Assessing Students' Global and Contextual Competencies: Three Categories of Methods used to Assess a Program with Coursework and International Modules

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Introduction

> *U.S. engineers will represent a minority culture and, thus, will have to be open to different religions, different ways of thinking, and different social values.*[1]
> (National Academy of Engineering, 2005)

Undergraduate engineering programs must change along with the rapidly changing global landscape of the engineering profession.[1,2,3] Such change is necessary because a more globally interdependent society brings with it a host of new complex and interdependent challenges, which engineers will play a vital role in addressing.[2,3,4,5,6,7,8] As noted by the National Academy of Engineering's *Engineer of 2020* report,[3] to solve these complex problems, engineers will have to work with globally diverse, distributed teams and customers and communicate across political and cultural boundaries.

Indeed, ABET's criterion h explicitly calls for students to experience "the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context."[9] Programs have addressed this goal in a variety of different ways by offering, for example, study abroad opportunities, classes with a global focus, online courses, co-curricular student organizations, or general education requirements.[10,11,12,13] However, it can be challenging to demonstrate the impact of these kinds of interventions on the development of students' global and contextual competencies.

This paper describes a suite of assessments that have been used to uncover how students develop such competencies in Virginia Tech's Rising Sophomore Abroad Program geared toward first-year engineers. The program integrates a global engineering course meeting general education requirements with multiple tracks of short-term international experiences. This paper provides an overview of the assessments that we use throughout the program as well as example summary results from each assessment (n=92 students for Spring 2016 data) to demonstrate the unique information gained from analyzing each measure or activity. We hope these examples may serve as a model for other institutions seeking to assess students' global and contextual competencies.

Overview of the Program and Suite of Assessments

The program in which this suite of assessments was used provides first-year students with an opportunity to expand their global competencies through direct experience. It integrates an on-campus, Spring course meeting a general education requirement with a short-term international module immediately following semester exams in May. The 2016 program enrolled 92 students who participated in one of three international modules: Italy, Switzerland, and Germany; China; or the Dominican Republic. Engaging in the program provides students with opportunities to expand their global competencies while learning about differences in political, technological, social, cultural, educational and environmental systems. The program seeks to help students recognize how differences in contexts matter for engineering problems and solutions,

demonstrate how students might navigate cultural or international differences throughout their careers, and provide a structured opportunity for students to learn how to engage in a professional environment in an international location.

The sections that follow include overviews of the assessments that we use in our program to determine the extent to which we meet program objectives. To help faculty or program leaders can gain a sense of what might work best for their settings, we organize the assessments into three categories based on the amount of time they require to complete and analyze: 1) Quick Hitters, 2) More In-Depth, and 3) Longer Projects.

Quick Hitters

Cultural Intelligence Survey

The first of our quick hitter assessments measures students' cultural awareness. The Cultural Intelligence Survey (CQS), created by Ang et al.,[14] contains 20 different survey items measured on a 7-point Likert-scale to measure four dimensions of cultural intelligence: 1) cognitive, 2) metacognitive, 3) motivational, and 4) behavioral. Survey items can be found in Table 1. One of the first uses of the CQS was in a cross-cultural study in the United States and Singapore, where dimensions of the CQS were used to demonstrate differences between contexts in cultural judgment, cultural adaptation, and task performance.

Table 1. Items comprising the Cultural Intelligence Survey (CQS)

Dimension	**Question** *(1-strongly disagree, 7-strongly agree)*
Cognitive 1	I know the rules (e.g., grammar) of other languages.
Cognitive 2	I know the religious beliefs of other cultures.
Cognitive 3	I know the marriage systems of other cultures.
Cognitive 4	I know the rules for expressing non-verbal behaviors in other cultures.
Cognitive 5	I know the legal and economic systems of other cultures.
Cognitive 6	I know the arts and crafts of other cultures.
Metacognition 1	I am conscious of the cultural knowledge I apply to cross-cultural interactions.
Metacognition 2	I check the accuracy of my cultural knowledge as I interact with people from different cultures.
Metacognition 3	I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds.
Metacognition 4	I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.
Behavioral 1	I alter my facial expressions when a cross-cultural interaction requires it.
Behavioral 2	I change my verbal behavior when a cross-cultural interaction requires it.
Behavioral 3	I change my non-verbal behavior when a cross-cultural situation requires it.
Behavioral 4	I use pause and silence differently to suit different cross-cultural situations.
Behavioral 5	I vary the rate of my speaking when a cross-cultural situation requires it.
Motivational 1	I enjoy living in cultures that are unfamiliar to me.
Motivational 2	I am confident that I can socialize with locals in a culture that is unfamiliar to me.
Motivational 3	I am confident that I can get accustomed to the life style in a different culture.
Motivational 4	I enjoy interacting with people from different cultures.
Motivational 5	I am sure I can deal with the stresses of adjusting to a culture that is new to me.

