TLEF Project – Final Report

Report Completion Date: (2021/05/31)

1. **PROJECT OVERVIEW**

1. **General Information**

Project Title:	Equity education in engineering: Developing and implementing equity, diversity, and inclusion content for the second-year mechanical engineering program
Principal Investigator:	Agnes d'Entremont, Associate Professor of Teaching
Report Submitted By:	Agnes d'Entremont
Project Initiation Date:	May 1, 2020	**Project Completion Date:**	May 1, 2021
Project Type:	☐ Large Transformation X Small Innovation ☐ Flexible Learning ☐ Other: [please specify]

2. **Project Focus Areas** – *Please select all the areas that describe your project.*

X Resource development (e.g. learning materials, media)

☐ Infrastructure development (e.g. management tools, repositories, learning spaces)

☐ Pedagogies for student learning and/or engagement (e.g. active learning)

☐ Innovative assessments (e.g. two-stage exams, student peer-assessment)

☐ Teaching roles and training (e.g. teaching practice development, TA roles)

X Curriculum (e.g. program development/implementation, learning communities)

☐ Student experience outside the classroom (e.g. wellbeing, social inclusion)

☐ Experiential and work-integrated learning (e.g. co-op, community service learning)

X Indigenous-focused curricula and ways of knowing

X Diversity and inclusion in teaching and learning contexts

☐ Open educational resources

☐ Other: [please specify]

3. **Final Project Summary**

Our final project consisted of several equity, diversity, and inclusion modules that were piloted to the Mechanical Engineering Year 2 cohort for 2020-2021. We launched three modules out of our four planned. The launched modules consisted of content concerning equity, diversity and inclusion (EDI) in context, discussing colonialism, race, gender, sexual orientation and discrimination in society with a special focus on links to engineering. The final, undelivered module sought to expand on capacities briefly mentioned throughout the first three modules by including bystander intervention and "what to do" when instances of discrimination occur. We intend to complete the final module for delivery in the 2021-22 school year. In addition, we changed the course syllabi for Mech 2 to explicitly include assessment on EDI content, and require passing EDI content to pass two 1-credit courses.

4. **Team Members** – *Please fill in the following table and include __students__, undergraduate and/or graduate, who participated in your project.*

Name	Title/Affiliation	Responsibilities/Roles
Agnes d'Entremont	Associate Professor of Teaching, Department of Mechanical Engineering, Faculty of Applied Science	Content creation, revisions, survey review, filming and recording videos
Heather Gerrits	Manager, Student Services, Department of Mechanical Engineering, Faculty of Applied Science	Survey review and creation, administrative support, content review and creation
Graham Hendra	Lecturer, Department of Mechanical Engineering, Faculty of Applied Science	Content creation, revisions, survey review, filming and recording videos
Will Shelling	Graduate Academic Assistant, Student at the Public Policy and Global Affairs school	Creation of modules, revisions, creation of surveys and survey data analysis.
Sakshi Jain	Teaching Assistant, PhD Student in Mechanical Engineering	Marking of reflection activities

5. **Courses Reached** – *Please fill in the following table with __past__, __current__, and __future__ courses and sections (e.g. HIST 101, 002, 2017/2018, Sep) that have been/will be reached by your project, including courses not included in your original proposal (you may adapt this section to the context of your project as necessary).*

Course	Section	Academic Year	Term (Summer/Fall/Winter)
MECH 221	101	2020W	Sep
MECH 222	201	2020W	Jan

