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Decolonizing Engineering Education: A Cross-Institutional Approach Using Participatory Action Learning and Action Research (PALAR)

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ABSTRACT

PURPOSE OR GOAL

This paper presents findings from the Building a Legacy in Engineering (BLE) project, a cross-institutional collaboration between a Predominantly White Institution (PWI) and a Historically Black College and University (HBCU) aimed at transforming engineering education through a decolonizing lens. We define decolonizing as the disruption of dominant Eurocentric and technocratic paradigms and the elevation of community-rooted knowledge, historical accountability, and relational approaches to both pedagogy and design.

PROPOSED METHODOLOGY

Grounded in Participatory Action Learning and Action Research (PALAR), BLE engages students, faculty, and community members as co-researchers in iterative cycles of inquiry, design, reflection, and implementation of sustainable infrastructure solutions in historically marginalized communities. Drawing on qualitative data collected in Year 2, including structured student reflections, semi-structured interviews, field observations, and community partner feedback, this study identifies key outcomes such as the development of critical consciousness, enhanced cross-cultural collaboration, and the emergence of anti-racist, community-centered engineering practices. Students transitioned from deficit-based assumptions to asset-based engagement, and from top-down design thinking to collaborative problem-solving rooted in community knowledge and priorities. The program also catalyzed institutional shifts in how faculty engaged with engineering ethics, co-leadership, and interdisciplinary learning. One notable example includes student teams redesigning irrigation systems based on feedback from local elders, demonstrating adaptive design and cultural humility.

CONCLUSION

Although BLE is grounded in the U.S. South, its flexible model, emphasizing long-term relationships, place-based learning, and critical reflection, offers a framework for adaptation in national and international contexts seeking to transform engineering education through justice-centered practices. Potential for replication lies in its integration of culturally responsive pedagogy with rigorous design instruction, though such implementation requires strong institutional commitment, faculty training, and sustainable community partnerships. Limitations of the study include the challenges of coordinating across academic calendars and institutions, uneven student participation, and the resource demands of maintaining community engagement beyond the academic year. Nonetheless, BLE offers a replicable and transformative approach to reimagining engineering education as a relational, reflective, and justice-oriented practice that centers equity, historical context, and community voice.

KEYWORDS

Decolonizing pedagogy, engineering education, PALAR, critical service-learning, community engagement.

Introduction

Engineering education has long prioritized technical mastery, objectivity, and individual achievement, often at the expense of socio-political, cultural, and community considerations (Riley, 2008; Leydens & Lucena, 2014). This paradigm proves inadequate in an era of global systemic injustice and accelerating inequities. A shift is underway toward pedagogies that are ethical, contextual, and rooted in equity. This shift requires more than revising syllabi; it demands a fundamental critique and reimagination of what knowledge is valued and who holds it.

In this paper, we define decolonizing engineering education as the process of dismantling dominant epistemologies rooted in Eurocentric, technocratic, and colonial logics and replacing them with pedagogical and research practices that center community knowledge, relational accountability, and historical context. Decolonization is not a metaphor for inclusion or reform; it requires a material redistribution of power in knowledge production and a transformation of institutional priorities (Tuck & Yang, 2012; Mignolo, 2011; Patel, 2016). In engineering education, this means critically examining who defines knowledge, how engineering problems are framed, and who benefits from their solutions (Leydens & Lucena, 2017).

Decolonizing engineering education involves identifying and dismantling dominant epistemologies rooted in Eurocentric, capitalist, and colonial logics. As Tuck and Yang (2012) remind us, decolonization is not a metaphor. It requires a material change in land relations, institutional priorities, and pedagogical practices. In engineering, this means engaging with community knowledge, interrogating structural power, and cultivating technically proficient and socially conscious engineers (Leydens & Lucena, 2017).

This paper presents the Building a Legacy in Engineering (BLE) project as a case study in decolonial engineering education. BLE is a cross-institutional collaboration between a Predominantly White Institution (PWI) and a Historically Black College and University (HBCU), grounded in Participatory Action Learning and Action Research (PALAR). Through year-long engagements, BLE supports student development in critical consciousness, anti-racist STEM practices, and cross-cultural collaboration. In doing so, BLE serves as a tangible example of moving beyond theorizing decolonialized engineering education to implementing culturally inclusive practice among engineering students.

