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Growing Intercultural Global Energy Leaders

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Growing Intercultural Global Energy Leaders

Abstract

The *Growing Intercultural Global Energy Leaders* (GIGEL) Program, a 7-week summer certificate program, was developed to create a virtual learning opportunity for graduate students and postdoctoral scholars working at three energy centers: Center for Innovative and Strategic Transformation of Alkane Resources (CISTAR, USA), Resource Centre for Greenhouse Gas Innovation (RCGI, Brazil), and Center for Innovation on New Energies (CINE, Brazil). The National Science Foundation's Center-to-Center grant was funded to develop across these energy centers transformative technologies for decarbonization.

The overarching goal of the GIGEL program was to grow the graduate students' global engineering skills, resulting in more enjoyable and productive collaborations and interactions with their international colleagues. In keeping with research on intercultural competency, the program was designed to build intercultural awareness and skills, forge international personal and professional connections, and encourage thinking about the global energy landscape—with a special focus on Brazil and the U.S,

Twenty-three graduate students (12 from the U.S. and 11 from Brazil) completed all GIGEL program requirements in Summer 2022. The design of the program included: 1. asynchronous learning of online modules on Brightspace (an online learning platform); 2. five LIVE Zoom sessions, and 3. readings and assignments on Country Navigator (an online intercultural learning program).

We built the intercultural awareness part of the program using, in part, material from Purdue's *Center for Intercultural Learning, Mentorship, Assessment, and Research* (CILMAR), specifically their *Growing Learning Understanding Everyone* (GLUE) curriculum, and with the help and direction of GIGEL's co-instructor, Dr. Dan Jones, Senior Intercultural Learning Specialist at CILMAR. Survey results showed *strong* participant agreement with each program goal:

1. Provided an opportunity to work on one's intercultural awareness and skills;
2. Helped me think about being a future intercultural global energy leader;
3. Will help me have more enjoyable and productive future international research collaborations/interactions; and,
4. Allowed me to make some initial personal and professional connections.

Participants also rated as *good* or *excellent* the quality of the program content and the quality of breakout room conversations. Additionally, consensual themes captured by program participant comments, and actions taken to improve their experience, will be widely shared. As future leaders in the field of energy, the U.S. and Brazilian graduate students and postdoctoral scholars were challenged to think about how they can help to achieve global energy solutions that serve all people as the world transitions to less toxic, and cleaner, energy future. The GIGEL certificate program was a good beginning to an intercultural exchange between energy research centers in the U.S. and Brazil, and we also hope it is a good beginning to a satisfying and lifelong intercultural journey for the GIGEL participants.

Introduction

Our goal with the Growing Intercultural Global Energy Leaders (GIGEL) summer certificate program was to create a virtual intercultural learning opportunity for graduate students in the National Science Foundation's (NSF's) Engineering Research Center for Innovative and Strategic Transformation of Alkane Resources, CISTAR, in the U.S., and graduate students in two energy centers in Brazil: the Research Centre for Greenhouse Gas Innovation (RCGI) and the Center for Innovation on New Energies (CINE). These three centers are collaborating to share their expertise in research areas and help lower the global carbon footprint as the technology and infrastructure is being developed for renewable energy sources (https://cistar.us/c2c-supplement-grant).

Context for the Creation of the GIGEL Program

The purpose of the GIGEL program was to strengthen the Center-to-Center (C2C) collaboration between CISTAR, RCGI and CINE (see the below Figure 1). This collaboration was made possible with supplementary funding from NSF and the Brazilian São Paulo Research Foundation (FAPESP), the foundation that supports research in the state of São Paulo.

Figure 1: Three Energy Partners and their Associated Funding Agencies

The content of the GIGEL program was created by CISTAR's Director of Assess and Societal Impacts, Dr. Denise Driscoll, and a Senior Intercultural Learning Specialist at Purdue, Dr. Dan Jones, to address the intercultural competency goals outlined in the C2C grant. The graduate students were told that for the purposes of the 7-weeks, our roles were less "instructors" and more "intercultural mentors."

