Special Session: Starting a Dialogue on Decolonization in Engineering Education

Susan M. Lord, J. Alex Mejia, Gordon D. Hoople, and Diana A. Chen
Integrated Engineering
Shiley-Marcos School of Engineering
University of San Diego
San Diego, California, USA
slord@sandiego.edu, jmejia@sandiego.edu, ghoople@sandiego.edu, dianachen@sandiego.edu

***Abstract*— Decolonization is a radical approach to transforming education by confronting and undoing colonizing practices used in the past that continue today. This session endeavors to begin a dialogue on decolonization in engineering education. Through a series of activities and facilitated discussions, participants will critically analyze how engineering may not be neutral or objective, describe how the myths of objectivity and neutrality in engineering perpetuate colonialism, critically examine the different values and assumptions that underpin engineering decisions and how these affect different people in different ways, and reflect on what decolonizing might mean for engineering education. This is a challenging topic that requires considerable thought, reflection, and openness to different ways of knowing. We believe such conversations can help advance our shared mission of diversifying engineering education and enhancing research and engineering practice.**

Keywords — decolonization; inclusion; positionality

I. Introduction and Rationale for Session

Colonialism, the practice of acquiring full control over people, is enabled by the policies of imperialism. It was through colonialism that education was accepted as the gateway for development and the subsequent suppression of traditional education systems in colonized regions. For example, the traditional pedagogies used for the construction of philosophical, religious, musical or astronomical knowledge in the *calmécac*, the Mexica school, was completely prohibited, eliminated, abolished and replaced by an educational model that sought to Europeanize the aboriginal peoples [1]. Colonialism and education are two important ways in which European powers ensured that populations around the world would be exploited and subjugated [2]. In fact, education was the strategy used to colonize large parts of the world [3]. Along with the diffusion of Western ideas, education was used to establish cultural dominance and legitimize only certain ways of knowing, doing or being. These included forced assimilation, power relations, and institutional structures maintained through curricula.

Within engineering, Western, White, and male knowledge has historically been privileged over other ways of knowing [4-6], doing and being, primarily through colonialist educational approaches. Colonialist practices influenced the direction of engineering education by disenfranchising minoritized populations. Little recognition appears to exist that the ethnocentricity and masculinity of engineering curricula perpetuate not only the lack of diversity in engineering but also limit approaches to problem definition and methods of problem solving, teaching, and assessment [7]. This dominant approach undervalues the lived realities, perspectives, and epistemologies of those students who do not fit into this dominant category and ignores potentially useful knowledge. The reproduction and internalization of these perspectives in engineering have shaped and dictated the discourses, language use, and disciplinary knowledge that is validated and counted as "legitimate" in engineering. Recognizing and addressing this systemic bias is critical to reforming engineering curricula to be more inclusive for students from all backgrounds. By learning from other worldviews and ways of knowing, engineers have an opportunity to promote learning in ways that are meaningful and relevant while challenging deficit models [8-10]. Part of the decolonization process focuses on positive aspects of communities traditionally located at the margins of engineering, such as resilience and contextualized knowledge, rather than looking at the perceived deficits of the community.

Decolonization is a radical approach to transforming education by confronting and undoing colonizing practices used in the past that are still present today [11, 12]. In doing so, decolonization engages with the deconstruction of the concepts of colonialism and imperialism while having a critical understanding of the assumptions, motivations, and values that inform the practices of the individual (e.g., researcher, educator) [2]. In addition, decolonization seeks to challenge the established positional superiority of Western knowledge recognizing that colonization goes beyond land acquisition and also impacted knowledge where indigenous knowledge was "discovered, extracted, appropriated and distributed" [2 p. 61]. It is through a decolonizing perspective that we seek to legitimize and acknowledge the contributions of those who have been placed at the margins of the engineering discourse. Part of decolonization is re-establishing links to the community, contextualizing knowledge, deepening sociocultural understanding, and reconnecting with students.

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The colonialist narrative in engineering perpetuates the idea that technology is used for the progress and advancement of social welfare. However, this narrative also dictates the belief that engineering is objective and neutral with the underlying assumption that if society is to benefit from engineered artifacts, then engineering practice must be unbiased and apolitical. The separation of the object from the subject (e.g., engineers seen themselves as separate from the social, environmental, economical, or political aspects surrounding engineering problems) is problematic because, in essence, it continues to spread colonialist ideologies.