Background and Context

The Building a Legacy in Engineering (BLE) project is a cross-institutional initiative focused on exposing undergraduate students to equity-centered engineering practices through collaborative, community-based infrastructure projects. Implemented in 2021, BLE was designed to develop students' critical consciousness, cultural humility, and capacity for participatory design across institutional contexts. BLE brings together undergraduates from a PWI and an HBCU to co-create sustainable solutions with community partners in historically underserved contexts. The initiative is grounded in Participatory Action Learning and Action Research (PALAR), a pedagogical framework that promotes egalitarian research partnerships, iterative learning, and community co-leadership (Zuber-Skerritt, 2011; Wood & Zuber-Skerritt, 2019). Unlike traditional service-learning models, BLE resists top-down, technocratic approaches. Instead, students, faculty, and community members collaboratively define goals for their engineering projects and partnerships, reflect on progress toward creating contextually relevant, community-driven solutions, and adapt their designs and engagement strategies in response to evolving community needs and feedback.

Each year, BLE recruits a cohort of twenty undergraduate students: 10 from a PWI and 10 from an HBCU, alongside 4-8 faculty mentors and 1-5 community partners. The project spans 10 months annually, with weekly virtual learning sessions, asynchronous assignments, reading discussions, site planning, and multiple community site visits. Students work in interdisciplinary, cross-campus teams on projects such as rainwater harvesting systems, solar-powered infrastructure, agricultural sheds, and soil testing protocols. All projects are designed

in response to community-identified priorities and include feedback loops that ensure their relevance and sustainability.

This context offers unique opportunities for students to reckon with the legacies of systemic racism, land dispossession, and scientific exclusion, for example, through guided visits to local civil rights landmarks, conversations with Black elders about struggles over land ownership, and reflective assignments that connect the health inequities to contemporary health and infrastructure disparities. Simultaneously, it invites students to witness the power of community resilience, intergenerational wisdom, and innovation in science and engineering, for instance, by learning traditional farming techniques from local elders, co-creating low-tech sustainable irrigation systems, and participating in community storytelling sessions that highlight historical ingenuity in Black agricultural and engineering practices. BLE seeks to make these tensions and opportunities visible, not as background noise, but as central to the engineering process. In doing so, students learn technical skills and how to listen, unlearn, and design with cultural and historical humility and inclusion for future generations.

Theoretical Framework

The BLE project is grounded in a fusion of three educational and social justice theories that inform its design, pedagogy, and evaluation: critical service learning, culturally responsive pedagogy, and participatory action learning and action research. These frameworks challenge dominant paradigms in engineering education that prioritize neutrality, technical mastery, and Western epistemologies while ignoring historical and cultural context.

Critical Pedagogies: Service, Whiteness, and Consciousness

BLE draws on a critical approach to service-learning, emphasizing reciprocal partnerships, the redistribution of power, and a commitment to social change (Mitchell, 2008). Traditional service-learning models often replicate systems of privilege by positioning white, well-resourced students as helpers and communities of color as passive recipients. To counter this, BLE embeds authentic relationships and structured reflection into every stage of the program, inviting students to interrogate their assumptions and understand the sociohistorical dynamics that shape their work. This aligns with critiques of the "pedagogy of whiteness" (Mitchell, Donahue, & Young-Law, 2012), where the comfort of white students is often prioritized over engaging with systemic inequality. BLE intentionally creates discomfort as a learning tool, particularly through cross-institutional dialogues that surface positionality, race, and privilege. At its core, the project seeks to cultivate critical consciousness (Freire, 1970), not only by raising awareness of oppression (i.e., critical reflection) but by linking that awareness to critical action. Through reflective practice and co-design, students are invited to see engineering not as apolitical problem-solving, but as a profoundly social practice shaped by history, identity, and power.