MECH 233	201	2020W	Jan
MECH 224	1AB, 1CD	2020W	Sep
MECH 225	2AB, 2CD	2020W	Jan
MECH 221	101	2021W	Sep
MECH 222	201	2021W	Jan
MECH 224	1AB, 1CD	2021W	Sep
MECH 225	2AB, 2CD	2021W	Jan
MECH 221	101	2022W	Sep
MECH 222	201	2022W	Jan
MECH 224	1AB, 1CD	2022W	Sep
MECH 225	2AB, 2CD	2022W	Jan
MECH 221	101	2023W	Sep
MECH 222	201	2023W	Jan
MECH 224	1AB, 1CD	2023W	Sep
MECH 225	2AB, 2CD	2023W	Jan
MECH 221	101	2024W	Sep
MECH 222	201	2024W	Jan
MECH 224	1AB, 1CD	2024W	Sep
MECH 225	2AB, 2CD	2024W	Jan

2. OUTPUTS AND/OR PRODUCTS

2.1. *Please __list__ project outputs and/or products (e.g. resources, infrastructure, new courses/programs). Indicate the current location of such products and provide a URL if applicable.*

Product(s)/Achievement(s):	Location:
Changes to syllabi/EDI passing requirements	MECH 221 and MECH 222 Syllabi/Canvas
EDI content formed 3% of the final grade for MECH 221 and 3% of final grade for MECH 222. Additionally, passing EDI content (>=50%) in each term was required to pass MECH 224 (partner course to MECH 221) and MECH 225 (partner course to MECH 222). While not academically onerous, these changes indicated to students	

that this content was a critical part of the learning objectives for the year.	
Course material (three modules)	https://canvas.ubc.ca/enroll/6PW99G
Module 1: 6 video quizzes on aims of video series, EDI basics, colonialism, bias, privilege, intersectionality, and approaches	
Module 2: 5 video quizzes on racism basics (including anti-Black, anti-Asian, and anti-Indigenous racisms), racism and the engineering profession, cultural competency, equity and engineering projects, and barriers in engineering education.	
Module 3: 5 video quizzes on sex/gender/sexual orientation basics, SOGI privilege, gender diversity and engineering, masculinity, and inclusive language	
Guest speaker video and reflection assignments	https://canvas.ubc.ca/enroll/6PW99G
One reflection on "Colonialism and the Intersection with the Engineering Industry" from the 2020-21 APSC series "Truth and the Role of Engineers in Decolonization" - speakers Curtis Rattray of the Tahltan Nation and Ska-Hiish Manuel of the Secwepemc Nation	
One video and reflection on "Towards becoming an anti-racist engineer" - speaker Dr. Amanda Giang (MECH, IRES)	
Resource list for students on SOGI, Racism and Discrimination and other topics	https://docs.google.com/document/d/1VTSAes1frJ3wqmCw70etEZNLFSHb_peW8ZxBt1f1OKA

1.2. **Item(s) Not Met** – *Please list intended project outputs and/or products that were not attained and the reason(s) for this.*

Item(s) Not Met:	Reason:
Module 4 on Bystander Intervention	COVID-19 pandemic and an overloading of work onto the organizing team meant that while this work was drafted by the Mech 2 TLEF team, it was not completed and deployed since it was going to be too late to deploy it during the 2020-21 school

	year to reasonably expect student engagement and completion. This work will be completed for deployment in the 2021-22 school year.
Module 3 and 4 Guest Speakers	COVID-19 pandemic priorities shifted this toward the proper fulfillment of the foundational videos within the Mech 2 EDI curriculum over arranging these guest speakers to speak to healthy masculinity and how to properly intervene in instances of violence. We also found some difficulty in arranging speakers during the pandemic in general, as the people we approached were also overloaded in many ways. We intend to invite guest speakers in these areas during the 2021-22 school year.

1.1.

3. **PROJECT IMPACT**

2.2. Project Impact Areas – *Please select all the areas where your project made an impact.*

X Student learning and knowledge

☐ Student engagement and attitudes

☐ Instructional team-teaching practice and satisfaction

☐ Student wellbeing, social inclusion

X Awareness and capacity around strategic areas (indigenous, equity and diversity)

☐ Unit operations and processes

☐ Other: [please specify]

2.3. What were you hoping to change or where were you hoping to see an impact with this project? – *Please describe the intended benefits of the project for students, TAs, instructors and/or community members.*

We were hoping to see an increase in knowledge of topics and concepts related to equity, diversity, and inclusion (EDI), and especially demonstrating the connection of these topics to engineering. This includes both issues of EDI within the engineering profession (such as the higher attrition rates for women and queer people) and the impacts of engineering products on EDI within our communities (such as the impacts of particular technologies on marginalized groups - examples include automated soap dispensers that only work for light-skinned people).

