It Takes All Kinds: Incorporating Diversity Education in the Engineering Classroom

Dr. Elif Miskioglu, Bucknell University

Elif Miskioglu is currently an Assistant Professor of Chemical Engineering at Bucknell University. She graduated from Ohio State University in 2015 with a PhD in Chemical Engineering, and is interested in student learning in engineering. In particular, her work focuses on various aspects of students' development from novice to expert, including development of engineering intuition, as well as critical thinking, problem-solving, and communication skills.

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Abstract

The ability to work on diverse teams is an essential professional skill, and a common innate learning objective in engineering classrooms. Team diversity is often accomplished by "balancing" teams with respect to characteristics such as past performance or gender, but the ability to create diverse teams can often be limited by class composition. Recognizing these limitations, a "diversity module" has been piloted in a technical communications course at a small, liberal arts institution in Fall semesters 2016 and 2017. The module is designed to expose students to, and engage them with, various aspects of diversity in the absence of an intrinsically diverse classroom composition, as well as allow them to reflect on their own professional and personal experiences. Specifically, this module includes activities about implicit bias, stereotype threat, and cross cultural competence. Student response has largely been positive, and student reflection assignments have demonstrated critical thinking on the matter. As this is a recent pilot intervention, long-term longitudinal effects have yet to be investigated. Included here are descriptions of the module activities, generalized student responses, and instructor perspective. While this topic is of great importance to all educators, it is often difficult to incorporate such material in well-established courses. Thus, new engineering educators may find these activities and ideas particularly useful as they begin to establish their teaching practices.

Background and Motivation

Diversity of race, ethnicity, and gender are among just some of the classifications that are highly valued in the present day workforce, with diversity initiatives springing from academic institutions and companies alike. Despite these efforts to increase classroom and cubicle diversity, there are limitations to how much diversity can be achieved in some of these settings.

While data from the National Center for Education Statistics (NCES) reveal that diversity with respect to measures such as race and ethnicity has been increasing among American college students nationally [1], this diversity is not uniformly spread across campuses. The majority of college students in the United States attend public institutions regardless of racial or ethnic background [2]. It may appear from aggregate data that diversity at varying institution types (public vs. private, two-year vs. four-year, etc.) follows national demographic trends, however, these numbers are confounded by the distinctly different demographics found in Historically Black Colleges and Universities [3], Hispanic Serving Institutions [4], and Tribal Colleges [5]. At these institutions, the race or ethnicity served is disproportionately represented compared to national demographics.

The modules described here focus on exposing students to perspectives that stem from diversity of race, ethnicity, and culture. Such diversity in the classroom and on campus has been shown to have a positive impact on cognitive development [6-8], but this diversity is not always intrinsically available.

Thus, when classroom diversity with respect to these demographics is lacking, it often falls on the educator to simulate these diverse perspectives to enhance student learning. As educators, we strive to prepare our students for "the real world," which includes interacting with diverse colleagues in a diverse global workforce. Furthermore, as global industry becomes more and more interconnected [9, 10], it is highly likely that our engineering students will not only work with colleagues of diverse backgrounds but also have several international experiences throughout their career. For these reasons, awareness of diversity issues, biases, and general cross-cultural competence are critical professional skills that are not explicitly addressed in most engineering curricula. Opportunities to authentically expose our students to experiences that build awareness and cross-cultural competence is limited by the diversity (or lack thereof) of our own classrooms and campuses. Students in classrooms that happen to be less diverse may thus experience an unintentional impediment to professional development as they prepare for "the real world."

Technical and professional communication (TPC) is one essential professional skill that is, in many ways, intertwined with diversity. Organizational demography has been shown to have varying correlations with workplace communication [11, 12], including employees tending to communicate more often with those of similar age group or tenure [13]. It is natural to imagine that this extends to demographics of race, ethnicity, and culture. Our understanding of communication norms, our contextualization of situations, and our interpretation of nonverbal cues depend largely on previous experiences. Our experiences, in turn, can be shaped by our racial, ethnic, or cultural background. The absence of being able to consistently have a classroom of diverse students in an engineering-specific TPC course at a small liberal arts institution was the inspiration and motivation behind developing the "diversity module" described here.

