

Decolonizing Engineering Curriculum to Design an Equitable Society

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

After the protests in response to George Floyd and Breonna Taylor's murders, universities, corporations, and leaders were called to be accountable for their role in perpetuating violent racism and the history of white supremacy in the United States. Engineers also responded to these events in the Journal on Engineering Education's October 2020 issue. Here, engineering professors highlight how the engineering curriculum and the discipline contribute to upholding white supremacy. The journal focuses on how the white male perspective has been centered in engineering education curriculum and pedagogy because of the influence of the industrial revolution, colonization, and capitalism (Kelly C., 2020). This central perspective has actively detracted from the knowledge and skills of underrepresented and racially minoritized (URM) students and created standards with whiteness as the baseline. The reliance on structures of white supremacy, especially at universities that uphold these structures, has made engineers ill-prepared to tackle projects with diverse impacts. Garrick Louis highlighted this in their National Science Foundation proposal when stating, "engineers are not trained to consider the diverse dimensions and impacts of their work." In response to the Journal on Engineering Education and calls from the Black Charlottesville community, a collective of undergraduate students formed 'Students and Teachers Revolutionizing Inclusivity Values in Engineering' (STRIVE) to address issues of white supremacy in the School of Engineering and Applied Sciences (SEAS) at the University of Virginia (UVA) .

Racism and sexism were intentionally built into the structure of UVA. Founded by Thomas Jefferson in 1817, the school was designed to only include southern white men (McInnis, M. D., & Nelson, L. P, 2019). This legacy, combined with the fact that the school was built and operated on the stolen land of the Monacan Nation by the stolen labor of nearly 4,000

enslaved laborers cemented white supremacy into its operation (Indigenous/UVA relating, 2022)(Memorial to Enslaved Laborers, 2022). By not openly acknowledging this history, educating students on its impacts, accountably changing biased structures, and paying reparations to communities impacted by the university's racism, the school has continued to uphold its legacy of white supremacy. While there are current initiatives through the Division for Diversity, Equity, and Inclusion and the President's Commission on the University in the Age of Segregation, these programs are incredibly recent and are not enough to overpower the foundational structures of white supremacy at UVA. To contextualize this timeline, it is not until 2007 that there are any institutional efforts to address the legacies of slavery, segregation, or white supremacy. The resistance to diversity efforts and the recency of acknowledgment of this history has created an environment that still supports white supremacy through the school's investments, student engagements, representation, memorialization, and classrooms. This institutional legacy combined with racism embedded into engineering has created structures in SEAS that are detrimental to URM students.

As a technical solution, STRIVE, developed a six-year framework to tangibly provide a framework for interventions, programs, and further research on equity in the SEAS curriculum. This plan contains short, mid, and long-term interventions that specifically address the culture of white supremacy at UVA, which furthers the prioritization of western male perspectives in SEAS. After diagramming the components of this socio-technical problem, the Actor Network Theory (ANT) highlighted that western cultural influences and people had the largest influence over the SEAS curriculum. The actor-network theory is the "framework and systematic way to consider the infrastructure surrounding technological achievements. Assigns agency to both human and non-human actors (e.g. artifacts)" (David L., 2020). The interventions were

developed by analyzing the actors of the engineering curriculum that are specific to UVA's historical context and targeted human opinions, reflections, and biases. These interventions are supported on the social side, with the analysis between SEAS and engineering programs explicitly prioritizing equity ANT frameworks.

STRIVE Community Initiative Methodology

In a localized approach STRIVE is building social momentum to demand accountable structural changes in SEAS through educational and behavioral interventions. STRIVE is an undergraduate initiative working with professors and graduate students to decolonize and deconstruct the foundation of white supremacy in SEAS. This initiative addresses needs laid out by both the Racial Equity Task Force and Black Charlottesville community while fitting into the inclusive excellence framework. The overarching goal is to fully restructure the core engineering curriculum and student educational experience to ensure engineers' average deficit in historical and social justice topics is accounted for, students are welcomed into classrooms using culturally sustaining pedagogy, and professors are prepared to moderate conversations on race and privilege.

The planning for STRIVE took an extensive literature review, numerous meetings with professors and administrators, and securing funding for the interventions through grants. STRIVE currently has a framework of short (present-1 year), mid (2-4 years), and long (5-6 years) for interventions targeting UVA students' lack of knowledge of the school's history, the university's relation to trends of racism and white supremacy throughout the country, and engineering's culture of perpetuating traditional wastelanding concepts (Appendix A).