Culturally Responsive Pedagogy (CRP)

BLE also draws on culturally responsive pedagogy, which affirms the value of students' and community members' lived experiences as sources of legitimate knowledge (Ladson-Billings, 1995). Students' local expertise, particularly around land, farming, and environmental history, was positioned as essential to technical design, challenging dominant hierarchies of expertise. This approach fostered mutual respect, built cultural humility among students, and redefined what counts as engineering knowledge.

Participatory Action Learning and Action Research (PALAR)

As a methodological and pedagogical foundation, PALAR (Zuber-Skerritt, 2011) operationalizes BLE's commitment to shared authority, co-learning, and iterative engagement. By involving students, faculty, and community members as co-researchers, PALAR breaks down the traditional roles of "expert" and "subject," reinforcing justice-centered inquiry. Its

recursive cycles of reflection and action align with both the engineering design process and decolonizing pedagogical aims, allowing BLE to remain flexible, ethical, and contextually grounded.

Figure 1 illustrates the theoretical framework of Participatory Action Learning and Action Research (PALAR), adapted from Zuber-Skerritt's original model. This visualization highlights the cyclical, relational nature of PALAR by centering context, practice, and shared vision. It underscores key components such as relationship building, role negotiation, collaborative reflection, and community-defined research goals, all of which are foundational to BLE's approach to decolonizing engineering education.

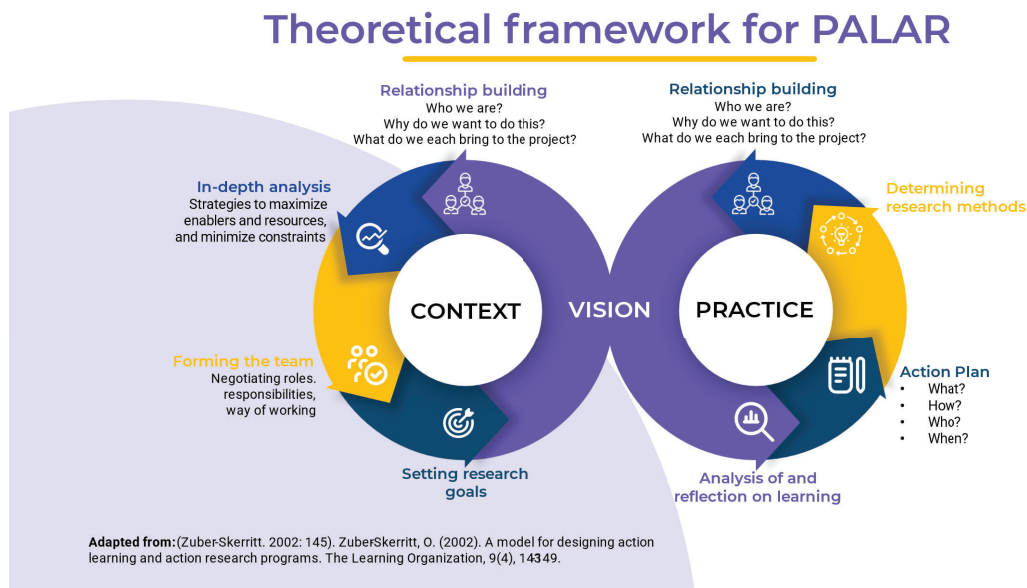


Figure 1: Participatory Action Learning and Action Research (PALAR)

What distinguishes PALAR from other participatory frameworks commonly applied in engineering education, such as traditional participatory action research (PAR) or user-centered design, is its emphasis on iterative reflection as a collective practice and its insistence on co-leadership among all stakeholders. In contrast to models that position community feedback as a final design checkpoint, PALAR embeds community members as co-researchers throughout the full cycle of inquiry, planning, action, and evaluation. Moreover, PALAR explicitly foregrounds relational accountability, emotional labor, and values-driven collaboration, which are often overlooked in more technocratic applications of participation. Within BLE, this meant that students and faculty not only co-designed with community members but also shared decision-making power in setting project goals, timelines, and evaluation metrics, often adjusting technical expectations to honor community-defined success. This approach offers a critical departure from conventional engineering pedagogies by repositioning learning as a dialogic, relational, and justice-centered process rather than a linear technical transfer.

