; Ina Fourie, "Twenty-First Century Librarians: Time for Zones of Intervention and Zones of Proximal Development?" *Library Hi Tech* 31, no. 1 (2013): 171–81, doi:10.1108/07378831311303994; Melanie Lazarow, "Constructing Information Literacy: A Vygotskian Approach," in *Lifelong Learning: Whose Responsibility and What Is Your Contribution?* (Yeppoon: Central Queensland University Press, 2004) 205–10; Li Wang, "Sociocultural Learning Theories and Information Literacy Teaching Activities in Higher Education," *Reference & User Services Quarterly* 47, no. 2 (2007): 149–58.
10. Skip logic, also known as conditional or branch logic, allows the creator of a survey to make the questions a participant sees dependent on the answer to a previous question. This allows for easy customization of a survey. See "Using Skip Logic in a Survey," SurveyMonkey, accessed January 24, 2017, <https://www.surveymonkey.com/mp/tour/skiplogic/>.

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