STRIVE's first phase intentionally targets UVA's lack of recognition and education on its contributions to slavery, white supremacy, and imperialism. Since UVA has only recently begun addressing its history, these legacies are not understood by the community causing racism and sexism to be prevalent throughout grounds. These interventions include the inclusion of educational slides on history in the engineering school, oral history exhibits on the first BIPOC women in SEAS, advising on the creation of a new first-year engineering curriculum, organizing

the first-year History of Enslaved African American Laborers (HEAAL) historical tours, and the strive-ej.org website. The current work and research for the first phase of interventions is shifting the educational understanding, personal awareness, and social norms within SEAS to create support and knowledge for future programs.

STRIVE designed the educational slides with three goals in mind: to educate UVA engineering students on the history of the school, to call attention to the influence of racism in engineering designs and products, and to highlight alumni success stories from URM students. The slides were designed to be implemented in a similar fashion to the Engineering Systems and the Environment department program that includes an informational slide about resources and opportunities in each intro-level lecture. Here, STRIVE attempted to normalize learning about topics concerning race, social justice, and history in engineering classrooms to emphasize that these are vital skills to have in order to understand the larger implications and impacts of engineering designs. This initiative aims to target the failures that Garrick Louis highlighted in his National Science Foundation Grant when he stated “engineers are not trained to understand the diverse implications of their work.” By including these slides in every class, SEAS could target engineers’ deficits in these areas and will train engineering students to actively consider the implications of their work in every setting. In relation to the HEAAL tour program, this initiative was formed very specifically to emphasize the school’s legacies of slavery, white supremacy, and activism which differs from the traditional ‘History of African American’ tour engineering students previously attended. This tour was created in a manner that improved engagement, opened up discussions, and called on students to progress current activism.

Previous historical tours that engineering students went on lacked intention in the design and creation of the tour. STRIVE has multiple members who are a part of the University Guides’

Service, including their Community Education Chair, who give historical tours and understand the variance of material depending on the tour guide. In designing the tours, this was a concern for coordinating groups including HEAAL (History of Enslaved African American Laborers) and the Descendants of Enslaved Laborers because all parties wanted to ensure all students attended a similar experience that represented the violence and harm enacted by the UVA, legacies that, until recently, have been largely ignored by the school. Here, STRIVE coordinated with partners and created an outline for tour guides that explicitly discussed the legacies of white supremacy at UVA, the hesitancy of administrators to acknowledge this past, and the activism of URM students who have fought to make the school more equitable. From observation of the tours and discussions with first-years, being this explicit on the tour about these legacies caused students to reassess their positionality at UVA and called students to be a part of change— like the tour they were on— that addresses the history of white supremacy and its impacts on the greater community.

Logistically, STRIVE attempted to create the most engaging and impactful experience possible. Engagement on the tour and with the program was a primary concern because of previous experiences with the STS 1500 History of African American tours. Based on the experiences of tour guides, students were usually not engaged and were distracted during the tour. This is due to the large group sizes and lack of a central goal and focus on the tour. On the tours, students could easily not pay attention on the tour because of the large group sizes — tours exceeding over 50 students. This allowed for distractions to occur, students to talk at the back of the tour group, and made it difficult in smaller locations to share the history of the space. In designing the HEAAL tour, STRIVE capped the tour group size to 25 students which made the tour much more accessible and engaging. STRIVE addressed the lack of focus on tours in

coordination with the requests of HEAAL and the Descendants' community by creating an outline that specifically discussed slavery, white supremacy, and activism at UVA. By ensuring these themes throughout each stop on the tour students were able to more easily follow the progression of history and connect analysis to their present-day experiences on grounds.

Further, STRIVE wanted to ensure students felt comfortable on the tour, were engaged, and could discuss this information with their peers. To achieve this, STRIVE scheduled all tours through Housing and Residence (HRL). Here, each UVA association had a designated week to attend the tour. Each association was grouped together by their area on grounds so that once students left the tour they could discuss the experience with their peers they lived near. By coordinating tours through HRL, STRIVE capitalized off of the relationships residents advisors have with their halls of students and incentivized halls coming together to create a comfortable and welcoming experience where students could learn about white supremacy at UVA. Combined, these logistical focuses created a program that prioritized engaged learning and welcomed students into the experience.