For example, the hallmarks of the dominant engineering discourse are inherent in the way engineering students are introduced to energy concepts. Consider the common grouping of solar and wind as Alternative Energies. This categorization, rather than the use of the term Renewable Energies or Sustainable Energies, inherently prioritizes fossil fuels over other options. In many engineering programs, students first see energy concepts in "Introduction to Thermodynamics", which emphasizes discoveries and examples from the Industrial Revolution based on White and colonial mindsets. Emerging power sources such as wind and solar are rarely discussed and often left to elective courses. The ethnocentricity and masculinity of engineering curricula can be discouraging to minority and women students and yet is rarely addressed. For example, textbooks contain a wealth of esoteric and hobbyist examples related to car engines and ballistics, but rarely apply thermodynamic analysis to everyday accessible artifacts and processes such as hair dryers or cooking. We are exploring examples from a wider variety of epistemologies that we will include in a course that we are developing that reimagines energy [13, 14] while decentering hegemonic narratives.

Our overarching goal is to initiate conversations amongst engineers on how decolonization can benefit engineers and engineering students by broadening engineering epistemologies while discovering and legitimizing examples of engineering practice from outside the traditional canon. In addition, we seek to engage participants in this session in conversations related to the hegemonic practices of engineering emerging from colonialist ideologies that have disenfranchised minoritized communities, particularly through the myths of objectivity and neutrality. This session serves as a first step to de-centering engineering knowledge, objectivity in engineering, and considering the impact of decolonization in engineering education.

II. Goals of othe Session

At the end of the session, each participant will be able to:

- Critically analyze how engineering may not be neutral or objective
- Describe how the myths of objectivity and neutrality in engineering perpetuate colonialism
- Critically examine the different values and assumptions that underpin engineering decisions and how these affect different people in different ways.
- Reflect on what decolonizing might mean for engineering education

III. Intended Audience

This session would be accessible to any FIE attendee. It would be particularly valuable for those interested in exploring broadening participation in engineering education beyond the typical approaches focusing on representation. Decolonization challenges researchers and educators to think deeply and can be uncomfortable. As Tuck and Yang say "decolonization is not a metaphor" [11] but a radical approach that impacts real people in physical ways. There have been some efforts at considering decolonization of engineering curricula in South Africa [15, 16]. It is worth noting that decolonization depends on context and place and would not be expected to look the same across the world. Decolonization involves learning how to be ally while promoting and fostering an environment that acknowledges diverse communities in engineering. Thus it is a topic worth considering for all engineering educators.

IV. Interaction

The facilitators are an interdisciplinary team including professors with expertise in Civil, Electrical, Materials, Mechanical Engineering as well as engineering education research. All have experience with active learning techniques and facilitating workshops. For example, Drs. Chen, Lord, and Mejia facilitated a well-attended session at ASEE 2018 on "Revealing the Invisible: Conversations about –Isms and Power Relations in Engineering Courses." [17] Dr. Lord has facilitated many workshops and interactive sessions including the National Effective Teaching Institute (NETI) [18]. The facilitators will help attendees from various backgrounds feel comfortable and the special session will include hands-on activities.

V. Overview of the Session

In this special session, participants will engage in hands-on activities as we facilitate discussions. In Activity 1, we will use cards with a variety of pictures for participants to describe what engineering means to them [19]. Participants will share their perspectives to highlight the diversity of ideas. In Activity 2, we will have participants respond individually to questions such as "Is engineering objective? Who does engineering? Is engineering neutral?" In viewing and discussing the overall responses from the room, we will also consider how objectivity and neutrality can perpetuate colonialist ideologies. We have developed case studies around a few examples of engineering design that we will share with participants. These examples highlight the myths of objectivity and neutrality. Participants will be asked to reflect on these case studies in light of these principles in Activity 3.

Tentative Agenda for 80 minutes

Time	**Topic**
15 min	Introductions and Goals
20 min	Activity 1: What is engineering?
20 min	Activity 2: Is engineering objective? Who does engineering? Is engineering neutral?
20 min	Activity 3: Case studies on non-neutral examples of the engineered world
5 min	Summary, Acknowledgements, Questions

We will also share our experiences in facilitating a related session at the Research in Engineering Education Symposium (REES) in July 2019 with facilitators from South Africa and international participants.

VI. Expected Outcomes

We hope that this session will begin a dialogue at FIE about ways to consider the impact of decolonization in engineering education. This is a challenging topic that requires considerable thought, reflection, and openness to different ways of knowing. We believe such conversations can help advance our shared mission of diversifying engineering education and enhancing research and engineering practice. This session also contributes toward expanding the adoption of asset-based frameworks in engineering. We hope that the dialogue and deep reflection on decolonization in engineering education will continue.

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[18] National Effective Teaching Institute (NETI) https://www.asee.org/education-careers/continuing-education/courses-and-workshops/neti .

[19] For example, Center for Creative Leadership Visual Explorer Facilitator's Post Card Set.