In keeping with research on intercultural competency in engineering [1, 2], the program was designed to build intercultural awareness and skills, forge international personal and professional connections, as well as encourage thinking about the global energy landscape. Some of the specific research literatures taught during the GIGEL program included those on cultural intelligence [3], global dexterity [4], teaming well [5], cognitive bias detection [6], and the intercultural development continuum [7]. What was unique about the GIGEL program was that the graduate students could learn something about intercultural competency and then examine it for what implications it might have for the field of energy, a research interest they all had in common.

A second unique aspect of the virtual GIGEL program was that some of the graduate students could expect to, eventually, meet in person as there were student exchanges taking place and international conferences they were attending. In fact, one graduate student who came to the U.S.

told me it was reassuring because at least he had gotten to know several GIGEL participants from the U.S. virtually, and so felt he knew them *in a way* when meeting them for the first time in person. He also better understood some of the cultural differences, and consequently didn't take some things personally that he may have before. These are important elements to consider in deciding whether the GIGEL has value for your graduate students and postdoctoral scholars.

GIGEL Program Participants

GIGEL participants were primarily recruited through the faculty engaged in the C2C grant, as well as faculty who were active across the three centers. Thus, the GIGEL participants were predominantly chemical engineering graduate students, but with a few in other engineering fields (e.g., materials engineering), and a few who were chemistry graduate students. Although about ¼ of the GIGEL participants were from Brazil, and about ¼ from the U.S., the remaining ½ of the participants were from all around the world (international students). These GIGEL participants were mostly traditional-age graduate students (late 20s) and about 50% were female.

When the GIGEL program was first advertised, there seemed to be little enthusiasm from the CISTAR graduate students to take a certificate program, especially one that was not focused on technical skill-building. There were several faculty who stepped in to recommend it, however, and advocated for its usefulness given not only the C2C grant, but the growth in the international nature of research teams increasingly occurring in engineering and science [8].

When asked to write about what motivated them to grow their intercultural skills in Week 1, there was widespread acknowledgment by the graduate students of the value of teaming well with people across national boundaries on a topic such as the challenges of the energy transition. Given the international nature of many engineering programs, already, it wasn't surprising how often their motivation for taking the GIGEL program was how interconnected our world is, and that the future will be even more so. Many graduate students talked about the need for energy to be available for all people and that it should be a common goal among engineers and scientists to work to make that happen while trying to reduce its negative impact on the world.

The program goals laid out in the beginning for the graduate students taking the GIGEL program were: 1. Building their intercultural awareness and skills (in the context of why intercultural skills are critical to being a global energy leader); 2. Helping them think about being a future global energy leader while learning about culture and the global energy landscape; 3. Forging personal and professional connections with other GIGEL graduate students and guest speakers; and 4. Having more enjoyable and productive future international research collaborations/interactions.

The program was pass/fail, with a certificate awarded once all assignments were complete. Twenty-three graduate student participants– ½ from a U.S. energy center, CISTAR, and ½ from Brazil energy centers (RCGI, CINE)– received a final certificate. Twenty of the 23 GIGEL participants (Ps) completed the survey (87% return rate), which was excellent.

Design of the Program

The modules and live sessions were designed to get graduate students to think about how intercultural development, and one's primary culture, affects thoughts and actions toward 1. collaboration, 2. research, and 3. the future of energy. Thus, consistent with research on growing

intercultural competency in engineering, the program's focus was on *self-discovery* (i.e., learning to be more culturally savvy, building better intercultural skills with "active listening" and "building empathy" techniques), all in the context of understanding why intercultural skills are critical to being a global energy leader.

There were 7 modules - with videos, short articles, and guided activities - created on Brightspace, a learning management system, for students to complete asynchronously before attending one-hour "live" in-person virtual Zoom sessions. The approach was intended to build intercultural leadership skills by giving the GIGEL participants access to several different theoretical frameworks so that they could build a language for thinking about intercultural issues in the context of being a global energy leader. Here is the introductory summary of each week in Table 1 to illustrate.