Anecdotally, engineering students tend to see EDI issues as separate from engineering (which is perceived as meritocratic and impartial). We wanted to embed EDI learning within the regular curriculum and to have engineering instructors teaching this content and linking directly to engineering as a way to reinforce the importance of EDI considerations.

We wanted to create high-quality resources that were seen as useful/important by the students.

2.4. Were these changes/impacts achieved? How do you know they occurred? – *How did you measure changes/impacts? (e.g. collected survey data, conducted focus groups/interviews, learning analytics, etc.) Describe what was learned from this process. You are encouraged to include copies of data collection tools (e.g. surveys and interview protocols) as well as graphical representations of data and/or scenarios or quotes to represent and illustrate key themes.*

We performed surveys at the start (n=60) and end (n=27) of the 2020-21 school year (total enrollment = 125) to capture learning about EDI topics over the course of the year and student perceptions of the value and quality of the learning approaches. We attempted to complete pairing of anonymous data, but we had only minor overlap (n=6) between pre- and post-surveys.

In both surveys, we asked identical multiple choice questions about the "most appropriate example" of different concepts we covered, and we asked about their confidence in the answer they gave (with 1 = very confident and 5 = very unconfident).

	Pre-survey (n = 60)		Post-survey (n = 27)	
Concept	**% correct**	**Mean confidence**	**% correct**	**Mean confidence**
Equity	54.5%	2.31	85.0%	1.95
Diversity	83.6%	1.78	66.7%	1.95
Inclusion	79.6%	2.15	76.2%	1.85
Intersectionality	42.6%	3.23	66.7%	2.48
Colonialism	100%	2.02	100%	1.90

