

## **EMBER: Bridging academic, social, and personal skills of students in transition to university**

### **Dr. Gerald Tembrevilla, McMaster University**

Gerald Tembrevilla completed his PhD in science (physics) education in the Department of Curriculum and Pedagogy, Faculty of Education at the University of British Columbia (UBC) in Vancouver, Canada in July 2020. Currently, he serves as a postdoctoral fellow for the PIVOT project, a cutting-edge revamp of the engineering curriculum in the Faculty of Engineering at McMaster University, Hamilton, Ontario, Canada. During his PhD program, he completed several research fellowships in STEM education and technology design as UBC Public Scholar Initiative Awardee, Mitacs-Canada and UBC Go Global Scholar at the University of California-Los Angeles, University of Cambridge in England, and ETH-Zurich.

### **Dr. Vincent Leung, McMaster University**

#### **Prof. Andre Phillion P.Eng., McMaster University**

André Phillion is an Associate Professor in the Department of Materials Science and Engineering and Director of the faculty's Experiential Learning Office at McMaster University, Hamilton, Canada. His research interests focus on mathematical modelling and 3D imaging of engineering metals and their manufacturing processes. The main focus of the research is to experimentally investigate and numerically simulate solidification across multiple length scales in order to develop new relationships linking heat transfer and fluid flow at the macro-scale with microstructure and defects. Dr. Phillion received his PhD from The University of British Columbia in 2007, where he combined high temperature experimental methods with multi-scale modelling to investigate casting defects in Al alloys. After completing his studies, Dr. Phillion was a post-doctoral fellow at the Ecole Polytechnique Fédérale de Lausanne, and a faculty member at UBC's Okanagan campus, before joining McMaster in 2016.

### **Dr. Melec Zeadin, McMaster University**

Melec Zeadin earned her PhD in Metabolism and Nutrition from McMaster University. She has been working as an Educational Developer at the Paul R. MacPherson Institute for Leadership, Innovation, and Excellence in Teaching since 2014 in supporting the Institutional Quality Assurance Process and more recently in leading the Teaching and Learning Grants program.

# **EMBER: Bridging academic and social skills of students in transition to university**

Gerald Tembrevilla  
Faculty of Engineering, McMaster University, Canada

Vincent Leung  
Dept. of Chemical Engineering, Faculty of Engineering, McMaster University, Canada

André Phillion  
Dept. of Materials Science and Engineering, Faculty of Engineering, McMaster University, Canada

Melec Zeadin  
Paul R. MacPherson Institute for Leadership, Innovation and Excellence in Teaching, McMaster University, Canada

## **Abstract**

This paper presents the Engineering Mentorship & Bridging Education Resources (EMBER) program to ease the transition for high school graduates coming to university as first-year students in the 2020 Fall Semester. Our overarching objective was to investigate how the EMBER program facilitated first-year engineering students' academic and social transition into the engineering community.

The data used for the analysis was gathered through an anonymous online survey (N=125) as a form of program evaluation and from student-participants' online engagement in both synchronous and asynchronous modules and sessions (N=942). Overall, 942 first-year students registered for EMBER, representing over 86% of the incoming class. Some 600 students accessed the online modules, around 550 students attended at least one live tutorial, and approximately 250 students actively engaged in the live tutorials throughout the two weeks. From the 125 survey responses collected, 96% of the students felt more prepared for first year, agreed that the modules were engaging, and would recommend EMBER to incoming first-year students.

EMBER provided incoming first-year engineering students with an opportunity to acclimate to university and online learning before the school year started. Next year, we will investigate student-participants' specific learning experiences with EMBER across the cohort's demographics to further examine how EMBER's offerings promote a successful academic, social, and personal transition into first-year engineering.

## **Introduction**

*“Having completed the program, I feel a lot more prepared to start university in general, and I am a lot less apprehensive about starting classes online.”*

*EMBER participant*

Entering university from high school is a critical transition. Identity formation is at stake [1], and the process can negatively impact wellbeing [2]. Research calls on universities to create relevant programs to support first-year undergraduate students' transition to their new university [3].

