WIP: Racialized discourses in engineering education: What can we learn from raciolinguistics to inform broadening participation in predominantly Latino/a/x engineering spaces?

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Abstract— This work in progress paper analyzes the ways in which raciolinguistics can help examine the racialized ideologies existing in engineering. In this paper, we describe how raciolinguistics contributes to the analysis of the predominant practices that emerge from the confluence of linguistic, discursive, and socialization processes that lead to racialized ideologies about what counts as engineering (knowledge), who belongs in engineering (kinship), and who does engineering (legitimization). We argue that the language, the practices, the labels, the words, even the discourse – the mix of all language itself – is one of the main systemic barriers that people encounter when entering higher education in general, let alone engineering. We also provide an exploration of the potential implications for this research in helping to broaden the participations BIPOC in engineering.

Keywords—racialized ideologies, broadening participation, engineering discourses

I. INTRODUCTION

Research has indicated institutions of higher education were not designed to be inclusive to people of color [1], but rather to maintain the existing social hierarchy and educate the privileged classes. This has been particularly evident in the field of engineering, where white male engineers constructed narratives of professionalization that perpetuated the idea of engineering as a white male occupation [2, 3]. The normalization of engineering as a rigorous and male-dominated profession [4] has led to the perception for people of color and women that engineering is not for them [5]. Racialization, or the process by which individuals or groups are identified and labeled by others based on physical characteristics that typically skin color or facial features [6], is a social construct that has been historically used to rationalize prejudice and unequal treatment based on race. The mechanisms of racialization can take many forms, including the use of racial categories in official documentation, media portrayals, stereotypes, and discriminatory policies and practices. Racialization also happens through language in its different symbolic and semiotic modes [7]. Even in integrated school systems after the landmark decision of *Brown v. Board of Education*, racialized ideologies persisted, and there were efforts to segregate engineering and technical training [2, 8].

The impacts of racialization go beyond microaggressive behaviors and actions. Engineering educators at some institutions have associated the expansion of educational opportunities for minoritized students with the lowering of standards [4]. Other actions include creating a two-tiered system where young Black, Indigenous, and People of Color (BIPOC) have been relegated to vocational education, while white men and have been able to pursue engineering degrees [8, 9]. Additionally, some universities have created separate and unequal engineering programs for students of color, while diminishing the value of minority-serving institutions [8].

Racialized ideologies continue to have a lasting impact on institutions today, and engineering is no exception. These ideologies have been used to exclude certain groups of people by defining engineers as specific types of individuals [10]. Particularly, scholars have noted how the poor education levels of Mexican American students in the U.S. Southwest can be traced back to the racialization of brown people, which has been used to portray them as culturally deprived and disadvantaged [9]. Additionally, racist ideologies embedded in IQ testing have been used to justify tracking these students into lower-paying industrial jobs, thereby reinforcing a socially constructed racial hierarchy [11].

In this work in progress paper, we discuss a current project that combines engineering education and raciolinguistics to explore the ways in which race, language, and practices are interconnected and manifested in engineering. The project is guided by the research question: *What are the most salient racialized language and linguistic practices that are common and unchallenged in the representation and teaching of engineering?* We will provide an overview of the project and describe the impact of using raciolinguistics as a framework to explore issues of broadening participation in engineering, particularly at Hispanic Serving Institutions (HSIs).

II. THEORETICAL FRAMEWORK

A. Raciolinguistic Ideologies

The notion of race as a social construct goes beyond physical characteristics and is perpetuated through language and cultural customs [7]. In the field of language education, Flores and Rosa [12] introduced the concept of raciolinguistic ideology, which refers to the beliefs that create a perception of racially marginalized individuals as linguistically abnormal, even when their language practices align with the norms or display innovation, in contrast to privileged white individuals and those in power. For example, the conceptualizations of "illiterate," "ignorant" or "unskilled" are based on historical racialized ideologies that can be traced to the time of the conquest [13]. These ideologies have had an impact on how language, culture and education are interpreted, how individuals are categorized *de facto* through socialization processes, and what is considered valuable or not. However, this framework has broader implications, highlighting the impact of language on racialized individuals. Rosa and Flores [14] argued that the interconnectedness of language ideologies, race, and ethnicity are integral to the existing societal hierarchies we experience today. In the case of engineering, the choice of language employed in program advertisements plays a significant role in signaling inclusivity and a sense of belonging for prospective students (particularly BIPOC students). The language used in lectures and curriculum delivery can also contain implicit racial implications or references [15]. A notable example is the field of electrical engineering, which still utilizes terms like "master" and "slave" [16], terms often mentioned in research manuscripts without critically examining their origin or impact on students. Another recent instance involves the chancellor of Purdue University Northwest during a commencement ceremony in December 2022, where they ridiculed Asian Languages by inventing a fictional "Asian" language, eliciting laughter from others present at the ceremony, including members of the institution such as professors and administrators [17]. This lack of awareness contributes to the establishment of racialized ideologies, whereby certain norms and conventional perspectives shape how people, cultures, and practices are perceived, reinforcing racialized connotations in bodies, actions, conduct, and institutions [18]. The choice of words we use to refer to our students, practices, and understandings carries implicit meanings that cast certain groups of people in a negative light.

