Developing Culturally Competent Engineers: Enhancing First-Year Engineering Curriculum

Chloe Mann[1]
Emily Fitzpatrick[2]
Dr. Jessica Deters[2]

[1] Department of Civil and Environmental Engineering
[2] Department of Mechanical and Materials Engineering

RESEARCH QUESTION

As teaching assistants and professors in Interpersonal Leadership, what measures can we implement to foster cultural understanding and promote the cultivation of culturally competent engineers?

BACKGROUND & PURPOSE

This project aimed to reconstruct a lecture and lab for the cross-cultural communication unit in a first-year engineering course, ENGR 100: Interpersonal Skills for Engineering Leaders.

Engineering students who receive their education and training in the United States frequently find themselves in a global arena, where they may face stiff competition, often due to a deficiency in essential soft skills such as cross-cultural and linguistic proficiency (Vitto, 2008). This realization underscores our emphasis on developing cross-cultural competence. As aspiring engineers, it is imperative to not only acknowledge the significance of intercultural communication but also to actively cultivate an awareness and respect for diverse cultural perspectives.

Cross-cultural competence was identified as a probable deficiency in both the instructional approach of ENGR 100 and the students' skill set. By delivering a lecture and assigning various teaching assistants to conduct a lab 10+ lab activities, we aim to foster a more culturally adept cohort of engineers within ENGR 100. Moving forward, this study will progress by gathering feedback from multiple teaching assistants to assess the outcomes of the cross-cultural communication initiative.

RESULTS: LECTURE

Overall Participation

- The lectures surpassed the expectations of the research team.
- Interacting with the students encouraged fresh perspectives on various topics.
- Active participation was evident with readily raised hands, fostering stimulating conversations in the first lecture.
- In the subsequent session held in the late afternoon, participation waned, likely due to the timing.
- Achieving the intended participation level was not challenging, as the overall engagement during the lectures were commendable.

Comprehension

- The lecture content was effectively comprehended, evidenced by the students' contributions regarding the components essential for an engineer's Cultural Onion and Dimensions, seen in Figures 1 and 2.
- Our designed activity not only incorporated the terminology covered in the lecture but also provided valuable practice for the students before engaging in laboratory exercises.
- Some students encountered difficulties in deciphering the cultural dimensions during the practical application.

Lecture/Lab Correlation

- In comparison to prior lectures, the lecture and lab developed for the cross-cultural communication unit displayed a significant correlation.
- While the lecture focused on understanding the concept of culture, the lab emphasized the practical application of cultural insights to decipher various cultures.
- This approach not only taught the definition of culture but also provided students with the opportunity to actively engage with diverse perspectives, fostering mutual respect for the values and traditions of other cultures.

Hofstede's Cultural Onion and Hofstede's Cultural Dimensions

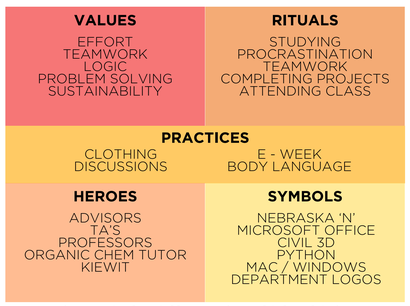

Figure 1: Student Self-Perceptions of Cultural Onion

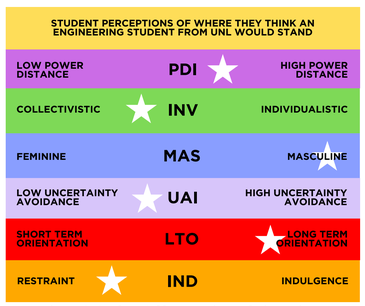

Figure 2: Student Self-Perceptions of Dimensions

LECTURE AND LAB DEVELOPMENT

Lecture Devlopment

Lecture Creation

- In Week 3, the lecture originally intended to cover goal setting, culture, as well as conflict resolution; however, the research team proposed a lecture that delves into cross-cultural communication, a focus not previously explored in the ENGR 100 course.
- Our aim was to equip students with the essential knowledge of communicating effectively across diverse cultures, starting with a comprehensive understanding of the concept of culture and its components.
- Notably, Hofstede's cultural onion (Poppenritsch, 2012) and cultural dimensions (Hofstede, 2011) emerged as pivotal frameworks for unpacking the multifaceted nature of culture.

Lecture Presentation

- Following the lecture's development, the research team incorporated feedback provided by our mentors, Dr. Stu Bernstein and Professor Karen Stelling, to finalize the content.
- Subsequently, following a collaborative session with our mentors, the research team engaged in a brainstorming session to devise innovative methods to encourage lively interactions among students and presenters, aiming to enrich the audience's comprehension of the subject matter.
- Research from US Department of Education indicates that increased verbal engagement during lectures can significantly enhance students' understanding of the material.

Lecture Analysis

- Following the completion of the initial lecture, the research team conducted self-reflections on our performance before proceeding to prepare for the subsequent lecture.
- Subsequent to the delivery of both lectures, we sought feedback from our supervising professors and fellow teaching assistants to gain valuable insights. In addition to seeking feedback from our peers, we evaluated changes in student participation levels compared to previous semesters' lectures.
- Incorporating the feedback received from our mentors and peers, the research team made necessary adjustments to the lab activities and lecture slides intended for the upcoming semester.

Hofstede's Cultural Onion

Inner Rings: Less Likely to Change
Outer Rings: More Likely to Change

VALUES represent cultural norms that are the most unlikely to change. Even if this norm seems outdated, it can still play a role in the present.