Building off the expansion of awareness in phase one, the next set of interventions target institutionalizing justice as a priority throughout the university. To be accountable for its contributions to white supremacy UVA leaders need to change the governing, curricular, and social structures rooted in the school's racist founding. Further, SEAS must address its perpetuation of violence through teachings based in wastelanding. Wastelanding is a staple in colonization and foundational to the development of white supremacy through engineers' actions. As prescribed by Traci Voyles in *Wastelanding: Legacies of Uranium Mining in Navajo Country*, "wastelanding" is "a racial and a spatial signifier that renders an environment and the bodies that inhabit it pollutable." To achieve these standards, STRIVE is working to fund a grant

program partnering undergrads and professors to restructure a class through a social justice lens, creating direct pathways between community and mutual aid organizations in Charlottesville with engineering classes to complete community projects, and mandating all professors attend moderator training for discussions on race and privilege. The interventions for year two through four present areas for UVA and SEAS build off the momentum of the educational interventions presented and continued since the first year for structural changes and reparative actions.

After including educational, social, and structural interventions, within six years a complete overhaul of the core engineering experience is possible. STRIVE chose a six-year framework to hold the university accountable and not perpetuate the cyclical nature of UVA students' demands. Jefferson's foundation of student self-governance allows the perpetuation of structures of harm because students graduate every four years. Student turnover allows administrators to have performative conversations without actually addressing any demands. These challenges are similar to grassroots environmental justice advocates on the national and international stages. Multinational companies perpetuate harm by lobbying against environmental reparations and protections. Further, companies' nearly unlimited funds allow them to silence environmental activists by depleting their resources through extensive litigation. At UVA, administrators or the Board of Visitors (BOV) can stop student projects and delay action long enough for students to burn out, have to prioritize school and other obligations, or graduate from UVA. There is an unprecedented amount of labor required by students to cause any changes with little to no accountability by UVA to continue their work once students graduate. By designing this layered and cumulative framework, STRIVE is attempting to stop this perpetual cycle in relation to our work.

STRIVE Analysis

As part of their short-term work, STRIVE surveyed first-year engineering students on their perceptions of engineering qualities and the impact of select educational initiatives. These interventions include the mandatory first-year HEAAL tour, research into the first Black women in the engineering school, and the design of educational slides teaching about the legacies of racism and white supremacy in engineering and at UVA. All of these programs seek to educate engineering students on the recency and perpetuation of racism at UVA and to push them to consider what this context means for their positionality as an engineer. First-year engineering students were surveyed specifically on the HEAAL tour program, how it impacted their perception of UVA, if it caused any changes to how they interact with the university, and what, if any, actions do students plan on taking to support anti-racist efforts. In relation to the HEAAL tour program, this initiative was formed very specifically to emphasize the school's legacies of slavery, white supremacy, and activism which differs from the traditional 'History of African American' tour engineering students previously attended. This tour was created in a manner that improved engagement, opened up discussions, and called students to participate in current activism on grounds.

To measure the impact of the HEAAL tours, STRIVE surveyed engineering students on their experiences on the tour, their perceptions of qualities that are necessary for engineering, and their experiences with diversity in SEAS. The survey includes questions that use a Likert scale — ranging from strongly disagree to strongly agree— and qualitative short text options. There are currently not enough survey responses to provide statistical confidence; however, from observations of the tours, discussions with participants, and responses on the impacts of the program, the HEAAL tours did increase students' understanding and awareness of UVA's

history of white supremacy. One student remarked specifically that the tour “opened [their] eyes to the ways in which technology can be oppressive and harmful to those it targets and emphasized the importance of designing with not only the majority in mind.” Further, students discussed the tour’s goal of being a call for future activism when they stated the tour “reminded me of how much this world still has to improve in every capacity and engineering is one of the capacities [they] can contribute to.” Overall, the majority of respondents and participants in discussions strongly agree that the tour was a valuable addition to their understanding of UVA and that the history of UVA has directly impacted the university as it is today. This is a history of white supremacy which students state still currently shapes the school and supports research highlighting systemic structures of racism that have been ingrained in the culture since its foundation.

