



Disruptions to traditional global engineering education programs has led educators to seek digitization solutions to help future engineers build global perspectives that can prepare them for a post-COVID labor market (Martel, 2020). This study explores engineering students' development of intercultural competencies within a global virtual team (GVT) program conducted by International Virtual Engineering Student Teams (InVEST) initiative at the University of Toronto.

INTRODUCTION

InVEST enables diverse students from various international universities to work together on authentic problems and engage in interactive Intercultural Competency Modules (ICM) around intercultural communication and sensitivities. We report on two iterations of the ICM curriculum delivered to multi-disciplinary engineering students engaged in collaborative virtual projects. The design of ICM curriculum was guided by the theoretical perspective of social constructivist (Koohang et al., 2009), Community of Inquiry (COI) framework (Cleveland-Innes et al., 2018), Kolb's experiential learning model (Kolb, 1984), and the Knowledge Community and Inquiry (KCI) model (Slotta et al, 2018).

BACKGROUND AND METHODS

The first ICM iteration was a successful 4-week program that produced a set of recommendations for improving future studies (Ndubuisi et al, in press). The second iteration was a 9-week program which incorporated these recommendations from the first study: (1) addition of a second "intercultural scenario"; (2) inclusion of more opportunities for intercultural experiences; (3) integration of more active learning techniques; (4) increased module duration; and (5) an increased interval between modules.

For each ICM, the students engaged in collaborative knowledge construction activities and engineering intercultural scenario exercises to gain an appreciation of their intercultural values and global perspectives. Then they reflected on their intercultural learning and experiences with virtual team members and constructed new intercultural understanding. Thereafter, students can apply the ICM concepts and co-constructed perspectives into their engineering technical projects for a deeper learning of global competencies.

	1 st Study Iteration	2 nd Study Iteration
Location of University Partners	Singapore, Canada, The Caribbean, and South Africa	Canada, Nigeria, and Brazil
Location of Industry Partners	Canada	N/A
# of Universities Represented by Students	7	3
Engineering Disciplines	Mechanical and Industrial, Civil and Transportation, Biocomputational, Biomedical, Electrical, and Computer	Chemical, Civil, Electrical
Geographic Location of Students	Singapore, The Caribbean, Canada, Zambia, Nepal, The United States, Rwanda, Burkina Faso, Tanzania, Poland, and United Arab Emirates	China, Canada, Nigeria, and Brazil

Figure 1: Overview of GVT Program Participants' Profile



The International Virtual Engineering Student Teams (InVEST) project team https://invest.utoronto.ca/





A GLOBAL VIRTUAL TEAMS APPROACH TO INCLUSIVE **ENGINEERING EDUCATION**

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Employing a mixed-methods study each approach, iteration comprised of a presurvey to gain insights into student's prior knowledge and cultural background, a post-survey to determine students' perceptions of their intercultural learning and experiences and focus group discussion for further understanding of their project experiences. The collected data from the two studies were coded, categorized, and analyzed using a content analysis method.

A. Pre-ICM Program Survey

Students did not appreciate the significance of intercultural competencies in a global virtual team environment.

- Few expressed English language concerns
- **36%** had prior experience with multicultural team working
- None identified intercultural communication as a condition for effective virtual collaboration

1. Intercultural Awareness and Understanding

- Recognized similarities in their cultures and cultural values.
- Understood the impact of culture on their worldview
- Accommodated the ideas & contributions of their peers.

"team members are very patient with me, quick in thinking outside the box and respect my own contributions at all times"

4. Intercultural Communication and Sensitivities

- Promoted and respected diverse voices and worldview.
- Regularly sought clarifications
- Engaged in social interactions
- Promoted intercultural experiences in the team.

"we first wanted to make electricity but due to the community needs we decided to make gas for cooking."

REFERENCES

- Global Workplace. IGI Global.



University Of Toronto

FINDINGS

B. Post-ICM Program Survey

Students were highly satisfied with the program.

~ 97 %	Rated the sessions as "very good" or "excellent"	
> 100 %	Would recommend these sessions to others	

2. Diversity Appreciation

- Recognized and valued the diverse cultures of team members.
- Appreciated the cultures of the target project communities
- Leveraged diversity of knowledge, skills and perspectives in the team.

"the design for the project should consider the Nigeria community"

5. Social Cohesion, Trust, and Commitment

- Earned swift trust of peers.
- Fostered a sense of community
- Stayed committed to team goals.
- Strived for inclusive decision making

""we all view each other as trustworthy."

"in conflicting issues, we have ensured" that every opinion is heard then we decide as a team what is best"

• Cleveland-Innes, M., Garrison, D. R., & Vaughan, N. (2018). Implications for distance education and beyond. In M. G. Moore & W. C. Diehl (Eds.), Handbook of Distance Education. • Kolb, A. (1984). Experiential Learning: Experience as the source of learning and development: Prentice-Hall Englewood Cliffs, NJ. • Koohang, A., Riley, L., Smith, T., and Schreurs, J. (2009). E-Learning and Constructivism: From Theory to Application, Interdisciplinary Journal of E-Learning and Learning Objects, 5(1), • Martel, M. (2020). COVID-19 effects on US higher education campuses: Academic student mobility to and from China. The Institute of International Education (IIE). • Ndubuisi, A., Marzi, E., & Slotta, J. (in press) Cross-Cultural Virtual Team Projects: International Virtual Engineering Student Teams. In Developments in Virtual Learning Environments and the

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C. Post-Program Focus Group Discussions

Five themes relevant to students' learning and experiences emerged namely a) intercultural awareness and understanding, b) diversity appreciation, (c) project planning coordination, (d) intercultural and communication, and (e) social cohesion, trust, and commitment.

3. Project Planning and Coordination

- Utilized technology for managing project activities - meetings, tasks etc.
- difference Managed time zone challenges.
- Split large team into sub-groups

" support each other by answering questions, providing feedback for improvement, and attending internal meetings for project discussions"

CONCLUSIONS

We found that blending global virtual team projects with ICM was a successful approach for helping engineering students gain international experience, acquire global perspectives, and enhance their technical engineering knowledge. This study is significant as it demonstrates a scalable approach for incorporating international research experiences into higher education institutions.