The concept of raciolinguistics has evolved into a comprehensive framework used to examine the intricate connections between language, race, and power in various ethnoracial contexts and societies [7]. In engineering, this means that raciolinguistics can contribute to the analysis of who belongs in engineering, who does engineering, and who is engineering for. Rosa and Flores utilized the idea of the "white listening subject and speaker" to challenge and the negative and deficit perspectives through which racialized individuals are often viewed [14]. This privileging of white perspectives simultaneously shapes a white speaking subject that perpetuates idealized linguistic practices associated with whiteness, and a white listening subject that interprets the speech of BIPOC individuals as illegitimate, thereby requiring remediation or additional assistance based on their racial and gender positioning. However, when a white speaking subject engages in similar discourse, it is deemed normal. Racialization exists in engineering education through the current discourse, such as dictating how engineers must act, behave, believe, and value those things that make them feel identified with and welcomed in the field of engineering.

In the field of education, longstanding labels have been used to describe individuals from diverse backgrounds, employing a deficit perspective [19]. Such labels include Limited English Proficiency (LEP), disabled, inner-city, or remedial students, which inherently position these students as inferior, deficient, and in need of remediation or "fixing." This deficit perspective permeates curriculum creation, lectures, and exam preparation. Consequently, these practices work against marginalized populations, leading to a predictable pattern where these groups are viewed as being less competent compared to those without such limitations (Flores & Rosa, 2015). These limitations are essentially a product of how they are perceived, rather than being inherent or systematic in nature. Therefore, raciolinguistics provides a lens to explore how racialized individuals (i.e., Chicano, Latino, Mexican Americans, Black, Indigenous student) experience language created, perpetuated, and emulated in engineering, and how institutions inadvertently socialize individuals into continuing this hierarchy.

B. Engineering Discourse and Current Racialized Ideologies

Foor and Walden [5] put forth the argument that specific practices and discourses are employed to uphold order and establish hierarchies based on perceived value within the field of engineering. It is this perceived value that often forms the basis for the emergence of racialized ideologies depending on the individuals involved in such dynamics. To illustrate this, Foor and Walden [20] studied the hierarchical value of different aspects of engineering and found that students described Industrial Engineering as less prestigious than other disciplines and considered it a natural space for women and people of color for its focus on creativity and integration of people and processes [20]. Their study highlighted a perceived significant gap between disciplines in terms of technological competence and rigor, two terms historically used to exclude BIPOC students from engineering spaces [8]. In this study, the participants associated the perceived lack of "prestige" and "rigor" and the notion that Industrial Engineering is "not real engineering" with women and people of color, thereby racializing their perceptions and attitudes. It is through these practices that faculty, students, and staff in engineering education learn and perpetuate racialized discourses.

Research conducted in the field of engineering education has focused on exploring the multifaceted aspects of engineers' identities and their connection to engineering work [21]. However, there is a noticeable absence of research examining the influence of racialized ideologies on these dynamics. Often these dynamics are framed in terms of hypermasculinity, competition, or rigor, rather than naming the inherent white supremacy uphold by racialized ideologies. Some studies have investigated how engineering students

learn to adopt certain behaviors, beliefs, and values that align with their identification and acceptance within the engineering field [22]. Nonetheless, at the heart of this discussion lies the critical analysis of racialized ideologies and their impact on the conceptualization of engineering, the individuals involved in engineering, and their role within engineering spaces. Some of these conceptualizations are not inherent but are intentionally constructed, especially when influenced by racialized ideologies [23]. Engineering students acquire an understanding of specific patterns and practices that define the identity and actions of engineers. These practices not only shape how engineering students perceive the world around them but also influence their negotiation of professional behaviors. Unless actively challenged, the racialized ideologies that have historically shaped the engineering profession will persist, leading to systemic barriers for minoritized students of color.