Conclusion

White supremacy has shaped engineering. Discrimination became key to the profession through its development during colonization and the Industrial Revolution and continues to shape the experiences of URM students at UVA. The SEAS must take direct actions in acknowledging and addressing the legacies and continued reliance on structures of white supremacy. After the murder of George Floyd, community members, graduate students, and undergraduate students pushed the school to prioritize DEI initiatives and goals in the SEAS (Black Community, 2020). SEAS responded to these calls by hiring a Dean for Diversity, Equity and Inclusion, through departments creating their own DEI committees and goals, and the creation of the directors of DEI. While this is progress, much of this work is being done through committee work and has yet to impact classroom education of the social culture that supports white supremacy. Further, while the Office of Diversity, Equity and Engagement sponsors “resources for personal and professional development, resources for financial assistance, academic advising and tutoring, a summer bridge program for entering first-years, and a variety of support services through the Center for Diversity in Engineering (CDE),” these types of programs have historically failed to make measurable progress in increasing diversity in engineering because they do not address the systemic structures which continue to perpetuate racism (UVA Engineering)(Lee et. al, 2020). These programs are band-aids to assist assimilation into the dominant perspective because they do not address the structures which cement white supremacy into the university. As an institution, SEAS can accountably educate students on the school’s history and recency of racism, include social justice specifically in the objectives of classes, and expand the perspectives which they include in classroom teachings and examples.

During their community initiatives, STRIVE assessed areas for educational programs which hold the university accountable for its contributions to white supremacy. In the process of holding UVA accountable for its historic racism STRIVE hopes the university will respond to repeated calls from the Black student body and Charlottesville community to change these structures. STRIVE suggests that SEAS continue historical training about UVA, sponsor student research projects into diversity in SEAS, and consider implementing required courses or workshops about white supremacy and DEI in every year of education. Combined, these initiatives seek to understand how racism created the spaces students occupy and how students benefit from this history all to address and change the foundations of white supremacy UVA is built on.

Appendix

Appendix A:

Short (present- 1 year):

- I. Inclusion of educational slides throughout the engineering school
 - A. This program will provide a database of PowerPoint slides. This database contains three categories: 'Contextualizing UVA's History', 'Designed Racism', and 'Alumni Successes.' Every week each class in the engineering school must discuss one of these slides, connecting the slide to their particular class, technical solution, or potential career path. Looking for implementation within the ESE department during the spring semester to pilot the program.
- II. Oral History Exhibit of SEAS Integration and Coeducation
 - A. In collaboration with Reflections: Oral History at UVA to be presented in Spring 2022.
 - B. Focusing on rebuilding relationships with BIPOC and female alumni and collecting their narratives of their time at SEAS.
- III. Collaborating with Professors Keith Williams and Ben Laugelli on developing the new STS1500/ENGR curriculum
- IV. Creating introduction slides for all the maintenance and facilities workers throughout SEAS.
 - A. Including pictures and bios submitted by each individual who chooses to participate. Slides then included on TVs throughout SEAS. Students will be encouraged to get to know the facilities and maintenance workers. Addressing the history of UVA's segregation, the treatment of the Black Charlottesville community, and a general disregard for the workers providing necessary services for the functioning of the university.
- V. Expanding STRIVE numbers to ensure longevity within the engineering program and commitment to these goals.
- VI. Designing a website based on trading zones to educate engineers on environmental justice and the Rights of Nature to limit the support of hazardous projects.
 - A. Designed in collaboration with SunTribe Solar and the Social Justice in Engineering Workshop and under the guidance of Kimberley Fields and Leidy Klotz (draft published by December)

Mid (2-4 years):

- I. Creation of a grant program partnering undergraduates with professors to redesign a course's curriculum with a focus on including diversity, equity, and inclusion throughout the class.
 - A. Creating between 6-10 pairs that can take their research and findings into their smaller learning communities (i.e. major departments and classroom discussions), creating an ever-expanding network of impact. Currently collaborating on this program with the Center for Teaching Excellence.
 - B. Has the potential to expand with Professor Louis' NSF proposal by having cross UVA and local minority-serving institution partnerships.
- II. Create direct pathways for classes to work with the Charlottesville community in outreach projects targeting the requests and needs of the local community.
- III. Mandating all professors attend moderator training for discussions concerning race and privilege.

Long: (5-6 years):

- I. Complete overhaul of core engineering curriculum ensuring that social justice, human impact, and one's privilege are adequately addressed.
 - A. Including culturally sustaining pedagogy throughout every class.
 - B. Examining how traditional teaching examples may or may not be connected to White supremacy.
 - C. Including classes relating courses technical material and social justice in core major requirements.

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