In return, several universities have presented proactive programs that develop first-year students' metacognition skills within an integrated first-year engineering curriculum [4] or created pedagogical scaffolding approaches for students to engage with fellow students, the faculty, and the industry [5]. Rutar and Mason [6] introduced first-year undergraduate students to the collaborative nature of university engineering designs by forming a learning community comprised of first-year students and students from a high school technology course.

In this paper, we present the Engineering Mentorship & Bridging Education Resources (EMBER)[7] program. It is a bridging program with a purpose of easing the transition for high school graduates joining the university as first-year students in the 2020 Fall Semester. Our overarching objective is to investigate how the EMBER program facilitated first-year engineering students' academic and social transition into the engineering community.

## **Methodology**

This section outlines the details about EMBER and describes the data gathering and analysis of the study.

## **The Context of EMBER**

EMBER was hatched when it was clearly imminent that face-to-face orientation programs and classes will be converted to fully online programming in Fall 2020 due to the pandemic.

Last year's first-year undergraduate students faced circumstances beyond compare. The seven months between March 2020 and September 2020 were trying times for such students. They missed significant milestones during their final year of high school (sports championship, in-person graduations and proms), and the first months at their chosen universities (extending up to this moment) remain fraught with academic, social, and emotional problems.

EMBER was offered a month before the start of the academic year as a tuition-free program for students entering their first year of Engineering, Bachelor of Technology, Computer Science, and Integrated Biomedical and Health Sciences programs at McMaster University. EMBER prepared students for academic success by reviewing concepts fundamental to first year via three streams: Math, Physics, and Chemistry. Not only did these streams provide a "sneak peek" into how students would be learning in university, but the streams also connected incoming students into the #FireballFamily, a community of students, faculty, staff, and alumni in the Faculty of Engineering.

EMBER provided opportunities for students to meet upper-year students as well as fellow first-year students through two weeks of live tutorials. Incoming students were introduced to the rich variety of services, resources, teams, and clubs the Faculty of Engineering offers to hasten their integration into the #FireballFamily.

### **The Details of EMBER**

EMBER offers three asynchronous online streams in Math, Physics, and Chemistry. The online streams consist of modules for students to study at their own pace and are accessed through Avenue-to-Learn (McMaster's learning management platform). Each module includes videos, virtual simulations, tests, formula sheets, and other helpful resources.

Dr. Vince Leung [8], a course instructor and the program lead for EMBER, led nine undergraduate Learning Resource Assistants (LRAs) in the development of all learning materials. This team created the content, wrote the tests, and facilitated the discussion boards. The tutorials were also mentored by LRAs. Sessions interspersed between the tutorials introduced students to clubs, teams, and services in the Faculty of Engineering. LRAs' own experience as former first-year students helped establish mentor-mentee relationships and a peer-learning atmosphere.

The synchronous modules included daily online tutorials for two weeks (August 10-21, 2020). The tutorials were offered multiple times per day and were led by the LRAs.

In total, over 140 videos and over 1000 minutes of educational content were created. The 20 modules covered 75 topics spanning the three streams mentioned above. These modules and materials will continue to be made available to the students on Avenue-to-Learn until the end of first year so they can refer to them for reference.

### **Data Gathering and Analysis**

The data used for the analysis was gathered through an anonymous online survey (N=125) as a form of program evaluation. Additional data were sourced from Avenue-to-Learn, for student-participants' online engagement in both synchronous and asynchronous modules and sessions (N=942). Invitations were sent to all officially enrolled incoming first-year engineering students. Participation was completely voluntary.

The self-assessment survey consisted of nine items rated on a 5-point Likert scale of agreement and disagreement as well as two open-ended questions. The survey was conducted at the end of the program during the last week of August 2020, one week before the start of the 2020 Fall Semester. Results of the survey were analyzed by percentages and thematic coding. Themes included students' academic and social transitions, while percentages described the number of students who participated and registered in the program. The online engagement data were also used to describe the extent of student-participants' academic preparedness, engagement with the

modules, and interaction with fellow students and LRAs. No demographic information was collected about the participants.

## **Results and Discussions**

Overall, 942 first-year students registered for EMBER, representing over 86% of the incoming class. Some 600 students accessed the online modules, around 550 students attended at least one live tutorial, and approximately 250 students actively engaged in the live tutorials throughout the two weeks.

