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Emily P. Frank

Louisiana State University and Agricultural & Mechanical College, efrank7@lsu.edu

Amanda B. MacDonald

Virginia Tech University

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Engineering Study Abroad as Strategic Exploration

Emily Frank

Coordinator of Scholarship and Open Access
Louisiana State University

Amanda MacDonald

Teaching & Learning Engagement Librarian
Virginia Tech

ACRL Information Literacy Frame: Searching as Strategic Exploration

Discipline: Science & Engineering

Subject: Engineering; Study Abroad

Learning Theory: Experiential Learning

Instructional Strategies: Backward Design; Reflection

Special Population: Undergraduate Students

Study abroad, defined by Lindell as a “short-term, formal, credit-bearing educational program taking place outside of the country of the home institution,” has traditionally fallen beyond the reach of direct academic librarian support at Louisiana State University.¹ While a cohort of liaison librarians serve the teaching, research, and learning needs of students and faculty within academic departments, energies have focused more on on-campus and distance learning students. Students studying abroad could access various support offerings, including virtual reference services providing: chat, email, and text reference; course and discipline guides providing curated resources and tools; and remote access to electronic resources. Yet librari-

ans tended to not embed in courses or prepare tailored content to support student information needs while abroad.

LSU's Academic Programs Abroad offers a mix of full academic semester and shorter-term summer programs for students in a variety of international countries and domestic locations. These experiences provide students "with a unique perspective through which they synthesize what they have learned through formal and informal instruction."² LSU engineering students have traditionally been less inclined to study abroad due to a curriculum that is tightly structured. Recently, emphasis on internationalization in the degree programs has grown to meet demands of the field. Reflecting on the structure of engineering education, Powell and Weenk discussed the importance of considering international influences such as "different assumptions and norms/standards in application of same scientific and engineering principles, different markets with differing consumer preferences and consumer standards, and even different standards on simple matters such as types of electrical plugs, voltage, paper size."³

Undergraduate engineering students studying abroad through the E3: Encounter Engineering in Europe program spent five weeks in the summer traveling throughout Germany. Students in E3 enrolled in either a special topics industrial engineering course, IE 4785, or an Honors contemporary issues course, HNRS 2020. In both courses, students were required to complete preparatory work prior to the study abroad. This preparatory work included meeting with their instructor, completing homework assignments, attending class meetings, selecting topics, conducting research, and completing annotated bibliographies and research papers or argumentative essays (depending on the course) before their departure. Even though the students were meeting prior to their departure, there was not time for formal library instruction. While completing their preparatory work, students reached out to the engineering librarian for consultations when necessary. However, the bulk of library support was provided online for the students to access while they were abroad.

In Germany, the students interacted as a single cohort. They attended regular class meetings, completed assignments, and enhanced their research through experiences exploring the country, reading local news, visiting the sites, meeting people, and reflecting with their classmates and instructors. German site visits focused primarily on industry operations facilities, including BMW vehicle research and development, Kronen bever-

age packaging and bottling, and Corratec bicycle manufacturing. Students were meant to learn from subject matter experts and see how engineering skills apply through these experiences. Visits to museums highlighted previous engineering applications. A visit to Dachau concentration camp underscored a discussion of engineering ethics and the role of engineers in the Nazi regime. While the site visits would deepen student research, they needed to achieve an understanding of their topic through traditional research avenues prior to departure. As a result, they were required to research and write in advance. This preparatory work allowed students to make connections between their experience abroad with what they learned from the literature domestically.

While interacting as a single cohort, the structure of research and assignments depended on the course. Students in IE 4785 began their research domestically by submitting a research project exploring a topic, such as manufacturing processes, technologies, products, materials, or design processes, that was unique to one of the companies they would visit when abroad. While abroad, they completed a presentation on their research and a final report with the goal of underscoring how what they thought they knew about their topics changed or deepened due to their study abroad experience. Students in HNRS 2020 also completed preparatory work prior to their departure, which led to work completed abroad. Students needed to research a topic related to global design or manufacturing in Germany. They completed an annotated bibliography where they listed potential sources and identified the anticipated usefulness of the source for an argumentative essay. Then they wrote this essay in support of an issue on this topic. For both classes, the final assignment deadline occurred after the last class abroad.