The integration of these three frameworks provides a comprehensive evaluative lens for BLE's activities. Together, these frameworks help interrogate structural power, examine how race and privilege operate within learning environments, and support students in developing both self-awareness and a commitment to justice-oriented action. As such, success within BLE is not assessed solely by technical outcomes or service hours, but by how deeply students engage in critical reflection, how effectively they navigate and learn across cultural differences, and how authentically they build reciprocal relationships with community partners. This multidimensional framework allows BLE to address the systemic roots of inequity in

engineering education while modeling an alternative path grounded in justice, humility, and solidarity.

Methodology

The BLE project was designed not only as a curricular innovation but also as an exploration of how engineering education might be transformed through community-engaged, justice-oriented practice. We employed a qualitative, participatory case study methodology to evaluate its pedagogical impact and student learning outcomes. This approach aligns with the project's epistemological commitments to equity, reflexivity, and shared authority in knowledge production.

Research Design and Paradigm

Our study was grounded in the methodological principles of Participatory Action Learning and Action Research (PALAR), which call for iterative cycles of co-inquiry, action, and reflection among all stakeholders (Wood & Zuber-Skerritt, 2019). Rather than treating students or community members as subjects, PALAR positions them as co-researchers, co-educators, and co-authors of the learning process. This participatory ethic shaped our research questions, data collection, and analysis. In addition, the study explores the outcomes of the Building a Legacy in Engineering (BLE) project through the lens of decolonizing pedagogies, anti-racist design, and cross-institutional collaboration.

The research questions guiding this analysis are:

- **Student Experience and Learning:**
How do students experience and interpret BLE's decolonizing, community-engaged pedagogies?
In what ways do students develop critical consciousness, cultural empathy, and cross-cultural competence through participation in BLE's curriculum?
- **Pedagogical and Institutional Transformation:**
How can cross-institutional learning experiences between a PWI and an HBCU support authentic STEM innovation, challenge traditional hierarchies, and center culturally relevant design practices?
What are the pedagogical and institutional shifts needed to enable sustained anti-racist, decolonizing engineering education?
- **Community Collaboration and Legacy Impact:**
How does collaborative work on tangible, community-centered infrastructure projects influence students' sense of belonging and their perceptions of engineering as a social practice?
How does the PALAR model facilitate (or constrain) equitable collaboration among students, faculty, and community members?

Participants

This paper draws on data collected during the second year of BLE implementation (2023–2024). Twenty undergraduate students were initially recruited through a competitive application process that emphasized personal motivation, prior community engagement experience, and disciplinary diversity. Students represented a range of majors, including civil and environmental engineering, agricultural science, environmental design, and mechanical engineering. Of the twenty students, eight completed the full 10-month program, which included consistent participation in bi-weekly virtual seminars, a 10-day intensive field experience, and submission of final reflective artifacts (e.g., project deliverables, reflective essays, and exit interviews). The remaining twelve students either withdrew early, participated partially (e.g., only in the fall semester), or were unable to travel for the in-person site visit. In addition to the student cohort, the program included three faculty mentors and four community partners who collaborated in co-facilitation, curriculum development, and research reflection.

Data Collection

We collected multiple forms of qualitative data to triangulate findings and capture the richness of participants' experiences:

- **Student reflection journals** in response to structured prompts
- **Final reflective essays** written at the end of the academic year
- **Field notes** from in-person community site visits
- **Community partner feedback interviews** and group debriefs
- **Video recordings and transcripts** of weekly cross-institutional virtual class sessions
- **Semi-structured interviews** with a subset of students ($n = 8$), conducted by research assistants not directly involved in grading or facilitation

All participants provided informed consent under an IRB-approved research protocol. Student submissions were anonymized and coded using pseudonyms.

Data Analysis

We employed thematic analysis following Braun and Clarke's (2006) six-phase framework: (1) familiarization with the data, (2) generation of initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. Coding was iterative and conducted using Dedoose software. An interdisciplinary team of researchers, including faculty from both institutions and a graduate research assistant, engaged in collaborative coding sessions to ensure intercoder reliability.

