Paper Title Literature Review: Black, Latin, and Indigenous Students' Experiences of Stress, Distress, and Trauma in Engineering

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Literature Review: Black, Latin, and Indigenous Students' Experiences of Stress, Distress, and Trauma in Engineering

Introduction

Structures of racism, colonization, and white supremacy have traditionally excluded minoritized populations, namely Black, Latin, and Indigenous (BLI) communities, from participation and success in engineering [1]. As a result, BLI students can experience a significant disadvantage in exposure, preparation, and skillset development upon entering engineering spaces compared to their white counterparts. This setback and subsequent expectation to perform at a level that requires previous knowledge not yet obtained creates environments of undue stress for BLI students in addition to the stressors of engineering education inherent in the curriculum. The repression and neglect of marginalized identities in engineering education undermine their reality and echo the traumatic historical experiences of those holding those identities. The objective erasure of identities in traditional engineering education contribute to the stress, distress, and trauma (SDT) of BLI students.

The purpose of this systematic literature review is to summarize literature surrounding SDT within the experiences of undergraduate engineering BLI students. This serves the greater purpose of the study: to make clear that traditional engineering education can serve as a stressor that is sufficient to (1) cause/initiate distress and dysfunction or (2) maintain/make worse pre-existing stress reactions. To navigate the literature in this review, we use the guiding research question: **How has engineering education research explored the racialized experiences of stress, distress, and trauma of Black, Latin, and Indigenous students in the engineering education context?**

Background

This literature review is part of a larger, mixed methods study on racialized trauma for engineering BLI students. We chose BLI students as the focus of this paper because data shows that BLI individuals remain significantly underrepresented in engineering [1]. Further, reports indicate that representation in several engineering disciplines is getting worse, not better, despite substantial effort [2]. Engineering programs also have an attrition rate that exceeds 60%, which is higher than any other STEM discipline [3], [4]. This high attrition rate includes disproportionately high numbers of traditionally excluded students and is attributed to the cultural ethos of engineering departments [3], [5] and implicit biases, specifically deep-seated racial and gender biases within the cultures of engineering [6]. The culture of engineering manifests in daily experiences of conscious and unconscious bias and microaggressions [7]–[9] and limits student engagement [10], [11]. For example, Burt and colleagues [12] found that racialized microaggressions (a form of racialized stress) within the advisor-advisee relationship was a leading cause of Black males leaving engineering. Cross and colleagues [7] connected the lived experiences of women of color in engineering to their elevated levels of stress and anxiety. When increased stress levels are present, students are less likely to identify with engineering, feel like they belong, or persist [5], [13], [14]. Being exposed to microaggressions and similar stressors for long periods can lead to a multitude of distress responses [15]. For this literature review, we focus on BLI students because of their increased risk of exposure to SDT in engineering due to racialized experiences of microaggressions and perceived stereotypes and prejudices from others. Given the role of faculty and student interactions in fostering a hostile

climate for BLI students, it is critical to understand how stereotypes, biases, and microaggressions impact student outcomes, specifically those connected to well-being (i.e., stress, distress, and trauma).

Methods

Methodology

To answer our research question, we chose to perform a systematic literature review [16]. First, we accumulated articles in an initial database search of five (5) journals relevant to engineering education research (EER) from 2000 to 2023. Once a preliminary set of articles was found, we performed secondary and tertiary rounds of inclusion and exclusion as we read through the articles and determined if they addressed our research question. After excluding all articles that were out of the scope of this literature review, we performed a categorical analysis on the remaining articles.

Group Positionality

To provide context to this work and the aspects of our experiences that shape the ways we approach research, we provide a group positionality statement for the research team [17].

Our research team is composed of two Black, female engineering professors, one white, male engineering professor, and one white, female graduate student. The team has extensive experience in engineering education research with much of that research in diversity, equity and inclusion (DEI) and social justice spaces. Our combined research interests include the experiences of multiple marginalized groups including women of color and members of the LGBTQ spectrum, removing obstacles for STEM excellence, student motivation and learning, and epistemologies and epistemic injustice in engineering. Our goal with this research is to explore the norms in engineering to understand and identify systems of oppression embedded in the culture that may limit certain groups as well as give voice to those often overlooked in the business of educating engineers in the U.S.

Data Collection

The data collected in the systematic literature search were from papers from the following five (5) journal databases from 2000-2023.

- Journal of Engineering Education (JEE)
- Journal of Higher Education (JHE)
- Journal of Research in Science Teaching (JRST)
- American Education Research Journal (AERJ)
- International Journal of Engineering Education (IJEE)

These publication sources were selected due to being highly cited within the field of engineering education. We used the following search criteria to accumulate the preliminary set:

> "Black student + stress OR Latin* student + stress OR Indigenous student + stress",
> "Black student + distress OR Latin* student + distress OR Indigenous student + distress",
> "Black student + trauma OR Latin* student + trauma OR Indigenous student + trauma."