In several cases, both understanding (higher %) and confidence in their understanding (closer to 1) improved in the concept area, with other cases showing similar understanding but increased confidence. Diversity was the outlier, where both understanding and confidence in understanding were somewhat worse. It's not clear why this is the case, but we plan to review that content.
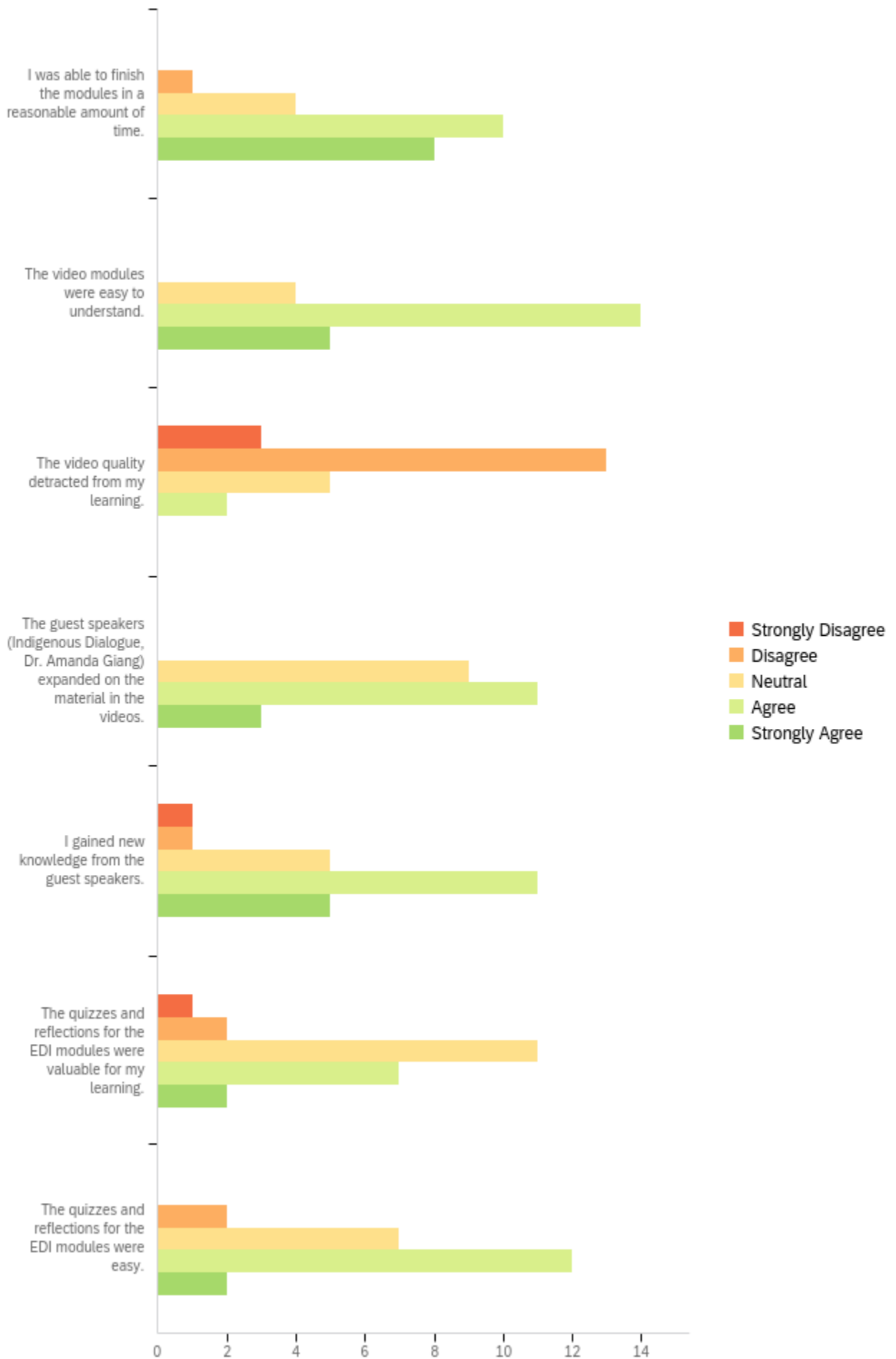
We also asked questions about the usefulness and quality of the learning materials.
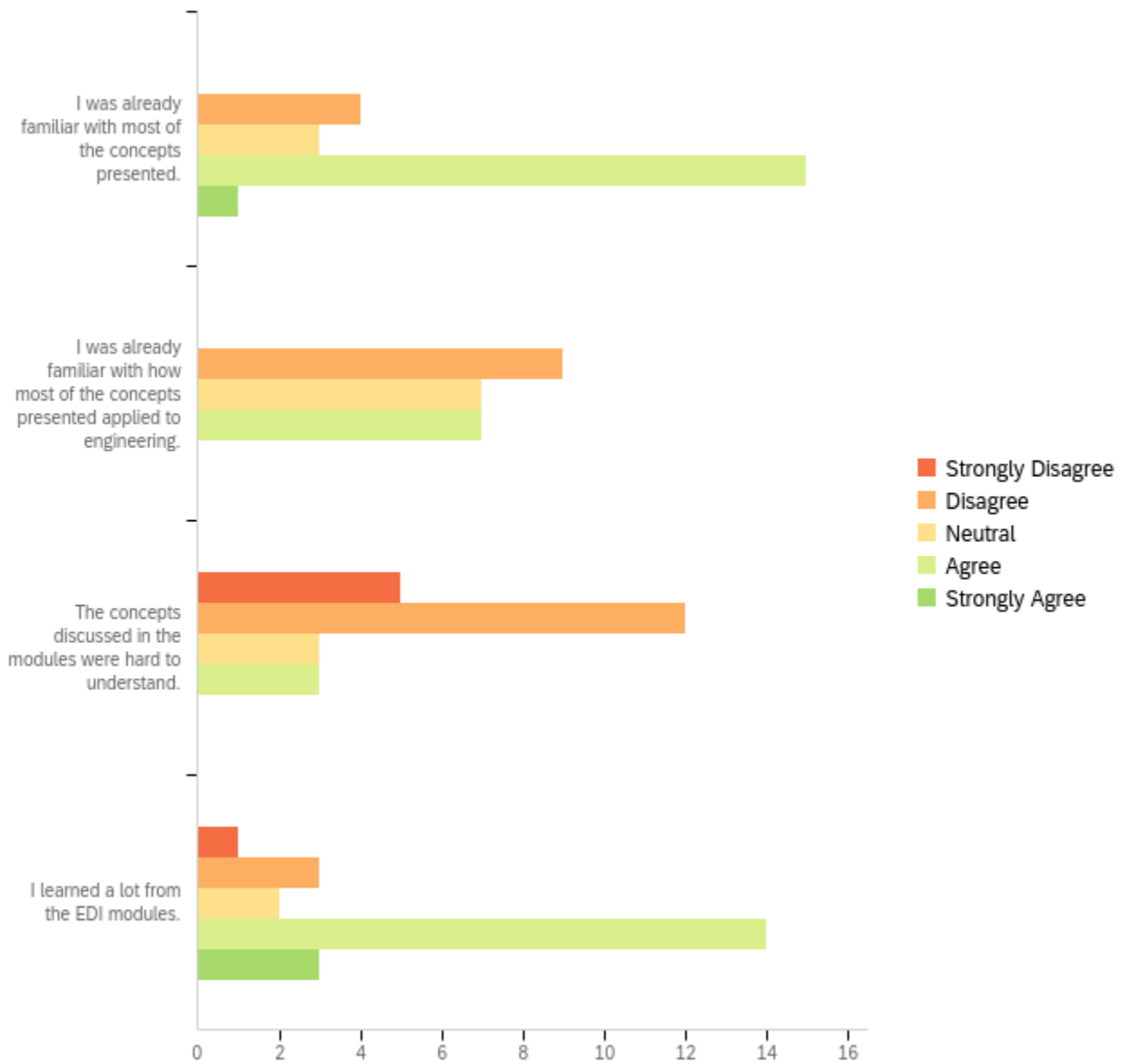
Interestingly, students surveyed reported both being already familiar with the concepts and learning a lot. This may be related to a lack of pre-existing