Table 1: General Topics Explored for Each Week

Week	General Topics
1	Exploring motivations for learning about intercultural issues and how it affects your thoughts about the future of energy and the research that you do.
2	Learning about different orientations toward cultural differences based on the Intercultural Development Continuum (e.g., denial, minimization, acceptance), your score, and understanding how it leads to different thoughts about reducing our carbon footprint, recycling, response to weather changes, etc.
3	Form a more complex view of culture through metaphors, hidden rules, and cultural worldview frameworks; explore Country Navigator's *WorldPrism Profile* and reflect on how this impacts your collaborating with people from different countries on energy.
4	Explore the way you deal with differences by developing your awareness of your own unexamined assumptions and better understand how to navigate cross cultural conversations by watching pairs of graduate students talk about how they navigate studying and living abroad
5	Gain an understanding of how to shift perspectives, other perspective take, actively listen, and empathize with others, especially when they have a different worldview.
6	Learn more about how to be uncomfortable and deal with uncertainty and ambiguity as communication is often interpreted through a cultural lens. Country Navigator's *flight packs* help us view other cultures as well as our own more objectively.
7	Consider the impact of your intercultural development and think about how it might affect your future personal and professional lives. Develop a plan for future learning and how you will continue to make progress in your intercultural journey, especially as a future leader in energy.

For these live sessions, the first ½ hour was reserved to discuss the content of the learning module with the instructors and with other graduate students in breakout rooms; the second ½ hour was reserved to listen to invited speakers and then ask them questions.[1]

Also, each graduate student participant received a year-long license to *Country Navigator*, a dynamic, interactive online tool for improving intercultural knowledge and engagement (https://www.countrynavigator.com/), with audio and video content for easy learning on both general topics related to *Cultural Intelligence*, as well as country-specific material on wide-ranging topics (i.e., politics to business etiquette). For example, graduate students learned about Brazil and the US by looking at videos and flight packs about their own and the other country, providing a useful insider vs. outsider perspective to make sure they understood that such learning is usually

[1]Thanks to Drs. Fabio Ribeiro, Juarez Da Silva, Abhaya Datye, and Brian Tackett, for being GIGEL speakers.

only useful as generalities and doesn't inform you, specifically, as to how a given individual will necessarily act.

The *Country Navigator* is also a nuanced instrument that will generally appeal to students who are often on-the-go but want to brush up on country-specific knowledge as they travel and/or work with other engineers from around the globe. Also, the team self-evaluation component of *Country Navigator* added several interesting ways for graduate students to think about how to more effectively collaborate with team members from cultures very different than their own.

Consistent with previous research, as well, we thought participants would benefit from a pre- and post- *Intercultural Developmental Inventory (IDI) assessment*. Group scores were shared and explained during a live session; an additional 9 participants met individually with Dr. Driscoll, an IDI certified administrator, to learn their individual pre- and post-IDI scores and to be debriefed (45-minute sessions). Although no statistical tests were conducted on such a small number of participants, there was an increase in perceived orientation (+5.87 difference from pre- to post-test) and developmental orientation (+12.38 difference from pre- to post-test), with a Gap (P-0) = -6.5. In a class of only seven weeks, we did not place much emphasis on these findings, but instead talked about the valuable insights gained by learning about the developmental continuum and by being individually debriefed. There was also some feedback from students that they appreciated learning about the primary orientations (denial, polarization, minimization, acceptance, and adaptation) and what they could do work to become more accepting.

Program Outcomes

In response to the anonymous survey, the graduate students overwhelmingly agreed that:

1. The four program goals were met (Table 2, left two columns) and
2. The program was "good" or "excellent" (Table 2, right two columns).