Overview of Course

TPC was developed by the author while at a large urban U.S. public research institution (R1). The module described was added when the author moved to a small rural U.S. private primarily undergraduate institution (PUI). The module was inspired by the change in the classroom population that came with the change in institution. After a semester of instruction at the PUI, it became clear that some of the perspectives that had previously arisen naturally in the R1 classroom were lacking, and this appeared to correlate directly with student population in the class. As summarized in Table 1, the course enrolled 12-18 students at the R1 and consistently included international, minority, or multicultural students. These students made up one-quarter to one-third of the student population in the classroom. In contrast, there has only been a single international, minority, multicultural, or multiethnic student in three semesters of the course at the PUI. Resulting from this apparent lack of diversity in these regards, the diversity module was developed and integrated into the course to expose students to these absent perspectives, as well as simulate experiences that they may not otherwise be getting. While it is infeasible to capture the breadth and depth of diversity issues as they relate to communication in a 15-week course, this module attempts to develop greater awareness of, and reflection on, such issues in the students.

Table 1. Summary of course enrollment and demographics across five semesters at two different institutions. R1 = research institution, PUI = primarily undergraduate institution.

Institution	**R1**		**PUI**		
Semester	**Spring 2014**	**Spring 2015**	**Fall 2015**	**Fall 2016**	**Fall 2017**
# Enrolled	12	18	6	10	12
Male (self-identified)	7	7	2	4	4
Female (self-identified)	5	11	4	6	8
International, Minority, or Multicultural Students (% of Total Class)	25	33	0	0	8.3

At both institutions, the course was a standard technical elective. At the R1 it met twice a week for 85 minutes per meeting, and at the PUI it currently meets three times a week for 52 minutes. There are also periodic one-on-one meetings with students focused on discussing personal development as communicators.

Overview of Module

The diversity module currently consists of three activities scattered throughout the semester. In order of appearance, these include: (1) Discussion of Implicit Bias and Stereotype Threat, (2) Open Scene, and (3) BaFa' BaFa'.

Discussion of Implicit Bias and Stereotype Threat

In the first week of the semester, following an initial discussion on understanding audience, students are introduced to the ideas of implicit bias and stereotype threat. Because it is so early in the semester, this involves a predominantly individual activity (to encourage full engagement) and serves as an opportunity for introspection and development of awareness.

While some students already know what implicit bias is, many are often either completely unfamiliar or slightly mistaken in their interpretation of the concept. In brief, implicit biases are attitudes or perceptions that may unconsciously manifest in our actions [14]. The tricky component to implicit bias comes from the fact that it is unconscious; we may not even be aware we carry the bias. In fact, implicit biases can directly conflict with our explicitly held beliefs. This makes implicit bias a sensitive subject by nature.

To introduce students to common implicit biases and spark reflection on their own potential implicit biases, each student takes an online Implicit Bias Assessment from Project Implicit designed at Harvard University [15]. This is done in class, and each student is given an implicit bias worksheet to guide their reflection and keep them engaged in the process. This worksheet includes questions such as: (1) What assessment did you choose to take?; (2) Without sharing your results [to protect student privacy and avoid discomfort on this sensitive topic], did your results surprise you at all?; (3) Based on your background, what implicit biases might others hold

against you?. In subsequent class discussion, we discuss the merits and drawbacks of the assessment in broad terms, as well as the general dangers and implications of implicit bias. In regards to question (3), we emphasize that it is important to not prematurely expect implicit bias from others, but rather be aware of the role it can play in communication and behavior.

Near the end of the class period, we switch gears to a brief discussion of stereotype threat. Again, students often do not accurately know what the term stereotype threat refers to. Stereotype threat is the "threat" of conforming to a negative stereotype held against one's group, simply from being aware or reminded of that stereotype. Numerous studies have demonstrated the danger of stereotype threat through immediate effects on performance [16, 17]. Again on a worksheet, students are asked to consider what stereotyped populations they belong to, and subsequently what stereotype threats they are in danger of succumbing to.

