



Study Abroad as a Means to Achieving ABET Criterion 3 Outcomes: A Case Study in Course Design and Assessment

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Study abroad is widely perceived as a transformational but elusive experience for engineering students: transformational because of its potential to combine experiential and intellectual understanding of engineering in global and social context, elusive because the highly structured character of engineering curricula means that students can rarely study abroad without falling behind in completion of their degree requirements.^{1, 2, 3, 4} For accreditation purposes, however, the outcomes of study abroad matter more than the motivations for it, and engineering educators must provide evidence to demonstrate student learning. Given the logistical demands of designing and implementing courses taught abroad, it is tempting to treat the specification and measurement of learning outcomes as an obstacle.

In contrast to that view, this paper argues that outcomes based assessment benefits the design and continuing improvement of study abroad courses. To support this claim, the paper describes the design and assessment of “Jefferson in France 1787: Connoisseurship, Commerce, and Engineering,” a study abroad course taught at the University of Virginia that develops several ABET Criterion 3 outcomes, specifically, (d) an ability to function on multidisciplinary teams, (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context, (i) a recognition of the need for, and an ability to engage in, lifelong learning, and (j) a knowledge of contemporary issues.

The Value and Challenges of Study Abroad for Engineers

The community of scholars concerned with study abroad for engineers is remarkably united in its assertion of the value and challenges of study abroad for engineers. That consensus is exemplified in a 2006 article in the *European Journal of Engineering Education* titled “Defining, Developing, and Assessing Global Competence in Engineers.”² Lohmann, Rollins, and Hoey, the authors of the article, review the literature on study abroad for engineers and articulate the consensus on “the importance of preparing [engineers] for transnational practice and a global society” (p. 1). They also identify the “major challenge” of doing so: “the highly sequenced and content-demanding nature of the curriculum” (p. 1). Their description of an innovative curriculum for achieving global competence at the Georgia Institute of Technology reflects other challenges of study abroad for engineers, including obtaining institutional support, providing incentives for faculty involvement, and overcoming the inertia created by the lack of a tradition of study abroad for engineers.

Lohmann, Rollins, and Hoey² also describe deficiencies in the existing scholarship that assesses the outcomes of study abroad generally: (1) a tendency to “dwell on logistical and actuarial aspects. . . or student satisfaction;” (2) lack of attention to “student learning effects or career impact;” (3) limiting assessment “to the development of psychosocial outcomes, such as increased self-confidence and increased understanding of participants’ cultural values and biases;” and (4) relying on student self-assessment (p. 124). They argue that assessment of outcomes of study abroad is even more limited in engineering education than in other fields. Trooboff, Vande Berg, and Rayman (2008)⁴ echo this assessment, asserting that study abroad

programs need to “pay more attention to desired learning outcomes in designing programs abroad for our students” (p. 30).

In a similar vein, Parkinson (2007)³ identifies the need to get beyond the “if we get the students abroad, good things will happen” mentality and very general objectives such as improving students’ understanding of “their place in the world” (p. 10). Parkinson explains, “Specific objectives can help drive preparation beforehand and the planned experience during the stay [abroad]. They can also be a useful vehicle to promote student reflection during the experience” (p. 10) The design and assessment of “Jefferson in France 1787” responded to these criticisms.

Course Overview

The course replicated portions of Thomas Jefferson’s 1787 journey through the south of France. It began just after final exams and concluded in mid-June, so that students could participate without foregoing the opportunity for a summer internship or other employment. Using the Institute of Political Studies (Sciences Po) in Lyon, France, as a home base, the course focused on the places, practices, and structures that made a lasting impression on Jefferson with the aim of expanding students’ capacities for observation, appreciation, and synthesis. The enrollment was evenly divided between engineering and non-engineering students.

The premise of the course is that Jefferson’s journey should be understood as a wide-ranging investigation of culture, agriculture, and engineering. Specifically, the course engages students in investigating and describing the distinctive features of French engineering, commerce, and aesthetics as they are exemplified in two of France’s most notable sociotechnical achievements: viticulture and the Canal du Midi, a 17th century feat of hydraulic and social engineering designed to connect the Mediterranean with the Atlantic. In addition to providing students with a disciplined, analytical approach to the interactions among science, technology, and society, the course is designed to deepen students’ understanding of technology in social and global context.

The culminating project for the course asked the students to synthesize first-hand observation with research to provide a coherent view of some particular aspect of French engineering, commerce, and aesthetics. Specific topics addressed by students included the function and regulation of public space; strikes and demonstrations; work, leisure, and the pace of life; wine as a business that exemplifies what the student called the “universal contradictions that business people wrestle with across the globe;” and public transportation as an expression of French values such as social orderliness.