We first coded all data sources inductively, noting emergent themes related to identity, equity, collaboration, and learning. We then mapped these codes onto our guiding theoretical constructs: critical consciousness, culturally responsive pedagogy, and anti-racist engineering practices. We engaged in member-checking with students and community partners by sharing initial findings during a summer debrief and incorporating their feedback into the final themes.

Trustworthiness and Limitations

To enhance the trustworthiness of our findings, we employed multiple validation strategies, including triangulation across data types, peer debriefing among faculty co-researchers, and member checking with participants. Limitations of this study include its modest sample size and the specificity of its context, which may constrain generalizability. Additionally, the participatory nature of the research meant that faculty played dual roles as facilitators and researchers, potentially introducing bias. We sought to mitigate this by involving independent coders and collecting anonymous feedback.

Despite these limitations, our methodological approach enabled a rich, layered understanding of student growth and program impact within BLE. The following section presents key findings, organized around themes of critical consciousness, community-centered design, cross-cultural collaboration, and reflective practice.

Findings

Thematic analysis of reflection journals, final essays, interviews, and observation notes revealed that the BLE project facilitated substantial learning and transformation among participants.

In pre-program surveys, 85% of participants described their goals using language centered on "helping" or "giving back", which was often absent from systemic, cultural, and sociopolitical understandings of the local context. By the end of the program, final reflections and interviews revealed that over 90% of students articulated a nuanced understanding of engineering as a socio-political and community-embedded practice. For example, seven out of eight interviewees described a transformation in how they approached design, shifting from efficiency-centered frameworks to ones grounded in cultural responsiveness, local knowledge, and sustainability. These findings suggest that BLE facilitated not just attitudinal change, but a fundamental reorientation of students' professional identities.

Four key themes emerged: (1) Development of Critical Consciousness, (2) Integration of Anti-Racist and Community-Centered Engineering, (3) Cross-Institutional and Cross-Cultural Collaboration, and (4) Embracing Reflective and Participatory Practice. Each theme is elaborated below with illustrative student quotes and supporting insights.

Development of Critical Consciousness

Students reported significant shifts in their understanding of systemic inequity, their positionality, and the broader societal implications of engineering. Initial reflections often revealed a charity-oriented mindset (e.g., "I hope I can make a difference here"). However, throughout the program, students began to connect community conditions to historical and structural forces, such as redlining, land theft, and environmental racism. This transformation was not limited to introspection; it informed and reshaped their engineering practices.

"I came into BLE thinking we'd design stuff to help. But it wasn't about fixing things, it was about learning the history, listening, and building together." — Student.

Students applied this deepened historical understanding in tangible ways. For instance, a student team co-developed a gravity-fed irrigation system after learning that a more automated design would be challenging to maintain. This design decision emerged from consultation with local elders, who shared knowledge about the land and community priorities. Such reflection-action cycles embody Freire's (1970) concept of *conscientização*—critical consciousness rooted in praxis.

Integration of Anti-Racist and Community-Centered Engineering

Students increasingly understood engineering as a socially embedded and political practice. Rather than treating community feedback as peripheral, they came to view it as central to the design process.

"At first, I kept asking how to make the system more efficient. Then I realized, the better question is: how do we make sure the system is usable when we leave?" —Student

Students embraced an ethos of "designing with, not for," elevating community voices and challenging traditional hierarchies in engineering problem-solving. This co-creation disrupted the assumption that technical expertise alone leads to the most effective outcomes. By centering local wisdom and community agency, students developed a justice-oriented understanding of sustainability, usability, and ethical responsibility in engineering practice. Further, this understanding translated into their engineering design and practice, completing the reflection-action cycle associated with critical consciousness praxis.

Cross-Institutional and Cross-Cultural Collaboration

Students cited working across racial, institutional, and disciplinary boundaries as one of the most transformative aspects of BLE. What began as discomfort and miscommunication evolved into trust and mutual respect.