The E3 classes represented an opportunity for us, the librarians, to support previously un-addressed or under-addressed information literacy needs. Students learning through study abroad experiences are engaged in a research process that is less linear and that draws on many non-traditional information sources. While skills learned for a more linear structure could be built upon, students in this environment are uniquely poised to develop and demonstrate cognitive creativity and flexibility.

After identifying E3 as an opportunity to work with engineering students completing research and a pilot to provide information literacy support to students studying abroad, we began to explore designing online information literacy instruction and corresponding assessment tools relevant

to the required assignments in both classes. In order to develop appropriate online support, we met with the two instructors to discuss student needs, course structure, and areas of integration. The instructors were enthusiastic and offered details about the assignments, which is when we learned that both classes of students would be researching and writing before, during, and after their study abroad experience. Additionally, the instructors shared concerns about students' abilities to navigate questions of credibility and to use information ethically with correct and consistent citations.

After this initial meeting, we communicated via email with the instructors, received the assignments, and were added to the courses in Moodle, LSU's learning management system (LMS). We went through an iterative process of providing drafts of the learning object and reflective assessments, receiving faculty feedback, and making revisions. We designed instructional content to align with the course schedule. Because students conducted most of their secondary research prior to departure, the engineering librarian held face-to-face consultations with students as requested. These consultations focused on searching for and evaluating sources to support the requirements of the annotated bibliography assignments. In turn, the online content the librarians developed focused on evaluating, citing, and using nonstandard and primary sources appropriately, as suggested by the instructors during the discussion. This is not typically where we would integrate into a course for maximum impact, as face-to-face instruction would have been useful prior to the student abroad experience. Given a compressed development timeline and constraints of the course, however, this was the sequence that we developed with the instructors' support.

Throughout the planning process, we were mindful of technological limitations students would face abroad. While Germany is a highly developed country, the instructors shared how internet access would be spotty. Because students traveled around the country during the program, access changed regularly. This was in part why students were required to complete the bulk of their research prior to departure.

ACRL Information Literacy Frame: Searching as Strategic Exploration

We began by situating our instruction within the ACRL Framework. The Searching as Strategic Exploration frame held many parallels to the expe-

rience E3 was designed to support. This frame states, “Searching for information is often nonlinear and iterative, requiring the evaluation of a range of information sources and the mental flexibility to pursue alternate avenues as new understanding develops.”⁴ The information literacy intervention designed in the lesson plan focused only on this frame. The decision to not integrate more of the framework was arrived at after considering the five-week length of the study abroad course and the need to compress support. Given this constraint, we determined that the course offered a unique opportunity to explore a single frame in isolation and to tailor all support and assessment to this frame.

Learning Theory and Instructional Strategy: Experiential Learning and Backward Design

For planning purposes, we leaned on Wiggins and McTighe’s *Understanding by Design*, a backward design approach that encouraged us to “identify desired results; determine acceptable evidence; plan experiences and instruction.”⁵ The desired results were identified in conversations with the instructors. They wanted the students to conduct research that connected their preparatory work to their study abroad experience. To do this, the students would evaluate various types of information sources, apply experiential learning to deepen this research, and synthesize the various types of information formally and informally gained to prepare complex research arguments and findings. This would be done in a way that was ethical.

Instructional Strategy: Reflection

As librarians, we had to think about what evidence would allow us to know if the students were able to connect their work to the experience. We decided on reflection prompts at key stages throughout the process. Reflection prompts would encourage students to think about their research and topics and to write about what had changed and what they had learned. When creating the reflections, we thought carefully about “Dee Fink’s Taxonomy of Significant Learning” and the learning category “learning how to learn,” which describes the self-knowledge of “becoming a better student;

inquiring about a subject; self-directing learners.”⁶ We used this structure to assess how students were expressing the learning outcomes. Given that students were researching domestically and abroad, we wanted the reflection to be a tool through which we could see how their research and learning changed. Additionally, we wanted the reflection to engage the students in this process to encourage the likelihood of a significant learning experience. Reflections would be spread out systematically to underscore how understanding developed over the course. They were designed to allow students to review and reconsider the research acquired in the US and findings experienced abroad—a process intended to encourage metacognition and self-direction. Essentially, we focused on eliciting intentional exploration of the research process through iterative reflection.