Design and Justification of Assessment Methodology

Assessment of student learning was targeted at five specific outcomes, all of which contribute to Criterion 3(h): the broad education necessary to understand the impact of engineering solutions in global and societal context. As noted below, several of the specific outcomes contribute to additional Criterion 3 outcomes.

1. Using details from the life of Jefferson to explain the strengths and limitations of historical narratives (h)

2. Applying STS concepts and frameworks to historical developments and contemporary human activities [(h) and (j) contemporary issues]
3. Using sociotechnical systems thinking to provide insight into similarities and differences of cultures [(h) and (i) lifelong learning]
4. Engaging in interdisciplinary, collaborative inquiry [(h) and (d) function on multidisciplinary teams]
5. Functioning effectively in cross-cultural and international contexts and engaging in the lifelong learning that travel can facilitate [(h) and (i) lifelong learning]

The students demonstrated their level of competence in class discussions, essays, a midterm examination, a journal, a research project, and a final essay. As part of the final essay, they also completed the self-assessment that is the primary focus of this paper.

The most interesting results of the self-assessment came from the evidence students provided to support that assessment. Reflection and assessment of learning were a central part of the instructional strategy for the course, so the students had become quite accustomed to those processes. Thus, it seems reasonable to conclude that the self-assessment completed as part of the final examination not only measured but also enhanced student learning.

Trooboff, Vande Berg, and Rayman's survey results (2007)⁴ support a case for "study abroad professionals to take steps that will convince employers that study abroad can in fact enhance such highly desired personal qualities and skills" (p. 29), for example, "working outside one's comfort zone." The survey results highlight not only the value employers place on study abroad, but also the need "to give students some basic training in how to present what they have learned through studying abroad, in ways that employers will appreciate" (p. 300). Instead of describing the place they studied or the local culture, these authors argue, students should talk in interviews and applications about "learning outcomes—the specific knowledge, skills, and perspectives they learned abroad" (p. 300). As they explain it, this capacity for articulation is especially important for students "who have participated in short-term programs" (p. 31) like the one described in this paper.

The other deliverables for the course allowed for multiple opportunities to measure student competence in all five objectives and to distinguish among various levels of development. The amount of time that students spend with faculty during study abroad experiences means that it is easier than it would be in a typical classroom context to assess student learning through observing student behavior. Perhaps most importantly, assessing student learning outcomes for ABET purposes provided an impetus for articulating learning outcomes and deliberately designing assignments that would achieve them. In other words, assessment accomplished one of its central purposes: improving instruction.