The CQS was administered three times in our program: the first day of class, the last day of class, and online after students returned from their trips. This research design enabled pre/post-test analyses for both the Spring class and the international modules. Student response rates

limited inferences that could be made for the post-international modules. 90 students of 92 (97.8%) completed both the pre- and post-class distributions of the CQS; however, only 42 (45.7%) completed the post-trip assessment. Based on this experience, one implication for practice is that it may be more effective to administer post-trip assessments during the last day of an international experience instead of asking students to complete those assessments from home. For the purposes of this paper, we report only the comparisons between the pre- and post-class responses.

Differences in students' responses between the pre- and post-class surveys were analyzed using a paired samples t-test. Descriptive statistics and t-test results are reported in Table 2. We observed statistically significant increases ($p<0.01$) between the beginning versus the end of the semester administrations for 13 of 20 items. These items fell within 3 of the 4 categories embedded within the CQS: cognitive, metacognitive, and behavioral. Items falling within the fourth category, motivational, did not show statistically significant changes in the pre- to post-test comparisons. Although we noted the response rate differences for the post-trip administration of the assessment, we did observe significant increases for 4 of the 5 motivational construct items following the international module. Thus, we found that the items within this assessment appear to behave differently following different kinds of experiences associated with our program.

Table 2. Descriptive statistics and *t*-test results for the Cultural Intelligence Survey (CQS)

	Pre-Class		**Post-Class**					
	Mean	s.d.	Mean	s.d.	Diff	T	Sig	
Cog1	3.16	1.45	3.63	1.54	**0.48**	**2.93**	0.004	***
Cog2	3.97	1.18	4.21	1.32	**0.24**	**1.66**	0.101	
Cog3	3.18	1.24	3.41	1.33	**0.23**	**1.41**	0.163	
Cog4	2.96	1.32	4.18	1.26	**1.22**	**7.35**	0.000	***
Cog5	3.19	1.24	4.14	1.41	**0.96**	**6.90**	0.000	***
Cog6	3.70	1.47	4.19	1.30	**0.49**	**3.08**	0.003	***
Meta1	4.51	1.36	5.30	1.22	**0.79**	**4.86**	0.000	***
Meta2	4.88	1.41	5.36	1.19	**0.48**	**2.78**	0.007	***
Meta3	4.80	1.21	5.42	1.24	**0.62**	**3.81**	0.000	***
Meta4	5.30	1.10	5.66	1.05	**0.36**	**2.34**	0.021	**
Behav1	4.39	1.44	4.97	1.16	**0.58**	**4.06**	0.000	***
Behav2	4.78	1.36	5.17	1.07	**0.39**	**2.71**	0.008	***
Behav3	4.57	1.41	5.31	1.11	**0.74**	**4.63**	0.000	***
Behav4	4.33	1.43	5.01	1.24	**0.68**	**4.55**	0.000	***
Behav5	4.82	1.44	5.28	1.22	**0.46**	**2.87**	0.005	***
Mot1	5.29	1.40	5.43	1.26	**0.14**	**1.01**	0.317	
Mot2	4.98	1.37	5.11	1.26	**0.13**	**1.03**	0.306	
Mot3	5.68	1.13	5.70	1.04	**0.02**	**0.17**	0.863	
Mot4	6.07	1.11	6.00	1.06	**-0.07**	**-0.59**	0.559	
Mot5	5.97	0.93	5.93	1.00	**-0.03**	**-0.30**	0.763	

Sojourn Readiness Assessment

Designed by Jesiek, Haller, and Thompson,[15] the Sojourn Readiness Assessment (SRA) was distributed to students to measure their "general sense of preparedness" for traveling abroad. In the original instrument, respondents rank their agreement to 15 survey items related to dimensions of cognitive preparedness, doubt, perception of benefits, and anxiety on a 6-point

Likert-scale. A new, 20-question SRA was produced based on the results from Jesiek, Haller, and Thompson[15] which we adopted for assessing our program (see Table 3 for the survey items; for each item, an (R) label indicates that lower responses for that item signify an improvement).