To appropriately scope the literature review, we used multiple exclusion criteria. First, any literature focusing on faculty, graduate students, or postdoctoral students was omitted. Also, literature published before the year 2000 was also excluded as much has changed in the field of

trauma studies since the 1990's. Lastly, any guest editorials or conference proceedings which did not include a paper were excluded from the literature review.

Data Analysis

We analyzed this data with secondary and tertiary rounds of exclusion based on how well the papers answered our research question. The secondary round of exclusion involved reading through titles and abstracts for key words or phrases. If the paper did not meet the exclusion criteria explained prior, it was excluded. Lastly, a final round of exclusion was performed involving a full read of the paper to narrow down the articles. If the paper did not focus on the experiences of BLI students or SDT-related instances, it was excluded.

Once we determined the final set of articles, we performed a categorical analysis to compare each article across multiple groupings of attributes. The categorical analysis involved the extraction of eight attributes of each paper: framework, methodology, population, research question, instrument, main result, related concepts, and unit of analysis. These attributes were described in a table that lays out each article and its contents. This table allows us to examine possible trends between papers and draw conclusions about how racialized trauma for BLI students have or have not been discussed in EER.

Results

Preliminary findings reveal that little research is done regarding Indigenous students' experiences of SDT, and little more is done on Latin students' experiences of SDT. We hypothesize that the low number of papers collected surrounding Indigenous students' experiences stems from the low number of Indigenous students in engineering [19]. Low results for Latin students may stem from issues in the search term "Latin*", which may not capture the multiple labels for Latin students, including "Hispanic," "Mexican-American," etc. Though Black students' experiences composed most of the papers in this literature review, their stories are still underrepresented within the whole of EER.

This literature review shows the gaps in the literature for the SDT experiences of BLI students in engineering. As BLI students are forced into a process of acculturation [18] into the engineering education environment, a predominantly white and masculine space, the mismatch of personal and engineering identities can lead to mental distress. Further research is needed to understand the nuanced, intersectional experiences of BLI students in engineering to uproot and dismantle the practices that offer inequitable outcomes in engineering education.

Overall, this result is not surprising since as of 2020, the percentage of bachelor's degrees awarded to underrepresented minorities was the highest at 20.5% in civil engineering [19, p. 4], and BLI students make up a fraction of the underrepresented minorities measured. However, this result emphasizes the importance of highlighting BLI students' experiences, especially in areas of SDT, as they are exposed to undue levels microaggressions in engineering environments [5], [8], [14].

Discussion

This literature review serves as the foundation for a larger, mixed methods study focusing on the racialized trauma experiences of BLI students in engineering. Findings from this study will advance knowledge and make visible how the defaults of engineering education exacerbate SDT reactions that disproportionately influence BLI students' experiences. Collectively, our findings address calls from the National Academies of Science, Engineering, and Medicine to better

students' mental health. Specifically, our work: represents one of the first attempts to define racialized SDT in engineering, which will expand the engineering and STEM communities' knowledge of the ways default educational practices increase each of these in students. Also, the study results will articulate the intersectional experiences related to mental health that occur within engineering education, and expands the use of existing theories and practice for understanding racialized SDT to foster positive mental health and wellbeing for BLI engineering students.

By developing specific practices that can foster healing and care for BLI students, we can create a set of educational practices that will foster the growth and development of a broader range of engineering students. Specifically, our work will: produce a model of BLI engineering students' characterization of trauma related to their engineering education to define and develop measures of stress and trauma in engineering, identify strategies to reduce educational experiences that lead to traumatic responses for BLI students, and develop and update engineering education pedagogy by helping engineering faculty recognize how their behaviors or interactions with students may contribute to students' repeated over-exposure to stress that could lead to traumatic responses.

Conclusion

In this study, we aimed to examine the experiences of Black, Latin, and Indigenous students regarding stress, distress, and trauma. To address this idea, we performed a systematic literature review and a multi-pass, categorical analysis of the articles that fit our inclusion and exclusion criteria. Results showed that BLI students' stories are by and large under-researched. This is most likely due to the overall underrepresentation and repression of BLI students in engineering spaces. Future work includes examining the racialized trauma experiences of BLI students from their perspective to address this gap in the literature. The larger study connected to this literature review aims to serve that purpose.

Now more than ever, with the Supreme Court ruling and the anti-DEI movement that is spreading across our country, students who identify as Black, Latin, and Indigenous have expressed feelings of isolation. This is further adding to their levels of stress that they experience on campus. The students feel as if they are under attack in spaces where they should feel safe and making them question their credentials and worth within spaces to which they have been admitted and through which they are currently matriculating. Current events create precedence around this research, and racialized trauma experiences must be examined to provide equitable policies and practices to ensure the safety and wellbeing of BLI students.

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