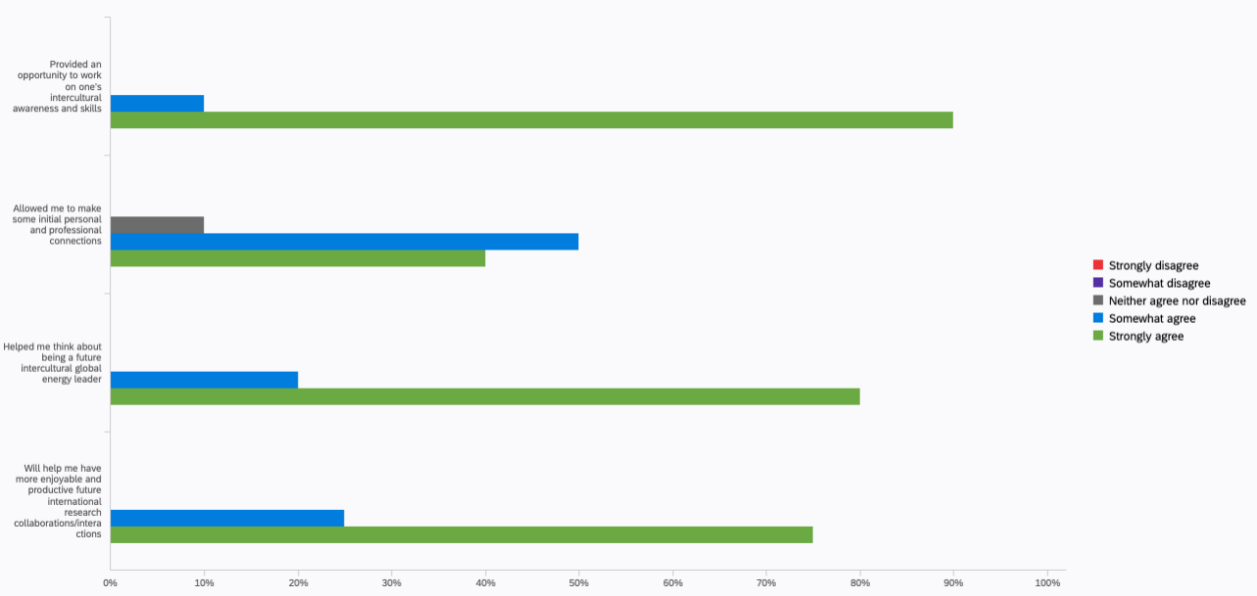
For a first-time program offering, this feedback exceeded our expectations but is consistent with how wholeheartedly the graduate students engaged with the program content and responded to online exercises and activities.

Table 2: Meeting Goals of Program

% Agreeing Program Met the Goal		% Rating Program Quality Good or Excellent	
Provided an opportunity to work on one's intercultural awareness and skills	100%	Quality of the Content	100%
Allowed me to make some initial personal and professional connections	90%	Quality of the Breakout Room Conversations	90%
Helped me think about being a future intercultural global energy leader	100%	Quality of the Intercultural Mentors	95%
Will help me have more enjoyable and productive future international research collaborations and interactions	100%	Quality of the Invited Speakers	90%

Goals. As can be seen with the distribution of the responses to the goals (see Figure 2), there was no graduate student strongly disagreeing or somewhat disagreeing that the goals were met. Across all four questions, the responses are overwhelmingly positive, with "somewhat agree" and "strongly agree" (the blue and green bars) capturing almost all of the responses.