In subsequent class discussion, we connect the ideas of implicit bias and stereotype threat to understanding your audience when communicating. Students are encouraged to remember that understanding audience also includes anticipating your audience's understanding of you, and that through greater awareness of implicit bias and stereotype threat we can not only better communicate with, but also can better advocate for others.

The ideas of implicit bias and stereotype threat resurface throughout the semester as we discuss specific communication case studies and through periodic reflective journals. This course also includes regular individual meetings with students to discuss their written and oral communication performance, during which some students recognize their susceptibility to stereotyped communication behaviors for a particular aspect of their identity (e.g., gender).

Open Scene

Open Scene is a common exercise in theatre in which two actors are given a short, context-free script. For example, an open scene script may consist of the following [18]:

A: What's that?
B: My latest project.
A: It looks very interesting.
B: Well, I think so.

In theatre, this can be presented as a challenge for the actors to develop their own context through improvisation.

In TPC, Open Scene is used differently. Students are paired up (with an occasional trio, if necessary) and given a generic set of instructions explaining that they will perform a 'scene' with their partner(s) for their peers in approximately ten minutes. These instructions also include some reminders of things to consider that may help them communicate their scene, including tone, volume, body language, and use of relational space (all discussed previously in course content). Students are additionally encouraged to use readily available props as they deem appropriate. Each group is instructed to keep their scene a secret from other groups as they prepare. Then, each group is given their "top secret" scene information, including: (1) script, (2) character

descriptions, (3) location, and (4) description of what is occurring in the scene. All groups have the same exact script, but very different contexts revealed in items (2) - (4). In the case of trios, one of the characters has a non-speaking role.

The groups disperse to nearby locations to practice their scene and are instructed to return to the classroom at a set time. As a side note, in the first use of this activity, the scripts were handed out at the end of an earlier class period and students had several days to prepare their scenes as homework. It has been found, and student feedback confirms, that the scenes are much better when the students are "under the gun" to perform immediately.

At the designated time, groups return to the classroom and are given a "scene interpretation" worksheet. For each scene, the audience is asked to hypothesize the "who, what, where" aspects of the scene. The scenes are performed in rapid-fire, after which we do a full class discussion of each. The non-actors share their theories regarding the who, what, and where of each scene, and evidence they have to support their theory. Once the discussion dies down, the actors in the scene reveal the intended who, what, and where. For each scene (excluding their own), students are asked to evaluate (in writing) the accuracy of their hypotheses, and reflect on what clues from the scene aided or distracted them from the true context.

The class quickly realizes by the second or third scene that while the scripts are not unique, the scenarios are. This activity powerfully highlights several learning objectives. The use of the same script in several, very different, scenarios emphasizes that much of communication happens "in between the lines." It is not necessarily about the words that are said, but about the multitude of surrounding contextual clues that lead to meaning. Another important learning objective highlighted by this activity is that our interpretation of context depends greatly on our own, personal, experience. Each time the activity has been run, there has been at least one scenario where a non-actor has misidentified the scene because the actors' portrayal did not match either their own personal experiences or expectations. We typically end the session highlighting that personal experience, which includes racial, ethnic, and cultural background, is the lens through which we interpret much of communication.

This idea that our experiences are the lens through which we interpret the world, and communication, is reinforced in the final activity in the diversity module.

<u>BaFa' BaFa'</u>

BaFa' BaFa,' the final activity in the diversity module, is an activity developed by Simulations Training Systems [19] and adapted for course use. In this activity, the class is split into two trade-based societies, the Alphas and Betas, each with a different social structure and intentionally conflicting cultural norms. Members of each society are given a set of instructions outlining how their culture behaves, after which the Alphas and Betas gather in different rooms to practice learning their cultural behaviors.

During this practice session, each society has an opportunity to send one member to briefly observe the behaviors of the other society and report back. The observers often mention that the

other society has peculiar behaviors, citing what they saw that conflicts with their own cultural norms.

The two societies are brought together to interact with the goal of achieving high trade with artificial currency. This trading phase can be quite chaotic, but is an essential part of the experiential learning process. The opposing cultural norms of the two societies result in behavior that the opposing society finds rude, insulting, or offensive. Depending on the particular group of students, some choose to abandon their cultural norms quickly to facilitate more successful trade while others stay steadfast and realize they are at a stalemate after several minutes. In the end, all students usually begin adapting to some degree to achieve successful trade.