RITUALS represent cultural norms that deal with day-to-day life. These habits are somewhat likely to change over time.

HEROS represent popular people or characters who have an impact on culture; they can be real or fictional.

SYMBOLS represent trends that are ever changing in a culture.

PRACTICES: All three layers can be trained and learned through practices except for the core: the inner cultural values.

Understanding the "inner layers" of cultural will help lay a foundation to continue to develop cross cultural communcation skills.

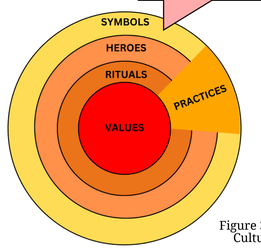

Figure 3: Hofstede's Cultural Onion

Hofstede's Cultural Dimensions

LOW POWER DISTANCE	PDI	HIGH POWER DISTANCE	Power distance delineates the hierarchical relationships among individuals.
COLLECTIVISTIC	INV	INDIVIDUALISTIC	Collectivistic individuals typically associate closely with family or social groups, while individualistic individuals tend to distinguish themselves from others.
FEMININE	MAS	MASCULINE	Masculinity emphasizes traits like ambition, wealth acquisition, and distinct gender roles, while femininity prioritizes nurturing and empathetic behaviors.
LOW UNCERTAINTY AVOIDANCE	UAI	HIGH UNCERTAINTY AVOIDANCE	This dimension gauges the level of apprehension and unease within a cultural context.
SHORT TERM ORIENTATION	LTO	LONG TERM ORIENTATION	This dimension reflects the emphasis placed on future prospects versus past traditions.
RESTRAINT	IND	INDULGENCE	Indulgence centers on the pursuit of happiness across cultures. Societies categorized as indulgent prioritize fulfilling human needs and desires, while restrained societies value self-control and adherence to societal norms.

Lab Development

Lab Creation

- In the lab activity, the research team chose to develop an exercise aimed at applying cross-cultural communication skills.
- Drawing from the framework outlined in Davis et al (2019), the research team incorporated Hofstede's Cultural Dimensions into a practical exercise involving two distinct groups representing different "cultures."

- The objective of the activity was to engage in a competition to decipher the other group's culture in the shortest time possible.
- This exercise not only facilitates interaction with diverse cultures but also imparts lessons on fostering respect for cultural differences.
- The presentation of this activity took place during a collective meeting with all ENGR 100 Teaching Assistants, providing an opportunity to address queries and inform the teaching assistants of their discretion to modify the cultures or game rules according to their lab class requirements.

Example

Culture A (TRIAL RUN)	
Rule	**What if the rule is broken?**
People with glasses are in power and sit on desks and stare at newcomers without speaking. No one looks at individuals sitting on desks.	No one speaks if newcomer attempts to speak or interact with an individual sitting on the desk.
Posture should be impeccably perfect, if not better. All members of Culture A should stand up very straight with snobbish body language.	Members should gesture to newcomers to improve their posture by rolling their shoulders back even more.

Culture B (TRIAL RUN)	
Rule	**What if the rule is broken?**
Everyone has shared power, and all members are very talkative and friendly. Every conversation should begin with a firm handshake and say "Hi, hello, how are you doing?" and responses should be "Hi, hello, I am well, how are you doing?"	Those who are not talkative are asked why they are not talking. All members should stick out their hand to be shook. If they do not give the correct response to "Hi, hello, how are you doing?" repeat the question until they get the hint.
All conversations should be about family and friends. Newcomers should be greeted with questions regarding family and friends. All members are expected to strictly discuss family and friends.	If a newcomer asks a question or makes a comment about something other than family and friends, members are to ask them "why don't you care about the people that really matter?"

RESULTS: LAB

Overall Participation

- The outcomes of the lab exceeded the expectations of the research team. By integrating a spirit of friendly competition, we cultivated an engaging environment where student participation was voluntary rather than obligatory.
- The approach involved two rounds of cultural competitions followed by reflective inquiries at the conclusion of the lab session. While the competitive element enlivened the lab, the post-activity questions required refinement to sustain engagement until the end.
- Feedback from fellow teaching assistants was consistently favorable, indicating a successful implementation of the activity.

Hofstede's Dimensions

- The fundamental principles governing a culture are intricately linked to Hofstede's dimensions, illustrating how various cultures often gravitate towards opposite ends of the spectrum.
- Through practice, students acquired the skill of identifying pivotal cues within these dimensions to assist them in deciphering the cultural nuances of other teams.

FUTURE WORK

- The Institutional Review Board has approved a survey aimed at exploring the perspectives of the teaching assistants who facilitated the lab activities.
  - This survey will shed light on the various lab sessions conducted, providing valuable insights into the success of the lab activities we designed. By receiving feedback from the teaching assistants, we can not only acknowledge positive aspects but also leverage constructive criticism to refine the lab activities for future semesters.
- The perspectives of the teaching assistants offer a unique viewpoint, allowing us to gain insights into unseen lab activities.
  - Examining how different teaching assistants approached and executed the lab activities will be enlightening in determining successful strategies and areas that may need improvement.
- With the successful implementation of both the lecture and lab components, these activities will continue in future semesters to nurture culturally competent engineers.
- In addition to crafting a detailed paper delving into the teaching assistants' perspectives, we aim to document the process of developing the lecture and lab activities to provide a comprehensive overview of the effort invested.

ACKNOWLEDGEMENTS

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