Table 3. Items from the Sojourn Readiness Assessment (SRA)[1]

	Question (1-strongly disagree, 6-strongly agree)
SRA1 (R)	I am anxious about going abroad.
SRA2	If I need help while abroad, I will know who to contact.
SRA3	While abroad, I know how to keep in touch with my family.
SRA4	I am prepared to go abroad.
SRA5 (R)	I question if going abroad was a good decision.
SRA6	I can deal with unexpected challenges while abroad.
SRA7	I will be able to communicate effectively while abroad.
SRA8	The benefits of going abroad outweigh the challenges.
SRA9	I will make the most of my time spent abroad.
SRA10 (R)	Thinking about going abroad makes me nervous.
SRA11	I have adequate knowledge about the host country.
SRA12 (R)	Adapting to the host country will be difficult for me.
SRA13 (R)	I worry about being away from friends and family.
SRA14 (R)	I wish I knew more about the culture of the host country.
SRA15 (R)	I fear I will have negative experiences while abroad.
SRA16	Going abroad helps support my professional development.
SRA17	My experiences abroad will help me improve and grow as a person.
SRA18	While abroad, I will be able to function effectively in most any situation.
SRA19	I am ready to interact with my foreign peers, colleagues, partners, etc.
SRA20	I have sound reasons for deciding to go abroad.

[1] From Jesiek, Haller, and Thompson (2014)

We distributed the SRA following a pre/post-test design; however, because the SRA was used as a measure of travel "readiness," the survey was only given at the beginning and end of the class and not after the international module. 90 of 92 students also completed both distributions of the SRA, representing a 97.8% response rate, and we conducted paired samples *t*-test analyses as with the CQS. 5 of the 20 SRA items significantly increased between the pre- and post-class survey distributions, but 2 items shifted in unintended directions (Table 4). Reflecting back on the class topics, we were unsurprised by the items that demonstrated an increase, as we emphasized safety, communication, and easing anxiety. We learned from and used these results to tweak the course for 2017, completing the course evaluation feedback loop so that we continually improve our program.

Table 4. Descriptive statistics and *t*-test results for the Sojourn Readiness Assessment (SRA)

	Pre Class		Post Class					
	Mean	s.d.	Mean	s.d.	Diff	T	Sig	
SRA1 (R)	2.90	1.42	3.20	1.55	**0.30**	**2.12**	0.037	*
SRA2	4.28	1.19	5.08	0.82	**0.80**	**6.22**	0.000	***
SRA3	4.70	1.18	5.07	0.85	**0.37**	**2.73**	0.008	***
SRA4	4.96	0.92	5.08	0.81	**0.12**	**1.17**	0.246	
SRA5 (R)	1.68	0.83	1.87	1.12	**0.19**	**1.77**	0.081	
SRA6	4.90	0.97	4.90	0.72	**0.00**	**0.00**	1.000	
SRA7	4.30	1.01	4.40	1.12	**0.10**	**0.82**	0.412	
SRA8	5.64	0.53	5.60	0.54	**-0.04**	**-0.73**	0.468	
SRA9	5.79	0.46	5.57	0.58	**-0.22**	**-4.28**	0.000	***
SRA10 (R)	2.70	1.20	3.04	1.47	**0.34**	**2.35**	0.021	**
SRA11	3.52	1.11	4.49	0.96	**0.97**	**7.45**	0.000	***
SRA12 (R)	2.54	0.93	2.58	1.06	**0.03**	**-0.32**	0.752	
SRA13 (R)	2.26	1.19	2.37	1.19	**0.11**	**1.11**	0.272	
SRA14 (R)	4.90	1.04	4.09	1.11	**-0.81**	**-5.71**	0.000	***
SRA15 (R)	2.09	0.92	2.27	1.10	**0.18**	**1.79**	0.077	
SRA16	5.43	0.60	5.40	0.58	**-0.03**	**-0.51**	0.615	
SRA17	5.57	0.58	5.44	0.60	**-0.12**	**-1.83**	0.070	
SRA18	4.92	0.80	4.87	0.82	**-0.06**	**-0.64**	0.525	
SRA19	5.16	0.81	5.04	0.75	**-0.11**	**-1.27**	0.206	
SRA20	5.36	0.64	5.32	0.62	**-0.03**	**-0.60**	0.551	