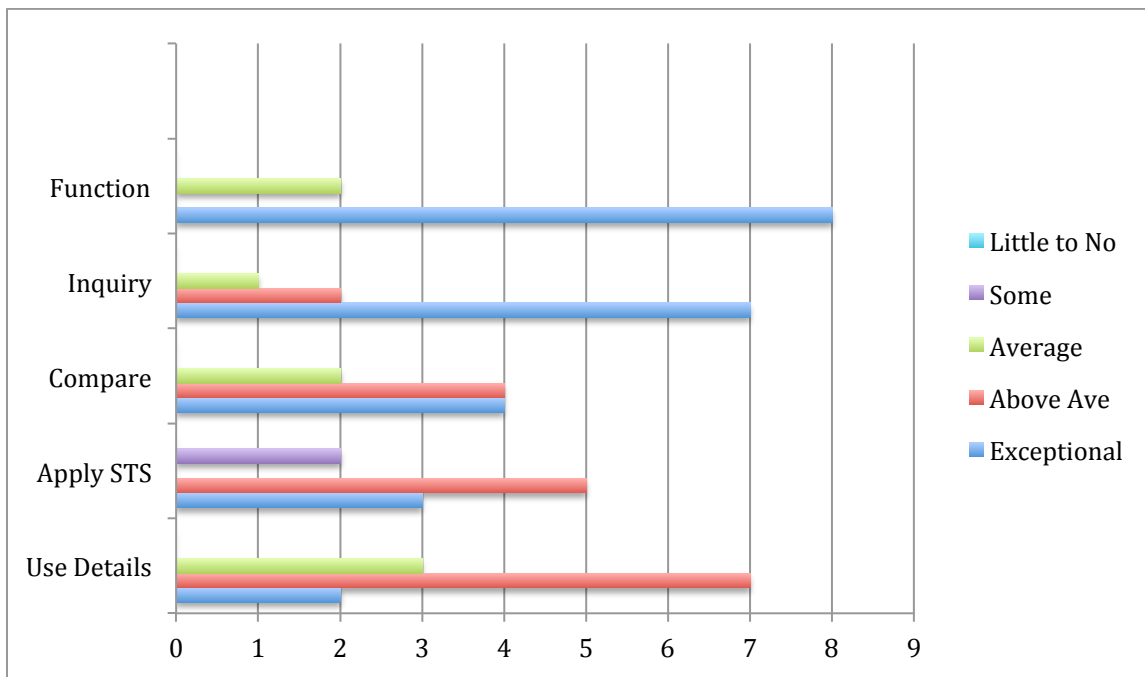
Assessment Results and Significance

The chart below summarizes the numerical results of the self-assessment. Of the ten students in the class, one assessed achievement of all outcomes as exceptional and one gravitated toward the lower levels of development with the exception of objective 4, engage in interdisciplinary, collaborative inquiry. As mentioned above, the significance of these results lies more in the

evidence students provided that in the numbers. The numbers do, however, reveal two trends in student perception of their learning, most notably:

- Students perceived the greatest amount of development in the psycho-social outcomes (function effectively in cross-cultural and international contexts, travel independently, and engage in the lifelong learning travel can facilitate and engage in interdisciplinary, collaborative inquiry). This result is consistent with the trend identified by Lohmann, Rollins, and Hoey.
- Students perceived significant, though less, development in the more explicitly analytical outcomes (use sociotechnical systems thinking to provide insight into similarities and differences of cultures, apply STS concepts and frameworks to historical developments and human activities, and use details from the life of Jefferson to explain the strengths and limitations of historical narratives).

Figure 1. Summary of Self-Assessment Results in Approximate Order from More to Less Development



The detailed results of the self-assessment are captured in the table below. Among the significant implications that either explain why the course was successful or how it could be improved are the following:

- Multidimensional learning experiences greatly enhance the development of competence
- Sociotechnical systems thinking can enhance cultural competence, as defined by Hammer (2012)¹, and provide a flexible framework for lifelong inquiry
- Combining students from various engineering and non-engineering disciplines (in this case, English, sociology, and business) accelerates the development of all competencies

Figure 2. Detailed Results of Assessment

5=exceptional development of competence, 4=above average development of competence, 3=average development of competence, 2=some development of competence, and 1=minimal to no development of competence

Learning Objective	Assessment	Evidence Used by Students to Support Numerical Assessment (1-2 sentences)
<p>1. Use details from life of Jefferson to explain the strengths and limitations of historical narratives</p>	<p>5=2 (students) 4=7 3=3</p>	<ul style="list-style-type: none"> ✓ “Learning that every narrative has an angle or opinion will be really helpful in my studies moving forward.” ✓ Several specific references to readings and papers “formal education” ✓ Value of reading multiple historical narratives, plus personal narratives, plus visiting sites Jefferson visited <hr/> <ul style="list-style-type: none"> ❖ Instructor assessment was higher than student assessment, perhaps because the essay that reflected mastery of this objective was written early in the course.
<p>2. Apply STS concepts and frameworks to historical developments and human activities</p>	<p>5=3 4=5 3=0 2=2</p>	<ul style="list-style-type: none"> ✓ Foundational readings and discussions at beginning of course made it easy to apply these to subsequent case studies ✓ Easy to observe interconnectedness of technical, organizational, and cultural dimensions of sociotechnical systems ✓ Learned a lot despite lack of previous exposure to these concepts and frameworks ✓ Variety of case studies and sites visited demonstrated wide applicability <hr/> <ul style="list-style-type: none"> ❖ Low assessments correlate in one case with misunderstanding the question and in another case with apparent resistance to the idea that STS concepts and frameworks exist or are useful.
<p>3. Use sociotechnical systems thinking to provide insight into similarities and differences of cultures</p>	<p>5=4 4=3 3=3</p>	<ul style="list-style-type: none"> ✓ “This was one of my favorite parts of the course.” ✓ “I thought about France and America as one system and attempted to identify interactions between the two countries.” ✓ “I searched for ways to understand global systems at work in the makeup of