Finally, we had to plan the experience and instruction for the students. This consisted of providing them information and support on using, evaluating, and citing non-standard sources. Examples of non-standard sources students could encounter included a stakeholder interviewed during a site visit or a German English-language news source. Like all sources, these would require the students to generate a citation. To instruct them on this, we decided to create a guide which they could consult at any point.

Lesson Plan

Learner Analysis

This lesson works well for any study abroad course in which students:

- select and identify a variety of sources;
- evaluate sources; and,
- synthesize information gathered from textual sources and from exploring sites in-person in order to see how the experience supports, contradicts, and/or expands upon what they thought they knew about their topic before the trip.

Limitations

- Limitations for the learners result from the constraints of the study abroad environment. These constraints include a disconnect between when research is conducted and when students actually go abroad, an inability to conduct additional research once abroad due to limited internet access, and the pressure of synthesizing

their research, work, and experience upon returning home. For librarians, an equivalent to this would be gathering all of the required research to write a book chapter on library instruction, teaching the instruction session a month later, and writing the book chapter another six weeks later without having the ability to access the internet or any additional scholarly literature once they begin writing the chapter.

Orienting Context and Prerequisites

- There are no required pre-instruction learner tasks.
- A face-to-face consultation with the librarian is recommended.

Learner prerequisites include

- identification of a topic;
- exploration of that topic through completion of annotated bibliography; and
- reliance on traditional, non-experiential sources like databases, books, and websites to support additional research once abroad.

Instructional Context

- A bare-bones approach to this lesson includes creating an online guide for students. Librarians can use Springshare's LibGuides platform, although alternative tools to curate and share content would also be appropriate. Librarians should share this guide with students through the LMS, but other means, such as email, would also work.

Optimal Setting

- The optimal instructional context is a hybrid approach in which students attend an in-person library instruction session, review an online guide for support after the session, and further develop their topic and knowledge during the study abroad experience. For the in-person session, the physical classroom includes internet, a projector, and seating for students with their own laptops. This provides an environment for students to watch and listen to the librarian, practice their own searching, and work in pairs or groups throughout the session.

- Prior to developing course resources, librarians should familiarize themselves with the study abroad program and course objectives, which should highlight the types of sources students will need to evaluate. As librarians, we often teach primary and secondary source evaluation for news, internet, and scholarly sources. It is rarer to teach applying evaluation skills to less common sources of information that the students will need to evaluate while studying abroad, like flyers, brochures, and advertisements, or navigating related questions like deciding stakeholders to interview, dealing with language barriers, or understanding how to integrate experiences into research.

Learning Outcomes and Activities

Learning Outcomes

The following learning outcomes describe learning completed prior to and during the study abroad experience:

1. Identify and select a variety of information sources (e.g., flyers, brochures, stakeholders to interview, etc.).
2. Evaluate these various types of information sources.
3. Reflect on the research process as assigned.

Learning Activities

Librarians can help students develop skills via research consultations before students go abroad because of the overall compressed timeline of the research process during a study abroad. Instead of more formal preparatory learning activities, librarians should prepare a guide⁷ which can be used to instruct the students throughout the study abroad. Given that students will already be engaged in the research process by the time they interact with the guide, it should focus on what students will need at the point when they are just arriving abroad. This means students will be beginning to visit sites related to the research they conducted in the US, interviewing stakeholders at the sites, and interacting with other primary source materials.

In addition to discussing strategies for interviews, the guide should provide a definition of and a guide for evaluating primary sources. Wanting something effective and easy to remember, librarians can simplify RAVEN—Reputation, Ability to Observe, Vested Interest, Expertise, and Neutrality—by rolling Vested Interest into Neutrality.⁸ This change is par-

ticularly useful for librarians working with lower-level college students because “vested interest” could be a concept many students are not familiar with. The second part of the guide should focus on using information ethically. Librarians can share the guide as a link that could go anywhere in a Moodle course, but we recommend it be placed in class content when students were starting to think about site interviews and dealing with other primary sources.