More In-Depth

Global Competency Scenario

The Global Competency Scenario (GCS) is a tool that can be used to assess the skills students think are important in global engineering work, ultimately revealing how they perceive global engineering competency. Developed by Brent Jesiek from Purdue University (unpublished, but country-specific iterations have since been developed) the version of the GCS used to assess students in our program asks students to list five competencies they believe would be needed to address a specific global engineering scenario. The full prompt provided to students follows:

> *<u>Scenario</u>: Imagine you are an engineer working for a multinational corporation that is expanding operations in both South America and Southeast Asia. You are involved in evaluating the feasibility of the expansion, including finding suitable locations and planning operations. How prepared are you to enter this work situation? What knowledge and capabilities do you have and what do you lack?*
> *<u>Task</u>: List and briefly describe five (5) competencies (knowledge, skills, and/or attitudes) you think would be most needed to complete this work assignment.*

We administered the GCS via an in-class online survey at both the start and end of the semester (in the same administration as the CQS and SRA). We coded student responses to reduce

variation in wording and then compared the frequencies of the codes between the pre- and post-test. The GCS is categorized as "More In-Depth" because the open-ended questions take students a bit longer to complete than a Likert-style set of items, and it is a larger undertaking for faculty or program leaders to collapse individual responses into codes.

Although we did not find drastic changes in the competencies students listed in the responses to the GCS, there were some interesting trends with regard to frequency. In the pre-test, students were more likely to list "knowledge" competencies (i.e., information they would need in this scenario), such as "cultural knowledge," "geography," or "local economy." They also tended to describe management skills in a very general sense, such as "communication," "hard work," or "pragmatism." In the post-test, however, students' responses seemed to reflect an increased understanding of the complexity of global projects, as they listed coordination-type skills such as "leadership," "adaptability," "responsibility," and "organization." Students also shifted more towards human-centered skills such as "empathy," "teamwork," and "listening." Empathy specifically was one of the competencies that increased the most in frequency between the pre- and post-tests which coincides with the program's focus on helping students recognize the importance of stakeholder needs and contextual differences. The competencies that dropped and jumped the most in frequency between the pre- and post-tests are listed in Table 5. Overall, these results have shown us that students are gaining a more nuanced understanding of global projects and learning; students recognized that human-centered skills and attitudes are important parts of global engineering work.

Table 5. Changes in responses to the Global Competency Scenario (GCS) (pre-/post-class)

Biggest Drops - Frequency		Biggest Jumps - Frequency	
Cultural Knowledge	-11	Empathy	15
Geography	-11	Leadership	15
Communication	-9	Adaptability	14
Local Economy	-8	Responsibility	11
Pragmatism	-6	Organization	6

Systems Thinking for Engaging Problem Solvers (STEPS)

To determine the extent to which our students were able to consider multiple facets of a problem, including technical components, contextual components, and different stakeholders, we administered the Systems Thinking for Engaging Problem Solvers (STEPS) scenario. The ability to "recognize, understand, and synthesize" the interactions and interdependencies inherent in complex problems[16]– a definition of systems thinking – is a crucial competency that should be developed in engineering students. Members of our team developed an assessment tool to measure the systems thinking competency of a diverse population of respondents.[17] The tool uses a problem scenario set in the fictitious town of Abeesee to draw out the reasoning processes of respondents. It is administered through an online survey that asks students to read a vignette describing the problem scenario and answer a series of open-ended questions. Questions are structured into three phases: *processing* (problem framing in response to the vignette; groups to involve in decision-making; potential indicators for success), *response* (draft/plan outline for addressing the problem; possible challenges in implementing the plan), and *critique* (analysis

and critique of a sample plan; potential unintended consequences). In total, it takes students approximately 30 minutes to work through this activity.

Student responses to prompts across the three phases are analyzed using a rubric that quantifies student proficiency according to 7 constructs:

1. *Problem identification*: ability to articulate problem/s based on information provided in the scenario
2. *Information needs*: ability to identify additional information needed to address the problem/s identified
3. *Stakeholder awareness:* ability to identify and include groups needed for decision-making
4. *Goals:* ability to identify short- and long-term goals towards addressing the problem/s identified
5. *Unintended consequences:* ability to identify possible limitations and unintended consequences of a potential solution
6. *Implementation challenges:* ability to identify expected barriers to their crafted response to the problem scenario
7. *Alignment*: degree to which the respondent incorporates aspects of the problem identified, goals, and plans across responses.