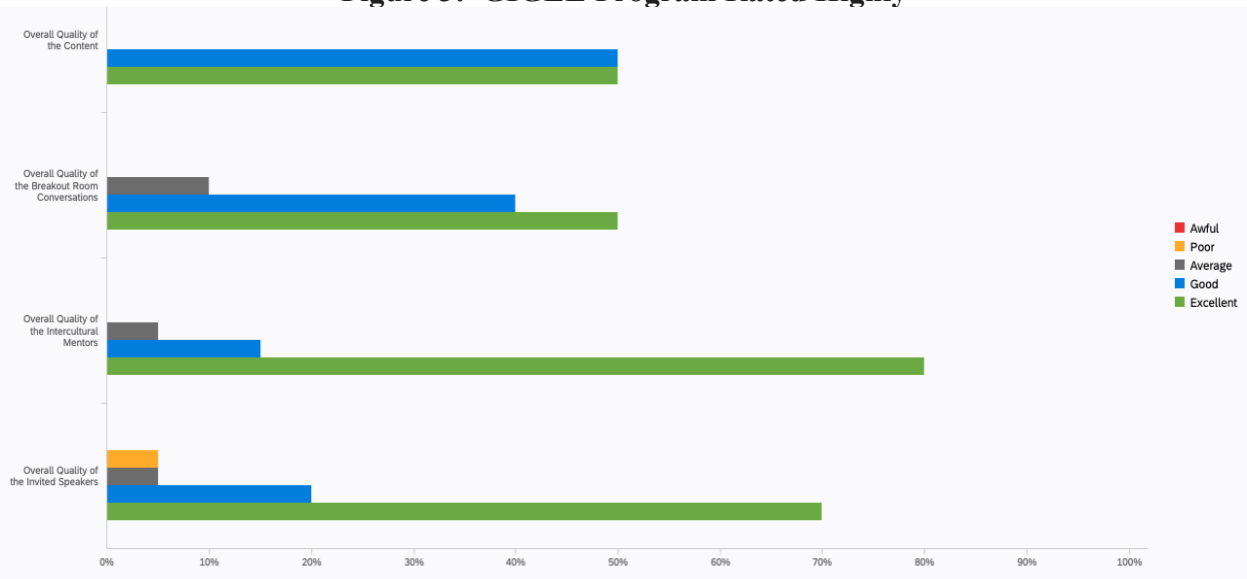
Figure 2: GIGEL Program Met Goals



A slight drop in the percentages of agreement with the last goal of making interpersonal and professional connections (10% neither agreeing or disagreeing) was clarified by comments that made it clear that some GIGEL graduate students wanted more time to interact with one another and to discuss what they were learning. In future, we will increase the amount of time spent in Live virtual sessions.

Program Quality. Across all four questions, the responses are overwhelmingly positive, with "good" and "excellent" capturing the majority of the responses to the program components (see the blue and green bars in Figure 3).

Figure 3: GIGEL Program Rated Highly



A slight drop in the ratings of quality was clarified by comments about wanting more time in breakout rooms and wanting the invited speakers to focus more on the intersection of intercultural issues and their research. In addition to these ratings of program goals and program quality, there were four open ended questions (liked, disliked, valuable take-aways, and recommend the program) that helped us to better understand what many of the graduate students were thinking about the GIGEL program:

1. **What Was Liked about the GIGEL?**

Seventeen GIGEL participants commented, with the main themes being: 1. How much they valued learning about intercultural skills, 2. How the program is needed if one is going to be a global energy leader, and 3. How much they learned from talking to graduate students and speakers from other countries. Here are three quotes to give a sense of the comments (which were all in this vein):

- *"It was an excellent opportunity to get to know other cultures and get to know myself better, as I was able to relate in environments outside my comfort zone. I believe that GIGEL was one of the most important moments of my career and the knowledge I acquired in the program will be very useful in my professional and personal life."*
- *"Intercultural competence is something I never thought we could develop, so I am thankful for this experience. It made me think more about previous interactions I had with people from different cultures and how difficult it was in the beginning. If I was more self-aware about these differences and knew about the importance of learning about other cultures, I would probably have adapted much more easily.*
- *I enjoyed the videos, the tools we had a chance to explore (such as the Country Navigator); I also found the exercises and group discussions very interesting, and the live sessions were an opportunity to discuss with my colleagues about the different topics we explored during GIGEL."*

2. **What Was Disliked about the GIGEL?**

Seventeen GIGEL participants commented, with the main themes being: 1. How they wanted to interact more with one another (breakout rooms longer; more live sessions) and 2. How they wanted more emphasis on energy and guest speakers who spoke to the material they were learning. Here are some quotes so you can get a sense of the comments (which are all in this vein):

- *"I think the program could be a little longer and we could have more live meetings to discuss further about the energy topic with our colleagues. GIGEL was very interesting, that's why I think we could explore it for a little longer."*
- *I think that would be interesting having less offline activities and more live sessions. Although the material was very good and brought interesting content, I felt like the live discussions were more enriching than the tasks. So, as a suggestion, I believe that some of the discussions we had in Brightspace should be done in the live sessions.*

3. **Valuable Take Aways**

Sixteen GIGEL participants commented what was a valuable take away. Comments were positive, but idiosyncratic. Here are some examples that are representative of the comments made:

- *"A valuable take away from this program for me was recognizing that though there may be common threads among people, cultural differences do exist and should not be overlooked or minimized. In doing so we can neglect or, worse, refuse the subtle characteristics that make a culture so rich. It really helped me to better understand that trying to find commonality among all people can itself be a barrier to my growth and understanding as a person living in a multicultural world."*
- *"I learnt to be more self-aware of the intercultural differences in the world, be more open-minded to change and about the importance of intercultural competence to the scientific career"*
- *"My valuable take-away was about being a better and more patient listener. Also, I feel that I have evolved in terms of understanding other cultures. Finally, I'm more encouraged to travel abroad."*
- *"A valuable take-away is that we are not as developed in terms of intercultural skills as we think we are. This is something that we should always keep improving in order to better collaborate with people from other cultures.*

4. **Recommend the Program**

When asked, "Would you recommend this program to other graduate students?" 15 of the 17 GIGEL participants (88%) answered "yes", and 2 participants (12%) responded "maybe" (with one of these participants answering "maybe" simply qualifying that a graduate student would need to have the time to take the program).

There were 8 comments made; here are examples that capture the gist of the comments:

- *"I got a lot out of this program. I support the mission it is trying to accomplish, and I think anyone could benefit from understanding the way we perceive, compartmentalize, and respond to differences in culture."*
- *"I think this is a valuable skill and one you would not always effectively master without guidance."*
- *"Yes, I recommend this program to every graduate student and also my friends and family. Beyond the energy leadership case, intercultural competence is an ability that all should have."*

Challenges and Future Plans

For teaching this GIGEL certificate program for the first time, it was surprisingly well-received and met the four goals we wanted to achieve. Also, thanks to the high return rate of the survey (87%) and the largely consensual feedback about what was disliked/needing improvement, the GIGEL program will be re-designed to better meet the needs of future graduate student participants by lengthening the Live sessions and increasingly the relevancy of guest speakers to what was learned online by them the prior week.

Important to the context of thinking about the outcomes of the GIGEL program is that it was offered to provide a *virtual* intercultural learning opportunity for all the graduate students after several years of not being able to travel in-person because of COVID-related travel restrictions.

When we teach it again in Summer 2025, we will be interested in seeing whether there is more 'burn out' with a virtual program when so many other offerings are now virtual and when opportunities to travel are available.

CISTAR plans to offer a certificate program in Summer 2025 when there are sufficient numbers of new graduate students across the centers to form another cohort of 20-25 graduate students. There seems to be a real interest in a next step program offering that addresses the intersection between the ongoing research in the centers, how that research makes sense in the context of a global energy landscape, and what implications all of it has for environmental justice issues. The most significant change planned for the certificate program will be to co-teach it with an engineering faculty member who can help the graduate students better understand how their research makes sense in the context of a global energy landscape, and what implications all of what they have learned over the weeks means for their research and their role as a future energy leader.

Conclusion

The U.S. and Brazilian graduate students were challenged to think about the influence their culture has on their thinking, perspective, and approach (how they do science), the value of working with international collaborators, and how working together on intercultural teams is necessary, productive, leads to new insights, and can be enjoyable when one has a better understanding of the influence of culture. For most engineers, working on international teams will be a part of their professional lives and so it makes sense to become more globally dexterous [4] and, as Molinsky defines it, be able to "adapt your behavior – smoothly and successfully – to the demands of a new culture, without losing yourself in the process."

It is hoped that the intercultural journey the GIGEL participants began will continue to influence them as they work to solve the global problems facing us with the energy transition. The final discussion board question that the GIGEL participants answered and discussed in Week 7 with one another was:

"As a future leader in the field of energy, what can you do to achieve more equitable energy solutions and environmental justice for all people as we focus on how to transition to cleaner energy sources?"

When offering the GIGEL certificate program again, the hope is to do more to encourage graduate students to use their technical and scientific training to help advance energy justice goals around the world; specifically, how does their research makes sense in the context of a global energy landscape and what implications does it have have for issues such as democratization of the energy burden, environmental exposures, and access to clean energy technology. Similar programs need to be taught so that "engineering for the people" becomes a natural part of the research process as new technologies are conceived and developed.

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