		<p>the cities and sites we encountered.”</p> <ul style="list-style-type: none"> ✓ “Allowed me to see intricacies in the way they interact” ✓ “A more organized way to think” ✓ Alcohol production, regulation, and consumption as an excellent case study in cross-cultural comparisons of sociotechnical systems ✓ Easier to perceive values and norms through comparison ✓ Common framework makes analysis easier ✓ “A very useful framework for comparing systems and cultures” ✓ “Journal placed good emphasis on keeping a comparative perspective.” ✓ “Most easily learned via informal learning.” <hr/> <ul style="list-style-type: none"> ⊗ “I understand how the framework works, but I have trouble identifying what belongs where.” ❖ The interconnectedness of the various elements of a system can make it cognitively demanding to distinguish them.
<p>4. Engage in interdisciplinary, collaborative inquiry</p>	<p>5=7 4=2 3=1</p>	<ul style="list-style-type: none"> ✓ Combination of various disciplinary perspectives and approaches was “very beneficial” ✓ “Accomplished remarkably well” ✓ “Stimulating conversations” ✓ “Great balance” ✓ “Filtered all experiences through the investigative framework of the class” ✓ “With constant course discussion and a small, close-know class of only 10 people, collaboration and cooperation were inevitable and necessary.” ✓ “Having all of these perspectives forced everyone to open their minds to new ways of thinking.”

<p>5. Function effectively in cross-cultural and international contexts, travel independently, and engage in the lifelong learning travel can facilitate</p>	<p>5=8 4=0 3=2</p>	<ul style="list-style-type: none"> ✓ “Overcame many obstacles and pitfalls” ✓ “Made very effective use of my time” ✓ “Learned more about the world and other cultures than I did academically” ✓ “Definitely gained in proficiency compared to students who haven’t traveled abroad” ✓ “I have never learned more about being independent than when I went on this trip. I now know my limitations, strengths, likes, and dislikes.” ✓ “I was worried about not knowing the language or customs of France, but through the class and an open mind, I was able to learn key phrases and customs very quickly.” ✓ “Travel is unparalleled in its ability to promote learning.” <hr/> <ul style="list-style-type: none"> ⊗ “We spent too much time as a group to learn to travel independently.” ❖ Students who assessed their development as average (3) focused on their initial impressions rather than outcomes
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Conclusion

The assessment results presented here demonstrate that outcomes based assessment supports not only the improvement but also the design of study abroad experiences. In fact, using the outcomes-based assessment approach required by ABET also solves one of the largest problems of study abroad experiences: being explicit about what the students should learn. Although there is a large body of material published on best practices for study abroad experiences, the objectives of study abroad are typically vague at best and only implied in the worst cases. The next step in this line of research will involve generalizing the approach used in this course to the study abroad community at large.

Bibliographic Information

1. Hammer, M. (2012). The Intercultural Development Inventory: A new frontier in assessment and development of intercultural competence. In M. Vende Berg, R.M Paige, and & K.H. Lou (Eds.) *Student Learning Abroad* (Ch. 5, pp. 115-136). Sterling, VA: Stylus Publishing.
2. Lohmann, J.R., Rollins, Jr., H.A., and Hoey, J.J. (2006). Defining, developing, and assessing global competence in engineers. *European Journal of Engineering Education*: Vol. 31: No. 1, pp. 119-131.

3. Parkinson, A. (2007). Engineering study abroad programs: Formats, Challenges, Best Practices. *Online Journal for Global Engineering Education*: Vol. 2: Iss. 2, Article 2. Available at: <http://digitalcommons.uri.edu/ojgee/vol2/iss2/2>
4. Trooboff, T., Vande Berg, M., and Rayman, J. (2008). Employer attitudes toward study abroad. *Frontiers: The Interdisciplinary Journal of Study Abroad*, Vol. 15: Fall/Winter 2007-2008, pp. 17-32.

Appendix: Instructions Provided to Students

Self-Assessment. (10%; pass/fail)

- The five learning objectives listed in the table below are drawn from the course syllabus. Assess the degree of development you achieved in each area through both informal and formal learning you did in this course. (The table simply repeats the outcomes outlined above. The most significant feature of its design is that it requires students to provide evidence to support their assessments.)

Provide evidence to support each of your assessments. **Your self-assessment will not affect your course grade.** The goals here are self-awareness and differentiating degrees of development. Specifically,

- Convey your assessment by filling out the table below.
- Compare yourself to University of _____ students who have **not** studied abroad but who are in the same graduating class as you
- Consider the university as a whole rather than just your area of study or school
- Provide comments where you think they will be helpful
- Rate your level of development on a scale from 1-5:
 - (1) minimal to no development of competence in that particular area
 - (2) some development of competence
 - (3) average development of competence
 - (4) above average development of competence
 - (5) exceptional development of competence