The constructs, rooted in literature,[17] serve as a means to characterize the responses and study variation in students' systems thinking competency. Since there is no "absolute" correct answer to any of the questions included in the tool, a scoring rubric was iteratively developed by a team of researchers to rate the quality of the responses within a construct. For this stage of tool development, a team of raters used the scoring rubric to evaluate student responses and assign a score for each construct (scoring range: 0 to 3).

To complement the STEPS tool, we also administered psychometrically validated scales for constructs we expect to moderately correlate with STEPS scores: *Systems Thinking Attitudes*[16] (20 items), *Critical Thinking Disposition*[18] (11 items), and *Interdisciplinary Skills*[19] (8 items). These items followed the problem scenario and its associated open-ended questions. The Systems Thinking Attitudes scale was developed as a way to measure systems thinking in the context of "quality improvement," and was an output of the ASQUIRE (Advance the Science of Quality Improvement Research and Evaluation) initiative.[16] The items on the Critical Thinking Disposition scale, on the other hand, measure students' disposition for critical openness and reflective skepticism, both domains of critical thinking.[18] The Interdisciplinary Skills scale was developed as one of three Likert-style scales that form a measure of interdisciplinary competence and measures "students' perceptions of their abilities to think about and use different disciplinary perspectives" in formulating solutions to interdisciplinary problems.[19] Any of those scales could also be used as Quick Hitters without the addition of the richer, yet more time-intensive, STEPS assessment.

Means of the scores of students' open-ended question responses indicate that our students are most proficient at *problem identification*, and articulating *goals* and *information needs*. Scores for *stakeholder awareness*, *unintended consequences*, and *implementation challenges* indicate limited ability to recognize multiple aspects and domains that may impact the problem and the process of identifying and implementing possible solution/s. The ratings for *alignment* indicate

limited ability to align responses across the articulated problem statement, goals, and proposed plan to address the problem.

Table 6. Mean ratings and scores: STEPS, Systems Thinking Attitudes, Critical Thinking Disposition, and Interdisciplinary Skills

Construct/Scale	Scoring Range	Mean Score	Std Dev
Problem Identification	0 – 3	1.65	0.19
Information Needs		1.73	0.15
Stakeholder Awareness		1.23	0.34
Goals		2.08	0.26
Unintended Consequences		1.18	0.17
Implementation Challenges		1.48	0.13
Alignment		1.38	0.10
Systems Thinking Attitudes	1 – 5	4.01	0.94
Critical Thinking Disposition		4.04	1.06
Interdisciplinary Skills		4.04	1.16

In general, rubric-guided scores were on the low side of the rubric, which may be a manifestation of the limitations inherent in the students as first-year engineers. These results present an opportunity for the program leaders to think about specific activities aimed at developing systems thinking competencies that may be integrated into the curriculum (note: this assessment was given during the second week of class). It is interesting to note, however, that self-reported scores indicate high perceptions of ability for systems thinking, critical thinking disposition, and interdisciplinary skills, as shown by the scores for these scales. This discrepancy in students' self-reported abilities and rubric-guided ratings may also be used as input to curriculum-related decisions related to developing systems thinking competency.

Longer Projects

Global Challenges Poster Fair

One of the longer projects that students completed aligned with the class's first module, *Global Challenges*, which focused on helping students recognize global challenges, technological problems, business opportunities, and contextual influences on engineering practice. The primary assessment for this module was a multi-stage group project that tasked students with identifying and defining a "problem" specific to an assigned country and discussing factors that could impact potential solutions. Teams were pre-selected within each international track and assigned a country in the Top 32 in Gross Domestic Product within the same region (i.e., Europe, Asia, the Americas) as the country to which they were travelling. The 6-week project culminated with a poster fair in which student groups presented to the rest of the class and the grading team. During the poster fair, students were asked to observe similarities and differences across the posters and submitted reflections due the following week.