The students are not explicitly told whether or not they are "allowed" to adapt by abandoning their own cultural behaviors. While some feel misled by this omission, it is intended to highlight that the decision on whether to adapt, to what degree, and with respect to which particular cultural norms is a difficult one.

After the activity, there is some time reserved for a formal, individual, written debrief after which we engage in a class-wide discussion. One of the formal debrief questions asks the students to describe, from the perspective of their adopted society's culture, the opposing society's culture. When reported in the large group discussion, these descriptions often include terms like "strange," "offensive," "barbaric," "peculiar," or "weird." Students are then asked if they have ever heard one population describe another using these terms, to which the answer is unequivocally yes. It is evident that while this truth, that perceptions of other cultures are based in your own culture's view, is by no means illogical, most students have not actively taken the time to reflect on this fact. Thus, this activity highlights how our own cultural perspective affects our views of others and the difficult decisions involved in adapting to other cultures, particularly when their norms or behaviors conflict with what we perceive to be appropriate. This activity not only vividly demonstrates that cross-cultural awareness, education, understanding, and adaptability are essential in a global workforce, but also that our view of others is very much defined by our own cultural perspective.

Student Anecdotes and Reflections on Module Success

Student response with respect to the activities incorporated in this module has been largely positive. Students have described BaFa' BaFa' as the "most engaging diversity activity" they have experienced, both in person and on anonymous, informal, activity-specific feedback. As mentioned, Open Scene has been much more impactful when students were only given ten minutes in class to quickly prepare their scene, and the Implicit Bias/Stereotype threat activity has been praised as a valuable opportunity for reflection. As with any activity, not all students have enjoyed each one, but the overall learning objectives have been broadly achieved in each case.

While it is difficult to truly assess the impacts of these activities without long-term longitudinal formal studies that also control for a multitude of other experiences, the short-term impact on student awareness and reflection is highly evident from an instructional perspective. In one-on-

one meetings at the end of semester, students demonstrate a greater degree of self-awareness and ability to empathize with their final paper/presentation's prospective audiences.

It is important to note that some of these activities need to be adjusted to accomodate larger class sizes. Open Scene could be adapted such that pairs or trios still perform the scene, but groups of up to five could work together to prepare the scene. The Implicit Bias/Stereotype Threat activity, on the other hand, is fairly straightforward and could be easily adapted to large class sizes. BaFa' BaFa' would be difficult to moderate in a single run with more than 20 students, but could be split into multiple breakouts with the support of extra facilitators (e.g., teaching assistants).

An additional consideration is that these activities are most successful when students engage fully, without fear of vulnerability. Engineers in particular are often not accustomed to discussing these topics in classroom settings, and some students may not be comfortable sharing their personal experiences or bringing their full, personal selves to the activity. It is for this reason that the Implicit Bias/Stereotype Threat activity is done individually. Open Scene and BaFa' BaFa' require more active engagement from students, but students have consistently engaged at a high level in these activities. They are intentionally included later in the semester, after the class has built a degree of rapport and comfort with each other, and most students appear comfortable sharing ideas and experiences. Additionally, both activities ask students to take on other personas, which may create just enough distance between themselves and the activity to allow them to fully engage without feeling uncomfortably vulnerable.

Future Work

Anecdotally, from an instructional perspective, this diversity module has been a highly engaging method for incorporating diversity awareness in a technical and professional communication course. The impact of the module has not yet been formally assessed, and future work will seek to assess both the short-term and long-term impact of this module on students' understanding of, and attention to, diversity issues. Intended short-term assessment includes pre-and post-awareness surveys that highlight familiarity with the language and issues surrounding diversity. Additionally, individual written reflections throughout the semester will be formally incorporated to better understand how students' understanding of diversity evolves. For long-term studies, student attitudes and experiences outside of the institution will be tracked through course alumni surveys. In combination, this should provide compelling data on the short- and long-term impact of the course activities.

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