knowledge about how those concepts apply in engineering.
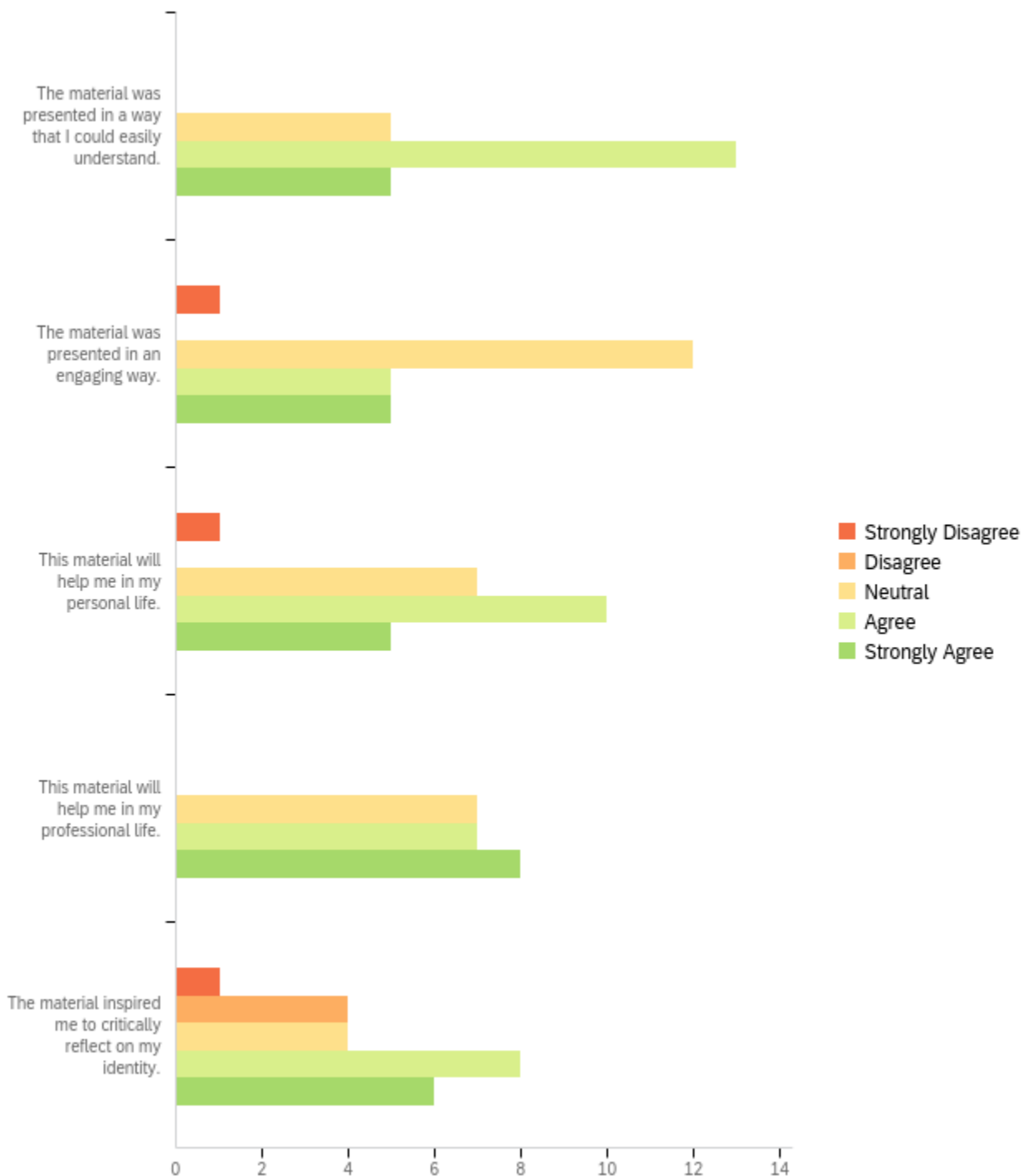
The students reported that the material was easy to understand, and would be useful in both their personal and their professional lives. There was also fair agreement with the idea that the material led them to reflect critically on their own identities.