Overall, our team was pleased with the poster fair and implemented a similar activity again in 2017. While many teams chose more technical topics related to the environment (e.g., pollution), other teams selected social issues, such as the European refugee crisis, and applied their engineering problem solving skills to those kinds of complex issues. Two lessons for our instructional team resonated loudest. First, problem scoping was a significant issue for many

teams. Our intention was for students to select a problem that could be addressed by a single firm. Instead, some groups chose problems at a national-level (e.g., unemployment in Spain, educational system of South Africa). This "scoping" led to rather superficial discussions and difficulties for those groups in identifying specific factors that would limit their solution. We took this observation forward and more explicitly discussed the importance of problem scoping for 2017. The second lesson learned was related to the requirement to discuss *influences* on solutions—many students tried to *solve* these problems, which went beyond the assignment description and again resulted in superficial ideas. As with the previous lesson, we were more explicit with students in 2017 about the focus on problem definition—and why it is important to spend so much time and energy on that single step.

Working with a Global Team

Another longer-term assignment helped students explore what it might be like to work on a global engineering team. Students were placed in small groups, and each person was assigned a country from a different region of the world (e.g., one team had members assigned Egypt, South Korea, the United Kingdom, Saudi Arabia, Colombia, and Indonesia). The students assumed the role of managers of an international team of engineers from their assigned countries and had to determine how to lead the team effectively. In the first part of the project, each group identified questions they could ask to learn about the cultural and business practices in their countries. Each student then located and communicated with an engineer from their assigned country to discuss those questions. Students wrote one-page summaries of their conversations and then worked in their groups to identify similarities and differences between the countries they represented. The final deliverable of the project was a plan outlining three strategies that the group would use as managers to ensure that their global engineering team would work effectively together, using supporting examples from their conversations with engineers.

Many students referenced this project in their final reflections on the course. Talking with an engineer from another country was a memorable and meaningful experience for students and may open the door for new questions about how engineering work varies between countries. This project did include some logistical challenges in helping students identify professional engineers from a wide range of countries, which we navigated by giving plenty of time for this part of the process and encouraging students to contact many potential interviewees. Some students were able to talk to graduate students or faculty members on campus who had worked as engineers in their home countries, and others reached out to alumni working abroad. In 2017, we made some adjustments to the assignment to encourage deeper investigation, as many of the questions selected by the teams in 2016 were superficial. Rather than having students write their interview questions, we provided a list of required questions which they could supplement with additional questions if they chose. Additionally, we asked students to research their country before conducting the interview in the hope that they would be able to explore the questions in more depth during their conversations.

Final Reflection: Preparing for an Interview

After completing the international module, students wrote a final reflection essay in which they imagined that they were being interviewed for an engineering internship. Their essays addressed the following questions about the class and international module:

- What new knowledge or skills did you learn or build upon while you were abroad?
- What specific examples from the in-semester class or international module helped you develop those skills?
- How can the international experience be a value-add for my company/organization?

The purpose of this assignment was to help students reflect on their experiences as a whole and identify the knowledge and skills they developed that could transfer to their future engineering education and career. The program's alumni are often able to use this information in job interviews in the summer or fall after their return and find that being able to talk about their experience coherently gives them an advantage over other sophomores applying for internships.

In addition to being a longer assignment for students, data analysis was more time consuming for this assessment. We coded essays for the 2016 cohort and identified several common themes in what students said they learned from the program, shown in Table 7. One key take-away from our analysis is that a majority (57%) of students described a situation where they needed to communicate with someone who did not speak English as a meaningful experience in the program. Many of these students discussed improvements in their communication skills as their key learning, making "communication" the most common code from the essays. Responses in this theme focused on picking up phrases in a foreign language or using body language, as described by this student:

> *"You have to be good at interacting with people in order to get anything you want in a country where nobody speaks your language and you don't speak the native language. Body language is beyond important, and being able to control the tone of one's voice during interactions is surprisingly important."*

Other students felt that their cross-cultural communication experiences increased their willingness to approach new and unfamiliar situations. One student put it this way:

> *"Being in these kinds of situations made me realize that no matter how dreadful a situation may seem, one can always make it out in the end. I used try to avoid uncomfortable situations, but now I am much more open to them."*

Similarly, other students described how their self-confidence increased after they successfully navigated a cross-cultural communication situation, including one student who said:

> *"Because I had to be so responsible, I now feel a lot more independent. I feel a lot more confident in my capabilities to handle situations. I have a tendency to question myself, but now I realize how much more I can do on my own."*

A smaller number of students extrapolated from these cross-cultural experiences to reflect on what it must be like for international residents living in the United States. These students discussed an increase in empathy for people living outside their home country, as described by this student:

> *"One piece of wisdom the whole experience imparted upon me was the value of compassion for people in foreign situations. Not only did we discuss real life problems*

pertaining to this in the class (such as the refugee crisis), but I was able to first-handedly experience feeling helpless in a foreign culture."