“We had assumptions, they {the other students} had assumptions about us. But then we started working together, and the assumptions fell away.” — Student

Cross-institutional teams allowed for distributed expertise: the PWI students often brought access to design software and academic resources, while the HBCU students contributed deep contextual knowledge, cultural insight, and community relationships. Through collaborative challenges, students learned to interrogate privilege and co-develop norms for equitable communication and leadership.

“We had hard conversations about privilege. It wasn’t easy.” — Student

These interactions served as opportunities to intentionally disrupt the “pedagogy of whiteness” (Mitchell et al., 2012), creating a shared space for reflexivity and relationship building.

Embracing Reflective and Participatory Practice

Students initially viewed structured reflection as “extra work,” but by the end of the program, many identified it as essential to their learning and growth. Weekly prompts, small group dialogues, and facilitated debriefs surfaced personal biases, team dynamics, and institutional assumptions.

“I used to avoid talking about race because I didn’t want to offend anyone. Now I realize that silence is part of the problem.” — Student

Reflective practices led students to revise designs, adjust team norms, and recognize the social stakes of engineering work. One group, for example, revised its communication strategy after a quieter student voiced concern about being overlooked. The team co-created new norms around turn-taking and inclusive facilitation. Reflection was not treated as a soft skill or developmental exercise; it was positioned as a rigorous, iterative practice central to both justice and technical excellence.

Discussion

The findings from the BLE project underscore the transformative potential of community-engaged, justice-centered engineering education grounded in the principles of decolonization and participatory action research. BLE challenges dominant narratives in engineering education that position students as technical experts who solve problems for communities, and instead cultivates engineers who collaborate, reflect, and co-learn with those most affected by systemic inequities.

Challenging the Traditional Engineering Paradigm

Traditional engineering pedagogy often reinforces a narrow view of engineers as apolitical problem solvers, trained to prioritize efficiency and innovation above context and consequence (Riley, 2008; Leydens & Lucena, 2014). BLE disrupts this paradigm by embedding engineering work within a rich socio-historical and cultural landscape and positioning it as relational, ethical, and justice-oriented. This paradigm shift foregrounds critical questions: Whose problems are being addressed? Who defines success? And who holds the authority to name what expertise looks like?

Students in BLE were tasked not only with technical design but with understanding how this land has been shaped by dispossession, resilience, and intergenerational knowledge.

Operationalizing Decolonization Through PALAR

Decolonization in education is often invoked rhetorically, but it rarely results in substantive shifts in pedagogy, power dynamics, or institutional practices (Tuck & Yang, 2012). In contrast, the BLE project sought to operationalize decolonization by grounding its pedagogy and research design in Participatory Action Learning and Action Research (PALAR). As discussed earlier, PALAR centers shared authority, mutual reflection, and iterative co-creation principles that align with decolonizing frameworks seeking to disrupt hierarchies of knowledge and power (Zuber-Skerritt, 2011; Wood & Zuber-Skerritt, 2019).

In BLE, PALAR served not just as a methodological choice but as a decolonizing practice that reconfigured traditional roles in academic projects. Rather than treating the community as a site of data extraction or intervention, PALAR positioned community members as co-educators and co-researchers. This shift decentralized the university's authority and elevated lived expertise as a legitimate and necessary source of knowledge.

For students and faculty, this required not only humility but also an openness to adapt, listen, and relinquish control. Outcomes were not predetermined but emerged through a collective process. As one student shared, "We didn't just learn engineering, we learned how to be in community."

The recursive nature of PALAR enabled students to engage in a cycle of reflection and action, similar to the engineering design process, but grounded in a justice-oriented ethos. When teams encountered cultural misunderstandings, logistical barriers, or concerns from community members, they were expected to pause, reflect, respond, and re-engage. This dynamic structure allowed BLE to be responsive, relational, and rooted in local contexts, further reinforcing its commitment to decolonizing engineering education.

Reflection as Technical and Transformative Practice

Reflection is often underemphasized in engineering education, viewed as a "soft" skill or tangential to technical rigor. BLE challenges this notion by demonstrating that reflection is both compatible with and essential to technical learning. Through structured journaling, facilitated dialogues, and community feedback, students developed empathy, humility, and ethical reasoning skills.

