SEAS Center for Women in Engineering

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Best Practices for
Diversity and Inclusion in Engineering Curriculum

The first day of a college experience used to begin with a word from a school leader that said "Look to your left, look to your right, one of you will not be here next term." As faculty, we realize that an academic start like that does not portend success for the student, the faculty or the engineering community. Leaving the "weed 'em out mentality" and establishing an inclusive curriculum is a worthy and noble endeavor requiring a comprehensive series of studies and reviews of our current state and extensive discussions with all stakeholders (students and faculty and business community)[1].

While we as faculty must continually aspire to such a goal, the scope of this document is to present actions that can be taken in the context of our current programs.

As of this writing, the COVID-19 coronavirus pandemic has forced a sea change in how academic institutions address learning. Teachers, students and support structures have had to quickly adjust to online learning, and many are struggling. At the same time, issues surrounding diversity and inclusion have gained new recognition in the national consciousness as the Black Lives Matter and other diversity movements have burst into the forefront.

Regardless of whether learning is taking place online or face-to-face, as we expect it will sometime in the future, the question of how to make our courses more inclusive is one that must be addressed. Before we can present some techniques for learning environments to promote inclusion, a word or two - or three!- about what inclusivity means.

In addition to the "accepted" inclusive categories[2] that include gender, prior experience, ethnicity and first generation students, we must add access to fast Internet, quiet spaces for focused attention to classes, and the balancing of household obligations.

According to Soudien (2010), the drive for inclusive engineering curriculum rests on three pillars:

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[1] For a review of such projects consider Olin College, University of Illinois, Purdue University, and University of South Australia
[2] See Beth Simon; UC San Diego

1. *Representation*: Increasing numbers of underrepresented groups;
2. *Ideological approach*: including adopting thinking, systems and processes that enable minority groups to contribute and lead change;
3. *Practical engineering and technology:* related actions to deliver inclusive engineers.

Inclusive curriculum is not just an academic exercise; rather, our students will work and study in engineering teams where inclusivity will help to mold thinking and processes. One only has to note that without inclusive design teams for new automobiles, female drivers' needs are not considered in the simple question of where to stow their purses!

A Review of the Basic Inclusivity Toolkit

A few basic suggestions for offering an inclusive course may fall into the category of "I am already doing that." Dr. Beth Simon, Professor at UC San Diego, has prepared a concise list:

- Set expectations and your motivation for those expectations in your syllabus.
  - Make it clear your expectations are intentionally designed to help students succeed and enjoy the learning experience.
- Consider new tools for collaboration and engagement.
  - Take some synchronous things and make them asynchronous.
  - Find free tools for use outside the classroom.
  - Take the time to look at your usual expectations and requirements and critically consider what value they have for learning.
- Increase your empathy.
  - Design equitable and clear options for requesting deadline extensions.
  - Be sure that new expectations (around cameras being on) have non-judgmental or embarrassing opt-outs.

Best Practices for Inclusive Curriculum Design

This section is by no means an exhaustive list of options and ideas, but rather an opening to start your pedagogic juices flowing. An excellent resource on suggestions for designing and implementing an inclusive curriculum can be found in Miles et al 2010. The charts on pages 9 to 11 provide questions to think about and suggestions on how to address them. For example, in addressing how to find alternative examples as we identify concrete examples of theory and practice, we might consider examples from domains including music, health, devices addressing disabilities.

Material Presentation should be prepared for a variety of learners: visual, auditory, and even kinesthetic. Inclusive techniques suggest:
- Use of clear visuals

- Review of reading levels of material
- Access to background materials.

Mills and Ayre (2002) propose a rubric whereby faculty can judge the inclusive impact of the way in which theoretical topics are presented. They suggest that, moving from least inclusive to most, the more the material is centered in terms of discussion, the more inclusive the presentation, especially as it relates to gender:

How is theory taught within your program?
Level 1 – Theory is taught largely in isolation.
Level 3 – Theory is presented in terms of specific industry related problems.
Level 5 – Social effects are considered and debated wherever possible.

New generic tools, valid for courses in engineering and beyond.
- Using shared document tools in the Google suite, including documents, slides and spreadsheets.
- Obtaining texts should be as easy as possible. Consider use of PDF materials and E-book purchase.
- Interactive tools for content presentation
  - [Peardeck](#) for multiple choice or free text response engagement during lecture
  - Mentimeter for interactive presentations, quizzes and polls (mentimeter.com)
  - Kahoot for quizzes (kahoot.com)
  - Jamboards an interactive whiteboard for shared discussions and presentations (jamboard.google.com)

Teamwork is integral to many courses and approaches for establishing inclusivity need to be intentionally addressed.

Students bring with them their prior experiences and attitudes when they walk into the classroom, and these differences can cause team conflict. Frequently, students self-select their teams and are left to assign a team leader. The implicit expectation is that they will become great team players, future managers or leaders by osmosis.

When preparing teams:

1. Establish clear expectations and deadlines.
2. Hold open discussions to ensure awareness of unconscious bias.
3. Discuss equitable assignment of tasks (i.e., notetaking should NOT be always assigned to the women in the group)
4. Provide tools for team interactions and team support.

5. Consider incorporating programs such as a Myers Briggs or CliftonStrengths assessment[3] to help students analyze themselves and share their profiles.
6. Check in on team progress.
7. Use role playing to demonstrate the various roles of team players (e.g., the do-it-all who takes on all the work, the loafer who does nothing[4], the student struggling to keep up).

Active learning and authentic problems and projects are exciting. However, active learning may be difficult to curate for large classes. Additionally, some students, and particularly international students, may find active learning chaotic as opposed to the "listen to the lecture" experience they have been accustomed to. Yet active learning has merits. An excellent starting point for ideas on active learning can be found in Hernández-de-Menéndez et al (2019).

Assessment, including multiple methods of analysis, promotes inclusivity. Assessment tools to consider:
- Formative and summative assessments (e.g., period assessments in the development of a term project
- Timely feedback
- Oral presentations
- Written exams
- Peer review
- Group assignments
- Self-assessment, especially in teamwork[5]

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[3] https://www.strengthsquest.com/home.aspx
[4] Recario, et al 2015
[5] Cervin-Ellqvist et al, 2020

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