These results indicate that students can take different lessons from the same cross-cultural communication experience. Because many students focused on the literal applications of their experience (e.g., improved ability to use body language) rather than the broader implications (e.g., self-confidence or empathy), we may consider changing the prompts to encourage deeper reflection in the final essay. Having identified cross-cultural communication experiences as significant learning opportunities for students, the program can more intentionally prepare students for these experiences (e.g., placing more emphasis on foreign language).

Table 7. Coded responses from students' Preparing for an Interview assessment

Code	China	DR	Europe
communication	87%	44%	52%
cultural differences	52%	52%	36%
adaptability	26%	26%	58%
different engineering practices	17%	37%	52%
facing new/unfamiliar situations	43%	19%	27%
respect for other cultures	22%	26%	24%
pre-trip preparation	39%	19%	12%
global perspective	26%	22%	15%
learning from the culture	9%	37%	15%
self-confidence	13%	19%	24%
design based on listening	22%	30%	6%
teamwork	4%	30%	12%
what we have in common	30%	7%	6%
global problem solving skills	9%	15%	12%
curiosity/adventure	17%	15%	3%
better together	9%	7%	9%
empathy for internationals in US	9%	4%	9%
impact of solutions	4%	11%	6%
American superiority	9%	7%	3%
contextual influences on engineering	0%	7%	9%
time management	4%	0%	9%
career goals	0%	4%	6%
ethical responsibility	0%	4%	6%
# Student Essays	23	27	33

Key
>= 50%
25-49% students
10-24% students
5-10% students
< %5 students

We also compared codes across tracks. Some codes, such as "communication" and "cultural differences" were common across tracks, but others varied significantly, possibly because of variations in the trip activities. For example, the Europe track saw higher incidence of the "adaptability" code, likely because of some logistics challenges experienced on that trip, which illuminated the complexity of foreign travel. Students on the China track had the opportunity to meet with Chinese college students, resulting in their writing about how much they have in common with people in China. The Dominican Republic track is built around a service project, which led students to write about teamwork and how much they learned from working closely with locals in the community. Using these results, we can begin to be more intentional in our international module planning based on the lessons we hope that students will be able to take away from the program's experience. If one track produced a learning opportunity especially well, we can try to incorporate similar experiences on the other tracks. Moreover, we can accentuate to students during recruitment each year the differences in learning opportunities that each track affords.

Conclusion

Multiple reports suggest that the engineering work of the future will be conducted by globally diverse teams for globally diverse customers; engineers will be required to communicate across political and cultural boundaries. To prepare students to enter the workforce, engineering programs should seek to educate "global engineers" and integrate global competence across curricula. However, it can be quite challenging to assess the impact of different interventions on students' development of this learning outcome. We positioned our paper to be a pragmatic discussion of the kinds of assessments that our team has used to demonstrate the impact of a Spring semester global engineering course followed by a short-term study abroad module. These assessments have all been carried out within the same semester, and so other program leaders or faculty members can determine the extent to which their resources, class time, and data analysis time will allow them to adopt different techniques. We hope the grouping of assessments into Quick Hitters, More In-Depth, and Longer Projects will help readers recognize differences in the time investment for both students and instructors. Additionally, each assessment seeks to generate different kinds of data for us to determine how our program meets its multiple learning objectives. Other program leaders or faculty should map the appropriate suite of assessments their unique set of learning objectives.

Another key lesson learned from implementing these assessments is that collected data should not be put into a "black box"—it must be acted upon in a transparent way. We have been extremely intentional in learning from our assessment data and making tweaks to the program in subsequent years. Students will take such assessments much more seriously—even if they are ungraded—if instructors are explicit about how the previous cohort's assessment data were used to make adjustments in students' experiences. We tell our students, "Here is what we learned from these assessments last year. And here is how we are adjusting the experience for you this year." Closing that feedback loop is essential, otherwise efforts to assess programs or classes like this is are fairly fruitless. Moving forward, our team will continue administering the short-term assessments described in this paper, making appropriate tweaks to the program each year. We have also developed medium-term (i.e., over the course of the college experience) and long-term (i.e., into students' careers) objectives for the program. We are currently undergoing data collection on the medium-term timescale and are looking forward to learning from those findings to continue enhancing Virginia Tech's Rising Sophomore Abroad Program.

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