Importantly, reflection in BLE was not solipsistic or abstract. It was tied to action and situated in real-world stakes. Students reflected on the design implications of internet inaccessibility, the political roots of disinvestment in Black communities, and their own unconscious biases. This mode of reflective engineering aligns with Freire's (1970) concept of praxis, which involves reflection and action upon the world to transform it. It supports Leydens and Lucena's (2014) call for sociotechnical integration in engineering education, where students are competent designers and socially responsible citizens.

Navigating Challenges and Tensions

While BLE's outcomes were overwhelmingly positive, the program also surfaced tensions that merit critical reflection. Cross-institutional partnerships require significant coordination. Differences in academic calendars, grading expectations, and institutional capacity created friction. Ensuring equitable participation and visibility across institutions, particularly when resource imbalances persist, was a persistent challenge.

While PALAR provided a robust methodological foundation for fostering co-learning and shared authority, its implementation also surfaced meaningful tensions. One recurring challenge was balancing the desire for collaborative decision-making with the practical constraints of project timelines, academic calendars, and varying levels of student availability. At times, iterative co-design processes conflicted with institutional expectations for deliverables and deadlines, resulting in stress or uneven participation. Additionally, some students expressed discomfort with the ambiguity inherent in PALAR's emergent, non-hierarchical

structure, mainly when roles and responsibilities were not clearly defined. Community partners also noted that while they appreciated being positioned as co-educators, they sometimes felt uncertain about how much authority they truly held in shaping technical aspects of the projects. These frictions highlighted the ongoing need for clearer communication protocols, a deeper orientation to participatory methods, and flexible timelines that balance relationship-building with technical progress. Rather than undermining the process, these challenges offered important opportunities for collective learning, reflexivity, and course correction, core tenets of PALAR itself.

Furthermore, the emotional labor of engaging deeply with topics like race, history, and privilege was taxing for some students, particularly those from marginalized backgrounds. Faculty had to be attentive to burnout, conflict, and the need for trauma-informed facilitation.

Community expectations also required careful management. In the project, there were moments of skepticism or fatigue, notably when timelines shifted, students and faculty lacked the necessary skills to complete the required tasks, or communication lagged. Maintaining trust requires a willingness to make and learn from mistakes. Rather than avoiding these challenges, BLE intentionally leans into them, recognizing that the friction of misalignment and the weight of historical injustice are integral to the co-creation process.

In doing so, BLE reflects what Leigh Patel (2016) and Indigenous scholars describe as “the study of struggle,” a framing that embraces tension, discomfort, and contradiction as generative forces for learning and transformation. These challenges are not signs of failure but learning opportunities to evaluate if the project should continue. Justice-oriented education demands this grappling; it is through the willingness to navigate struggle collectively that more equitable and relational models of engineering education can emerge.

Implications for Practice

The Building a Legacy in Engineering (BLE) project presents a compelling model for reimagining engineering education as a catalyst for social transformation. Our results and implications from this work extend beyond the confines of a single project or institution, highlighting broader shifts needed in curriculum design, institutional collaboration, and community engagement.

Embedding Justice in Core Curriculum

One of the most actionable lessons from BLE is the urgent need to integrate justice-centered, community-engaged pedagogy into the core of engineering education rather than confining it to elective courses or extracurricular experiences. Doing so requires a fundamental shift in how institutions define “rigor” and “relevance” within the field. Faculty and curriculum committees can initiate this transformation by incorporating reflective practice into design and capstone courses, collaborating with local organizations to develop long-term, reciprocal projects, and integrating critical readings on race, power, and sustainability into engineering ethics modules. Additionally, traditional problem sets can be replaced or supplemented with context-rich challenges rooted in real-world community concerns. These shifts not only deepen students’ technical competencies but also prepare them to become more responsive, ethical, and adaptable professionals, engineers who are equipped to lead and collaborate effectively in diverse and complex environments.