Finally, librarians should create reflection questions to help students develop self-awareness during the study abroad experience because reflections provide students a space to think about their process, the evolution of their topic, the rationale behind their source selection and their influences, their synthesis of information, their pressure points, their decisions, their trip, and their final work. In other words, this approach encourages students to reflect on their research experience, which helps to highlight how their understanding adapts and grows through traditional and experiential learning. Librarians should prepare two reflection questions, one for students to complete near the middle of their study abroad experience and one to be completed at the end.

Librarians may need to alter or change the reflection questions to fit their own study abroad programs and contexts; however, below is the first reflection assessment question that should be assigned at the halfway mark of the study abroad experience:

Reflection 1:

For your annotated bibliography, you had to reflect on how or why each source would be used for your final report/argumentative essay. Look at those reflections. Compare the reflections in your annotated bibliography to the sources you used and how you used them in your report/essay. Reflect on the similarities and differences you see from the sources you were anticipating to use and how you thought you would use them to the sources you actually used and how you used them. Why do you think those similarities and differences occurred?

- Learning outcome(s) addressed: 1–3
- Time requirement for activity: 5–10 minutes

The second reflection assessment question captures a holistic portrait of the student's research process. Below, this question should be assigned after the students complete and submit their final papers at the conclusion of the study abroad experience:

Reflection 2:

For your annotated bibliography and final report/argumentative essay, you had to reflect on how or why each source was used. Now that you've been to Germany, how has your knowledge about your topic evolved? Did your experience abroad bring new questions related to your research to the surface? If so, reflect on those. Or did it confirm questions/concepts/issues you explored through researching and writing your annotated bibliography and report/essay? If so, reflect on those.

- Learning outcome(s) addressed: 3
- Time requirement for activity: 10 minutes

Assessment

Because the process of supporting study abroad is still relatively new (or at least it was for us), success can be measured more informally than formally. Librarians can use the reflection assignments as the tool to assess their approach. For students, reflection questions are beneficial because they allow them to make meaning and to recognize what they have learned. For librarians, the overarching goal of these short, in-class summative assessments is to gauge how the study abroad experience changes what students think they know about their topics and to encourage their metacognition. From the student reflections, librarians should be able to make connections between what the students said about their research process and the frame. A specific measurement instrument from a rubric does not have to be used and particular terms for coding do not have to be selected. Instead, librarians can simply look to see if the students reflect on the process in a way that aligns with how the frame addresses the search process. For example, when we looked at our students' reflections, aspects of the frame that we considered most prominent were the elements encompassing inquiry, discovery, and serendipity. Reflection prompts allow students to thoughtfully work

through their research process, which is interdisciplinary, complex, and directly tied to the culture they are experiencing. By asking students to reflect on the work they completed in the US versus the work completed abroad, librarians should see students recognizing and describing the influence their study abroad experienced plays on their research. Their research and reflections require creativity, persistence, and use of nontraditional search tools and sources, all of which can be seen in the frame.

Notes

1. Ann Lindell, *SPEC Kit 309: Library Support for Study Abroad* (Washington, DC: Association of Research Libraries, 2008), 11.
2. Jill Clemmons, "Welcome to LSU's Faculty-Led Study Abroad Programs!," accessed November 1, 2016, <http://www.lsu.edu/intlpro/apa/faculty/index.php>.
3. Peter Powell and Wim Weenk, *Project-Led Engineering Education* (Utrecht: Lemma Publishers, 2003), 110.
4. ACRL Board, *Framework for Information Literacy for Higher Education*, accessed November 22, 2016, <http://www.ala.org/acrl/standards/ilframework#exploration>.
5. Grant Wiggins and Jay McTighe, *Understanding by Design* (Alexandria, VA: Association for Supervision and Curriculum Development, 1998), 9.
6. BYU Idaho, "Dee Fink's Taxonomy of Significant Learning," accessed November 20, 2016, <https://www.byui.edu/outcomes-and-assessment-old/the-basics/step-1-articulate-outcomes/dee-finks-taxonomy-of-significant-learning>.
7. Encounter Engineering in Europe, <http://guides.lib.lsu.edu/E3>.
8. Stephen Cleary, "Critical Thinking," 2008, accessed November 22, 2016, <http://www.staffs.ac.uk/sgc1/faculty/personal-skills/week4.html>.

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