Legend:
- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Survey questions (top to bottom):
- I was able to finish the modules in a reasonable amount of time.
- The video modules were easy to understand.
- The video quality detracted from my learning.
- The guest speakers (Indigenous Dialogue, Dr. Amanda Giang) expanded on the material in the videos.
- I gained new knowledge from the guest speakers.
- The quizzes and reflections for the EDI modules were valuable for my learning.
- The quizzes and reflections for the EDI modules were easy.

FInally, students reported that the videos themselves were a reasonable time commitment and easy to understand, and that the guest speakers added to the video quiz content.

Open comments on the structure, quality or applicability of the developed content included a few criticisms of the videos (wordy slides) and quizzes (odd phrasing or obtuse), but were supportive of the overall content and the aims of the project. Students reported that the complex topics were introduced in an approachable way, were constructive, and both led to critical reflection and were seen as helpful by students from underrepresented groups within STEM. When asked about the concepts presented, students' comments were primarily positive, with several indicating that they thought the topics were well chosen and that the content was important to include. One student specifically mentioned appreciating that all genders were considered when discussing concepts and issues. One student felt that the videos were presenting men in a negative way, although this student also said that the topics were important.

The strong support of this initiative from some students within underrepresented groups has been expressed informally in conversation with the faculty members involved. While we did not aim to measure this, it appears anecdotally that these students feel it is important that their peers get exposed to these ideas.

Finally, when asked what the most impactful thing they learned was, more than half of the open-ended responses (6/11) explicitly mentioned engineering, professional life and/or workplaces. This indicates that our goal of tying EDI content to engineering and professional activities was successful.

2.5. Dissemination – *Please provide a list of __past__ and __upcoming__ scholarly activities (e.g. publications, presentations, invited talks, etc.) in which you or anyone from your team have shared information regarding this project. Be sure to include author names, presentation title, date, and presentation forum (e.g., journal, conference name, event).*

We have created a demo Canvas site with the materials, which has been shared with the MECH EDI committee. We are considering whether we could **implement them at the graduate level** within MECH, and will be promoting the material as available for other instructors through the MECH and APSC EDI committees.

At the Faculty of Applied Science level, this project will be **featured as a case study** for the inclusion of equity content within engineering courses and programs.

We plan to **report on the development and outcomes in the future at one or more engineering education conferences** (Canadian Engineering Education Association, American Society for Engineering Education).

4. **TEACHING PRACTICES** – *Please indicate if __your__ teaching practices or those of __others__ have changed as a result of your project. If so, in what ways. Do you see these changes as sustainable over time? Why or why not?*

To date, we had not used any video quizzes in Mech 2, however we see these as an excellent option for this material. Specifically, this is generally introductory material well suited to video. It is also material that requires detailed and nuanced phrasing and is outside of our typical expertise, so video created in consultation with a team is much more comfortable for engineering instructors than a live lecture format would be. It also allows other instructors who may be less confident in presenting this material themselves to include it in their courses. As the videos will have essentially no overhead to implement for the next few years, they will be sustainable.

The quite positive response of the students to this material also will influence our decisions to include EDI content in other ways in the future - for example, Drs. Hendra and d'Entremont recently designed and delivered a new course in engineering research skills, and we explicitly included EDI topics in that course. Because the reaction to this Mech 2 content was positive, we expect that alterations to the videos in future will be seen as worthwhile, which assists in their sustainability.

5. **PROJECT SUSTAINMENT** – *Please describe the sustainment strategy for the project components. How will this be sustained and potentially expanded (e.g. over the next five years). What challenges do you foresee for achieving the expected long-term impacts listed above?*

   We know that with such a current topic of scholarly and public interest, rapid changes in examples, initiatives, and understandings about EDI and the role of engineers may occur, even in the near future. As such, we think that these videos may be acceptable (possibly with minor alterations) for about five years, mainly as major changes (we hope) take place in regards to anti-oppression in the world. We hope to have an opportunity to hire another graduate academic assistant to work with the instructors/program coordinator to edit, change, or add to the initial structure and content of these videos so that they continue to provide students with up-to-date knowledge. The original recordings and editable files (Camtasia) will be retained, which will make minor alterations fairly easy.

   The Mech 2 program invites guest speakers every year as part of the program, so the sustainment of the guest speaker aspect will be a part of regular course processes.

   We plan to complete the final module, and have discussed expanding the content to meaningfully include issues such as disability and neurodiversity, which were not discussed in depth due to project scope limits.

   We also think that, as other disciplines need to include similar content (due to Engineering Accreditation requirements, as well as helping to fulfill strategic plans at the Faculty and University levels), a larger pool of instructors and the Faculty of Applied Science itself will be invested in maintaining and expanding on this content. As we know, UBC Applied Science has a strong EDI mandate and backing, and we would like to deploy these resources across several other programs so that we can also seek to fulfill the goals in the Inclusion Action Plan, Indigenous Strategic Plan, and APSC goals surrounding inclusive excellence.