Building Equitable Institutional Partnerships

Building equitable institutional partnerships is essential to advancing justice in engineering education. BLE highlights the transformative potential of cross-institutional collaboration, especially between Predominantly White Institutions (PWIs), Minority-Serving Institutions (MSIs), and Historically Black Colleges and Universities (HBCUs). For these partnerships to be truly effective, they must be grounded in mutual respect, transparency, and shared governance. This involves co-creating curricula and research agendas with equal input from

all institutions, ensuring equitable access to resources, academic credit, and visibility for students, and explicitly addressing existing power asymmetries. Long-term commitments to multi-year, mutually beneficial collaborations, rather than one-off engagements, are crucial for sustained impact. As evidenced by BLE, such partnerships enrich student learning, diversify academic networks, and support a more just and sustainable redistribution of resources across institutions.

Sustaining Community Relationships

Sustaining meaningful community relationships is foundational to justice-centered engineering. However, university-community partnerships are often extractive, transactional, or short-lived. The BLE project offers an alternative model grounded in trust, reciprocity, and long-term commitment. To maintain and deepen these relationships, institutions must compensate community partners for their time and expertise, involve them in every phase of the project from design to evaluation, and remain transparent about goals, timelines, and constraints. Additionally, building continuity through mechanisms like alum mentorship or integrating projects into long-term strategic plans helps ensure that partnerships are not only impactful but also enduring. BLE demonstrates that when community voices are valued and institutionalized, engineering education becomes more relevant, accountable, and transformative.

Adapting the BLE Model Nationally and Internationally

While the BLE project is grounded in the historical and cultural context of the U.S. South, its core design principles are highly adaptable across diverse institutional and geographic settings. The emphasis on participatory reflection, cross-cultural collaboration, and community-driven engineering can be translated into urban or rural contexts, both nationally and internationally, by aligning projects with local histories, knowledge systems, and community priorities. Institutions interested in replicating BLE's outcomes can begin by establishing sustained, reciprocal partnerships with community organizations; co-developing curricular structures that blend technical learning with critical reflection; and adopting participatory frameworks such as PALAR to guide engagement. Adaptation will require flexibility, cultural humility, and resource investment, but the BLE model offers a scalable blueprint for transforming engineering education into a more just, inclusive, and community-anchored practice.

Educators and institutions seeking to advance equity in engineering education can draw from BLE by centering local knowledge, cultivating reciprocal partnerships, and grounding technical projects in community-identified needs. Replication of the model involves implementing participatory frameworks, such as PALAR, fostering sustained rather than short-term engagement, integrating technical learning with critical reflection, and facilitating dialogue across lines of difference, whether racial, disciplinary, or institutional. Moreover, evaluation metrics should prioritize the quality of relationships, community benefit, and student transformation over purely technical outcomes. While scaling the BLE model requires careful contextualization, continuous reflection, and a deep commitment to justice, it holds powerful potential to reimagine engineering education as a liberatory and community-anchored practice.

Conclusion

The Building a Legacy in Engineering (BLE) project represents a radical departure from traditional, hierarchical service-learning models by integrating community-engaged, justice-centered pedagogies into engineering education. Guided by Participatory Action Learning and Action Research (PALAR) principles, BLE repositions students from technocratic problem-solvers to critical co-learners, accountable collaborators, and reflective practitioners.

Through sustained, cross-institutional collaboration between a PWI, an HBCU, and community partners, BLE demonstrates how engineering education can confront the histories and

structures of systemic injustice. Students developed critical consciousness, deepened their understanding of anti-racist engineering, and gained firsthand experience with the complexity of designing for sustainability, equity, and relevance. At the same time, community members were not passive recipients but co-designers, mentors, and evaluators.

While challenges such as institutional alignment, cultural misunderstandings, and the labor of reflection persist, BLE offers a hopeful and adaptable model. Its approach demands more than curricular innovation; it calls for a cultural and institutional shift toward reciprocal partnerships, ethical engagement, and epistemic humility. BLE models the potential of engineering education to become a site of transformation that centers local knowledge, fosters cross-cultural collaboration, and reflects deeply on our roles in systems of power. In doing so, we move closer to an engineering discipline that builds towards progress and just futures, with and for communities.

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