From the 125 survey responses collected, 96% of the students felt more prepared for first year, agreed that the modules were engaging, and would recommend EMBER to incoming first-year students. LRAs' roles were crucial, as 94% of the students emphasized their appreciation of how welcome LRAs made them feel.

Daily online presentations and interactions with fellow students and LRAs during live tutorials made EMBER a platform to connect students to the engineering community. One student commented that "all of the upper year students teaching the tutorials were extremely helpful and open about their own experiences in engineering, which made me feel like I was entering a supportive community."

Another student expressed, "I loved being able to interact with my peers and with upper-year students during the live tutorials, talking about everything from academics to work-life balancing tips."

Finally, one student said, "All in all, EMBER was a fulfilling and enjoyable way to spend two weeks of my summer, and I am so grateful for the opportunity I had to participate in it. Having completed the program, I feel a lot more prepared to start university in general, and I am a lot less apprehensive about starting classes online."

## **Conclusions**

EMBER provided incoming first year engineering students with an opportunity to acclimate to university and online learning before the school year started. This experience was deeply appreciated by the students and desperately needed, especially given the uncertainty associated with a global pandemic. EMBER allowed students to interact, lowered the degree of social separation and anxiety within the course, and developed a sense of belonging to a community within a program [9].

We argue that EMBER, as a bridging program, blends engineering and socialization. As a disciplinary socialization, it creates stronger connections among the students, engineering program, and community than would stand-alone virtual social activities that are disconnected from the program [5, 10].

Next year, we will investigate student-participants' specific learning experiences with EMBER across cohort demographics. We will conduct a nested case study to trace how student-participants' experiences in academic and extra-curricular programs in their respective high schools could be further connected with EMBER's offerings, and through EMBER with a more successful academic, social, and personal transition into first-year engineering.

## References:

- [1] M. D. Berzonsky and L. S. Kuk, "Identity Status, Identity Processing Style, and the Transition to University," *Journal of adolescent research*, vol. 15, no. 1, pp. 81-98, 2016, doi: 10.1177/0743558400151005.
- [2] S. Fisher and B. Hood, "The stress of the transition to university: A longitudinal study of psychological disturbance, absent-mindedness and vulnerability to homesickness," *The British journal of psychology*, vol. 78, no. 4, pp. 425-441, 1987, doi: 10.1111/j.2044-8295.1987.tb02260.x.
- [3] R. S. Levitz, L. Noel, and B. J. Richter, "Strategic Moves for Retention Success," *New directions for higher education*, vol. 1999, no. 108, pp. 31-49, 1999, doi: 10.1002/he.10803.
- [4] P. M. Ostafichuk, S. Nesbit, N. Ellis, and G. Tembrevilla, "Developing Metacognition in First Year Students through Interactive Online Videos," *Proceedings of the 127th American Society of Engineering Education Conference, Virtual*, June 21-24 2020.
- [5] T. Bolstad, P. Wallin, L. Lundheim, B. B. Larsen, and T. Tybell, "Emergent premises in student experiences of a first-year electrical engineering course," *European Journal of Engineering Education*, pp. 1-16, 2020, doi: 10.1080/03043797.2020.1789069.
- [6] T. Rutar and G. Mason, "A Learning Community of University Freshman Design, Freshman Graphics, and High School Technology Students: Description, Projects, and Assessment," *Journal of Engineering Education*, vol. 94, no. 2, pp. 245-254, 2005, doi: 10.1002/j.2168-9830.2005.tb00845.x.
- [7] F. o. E. McMaster University. "EMBER: Engineering Mentorship & Bridging Education Resources." Faculty of Engineering. <https://www.eng.mcmaster.ca/programs/ember#About-> (accessed December 1, 2020).
- [8] V. Leung, "EMBER Program Overview," McMaster University, Faculty of Engineering, 2020.
- [9] A. Furlong and F. Cartmel, "Mass Higher Education," in *Handbook of Youth and Young Adulthood: New Perspectives and Agendas*, A. Furlong Ed.: Abingdon: Routledge, 2009, pp. 121–126.
- [10] R. L. Porter and H. Fuller, "A New "Contact-Based" First Year Engineering Course\*," *Journal of Engineering Education*, vol. 87, no. 4, pp. 399-404, 1998, doi: 10.1002/j.2168-9830.1998.tb00371.x.