III. METHODOLOGY

The aim of this project is to place Latino/a/x students, their stories, and testimonies at the forefront of the conversation about racialized ideologies, and their impacts on the experiences of engineering students. We critically examine the histories of HSI institutions, the prevailing racialized ideologies, the emerging language that reinforces racialization, and their contribution to the narratives that may or may not promote the broader participation of Latino/a/x students in engineering.

A. Context of the study

This project focuses primarily on the Mexican, Mexican American and Latino/a/x engineering student population of the U.S. Southwest because of their long history of educational oppression, which continues to have an effect on engineering education. In addition, the U.S. Southwest is a clear example of the process of *de facto* racialization when *de jure* policies were not in place. That is, Mexican and Mexican Americans in the U.S. Southwest went through a process of racialization after the United States and Mexico signed the Treaty of Guadalupe Hidalgo, which promised citizenship to all Mexicans after the Mexican American War in 1848. Throughout the years, Mexicans and Mexican Americans had to be considered "white" on paper to fulfill the promises of the Treaty while at the same time considered "non-white" socially [24]. Differential treatment emerged in the U.S. Southwest in the form of language subtraction, curricular differentiation and tracking as more Anglos settled in the region and took control of policies influenced by racialized ideologies that were detrimental to Mexicans, Mexican Americans, and Latinos/as/xs for years to come [25].

Research has shown that less than 20% of colleges and universities enroll over 65% of Latino/a/x undergraduates, but a significant majority of these students are not pursuing engineering programs [26]. Despite a 94% growth in the number of Hispanic-Serving Institutions (HSIs) in the past decade (several of them located in the U.S. Southwest), the percentage of Latino/a/x students earning undergraduate engineering degrees remains below 14%. Furthermore, nearly 50% of these students come from California and Texas [26]. As new HSIs emerge, it becomes crucial to have greater representation of Latino/a/x faculty and administrators who can effectively support these students, including a better understanding of their culture to address systemic issues stemming from racialized ideologies.

This study focuses on Metropolitan University (pseudonym), an R1, HSI that enrolls more than 60% Latino/a/x students. Almost 70% of the students come from historically marginalized backgrounds, and nearly half of the student population will be the first in their family to earn a bachelor's degree. Its college of engineering is also names one of the top institutions to graduate Latino/a/x engineers.

B. Methodological approach

This project adopts a humanistic approach to gain a more nuanced understanding of the impact of language and linguistic practices on perpetuating racialized ideologies in engineering education. Our aim is to provide an in-depth depiction of how individuals within the field of engineering interpret and navigate their environment [27-29], while also exploring the complex cultural phenomena that arise from embedded practices. Metropolitan University is an ideal setting for this research because studying the social world requires an examination of its authentic manifestations rather than artificial simulations or interviews [30]. Furthermore, as a designated HSI, Metropolitan University serves as a culturally affirming space where, although cultural affirmation is constant, raciolinguistics continues to influence the development of engineering identities. Therefore, this project aims to uncover the systemic realities of phenomena like racialized ideologies within the local context of an HSI. It will involve collaborative efforts with participants, specifically Latino/a/x engineering students, to collect and analyze their testimonies, perceptions, and interpretations. By working together and incorporating the perspectives of these actors, we aim to create a comprehensive understanding of the phenomenon from their standpoint.

C. Data collection and analysis

We will recruit five sophomore students to serve as both researchers and *testimonialistas* [31]. This study adopts a collaborative approach to knowledge creation, integrating thought, reflection, action, and application, also known as "theory in the flesh," drawing on the experiences of Latino/a/x engineering students to collect *testimonios* [32]. To collect testimonios, we will utilize the *plática* format, which fosters an equal relationship between the researcher and the participant [31, 33]. In this case, *pláticas* will occur between the principal investigators (PIs) and the five student researchers. *Testimonios* will serve as both a product and a process, where the student researchers, acting as *testimonialistas*, will document their own personal and communal experiences in engineering courses and spaces, make sense of those experiences, and interpret them in collaboration with the PIs. The *pláticas*, conducted as in-person group meetings every two weeks (eight times per semester), will be unstructured but guided by specific topics aimed to explore the impact of language, race, and other social categories on the students' engineering experiences.

The first two topics will be proposed by the co-investigators, while subsequent topics will emerge and be agreed upon by the undergraduate student researchers during the meetings.

Data collection will also include a one-hour ethnographic interview with each engineering faculty at Metropolitan University. These interviews seek to gather information on the instructors' level of linguistic awareness in their materials, their perceptions and attitudes toward engineering cultures, and the prevailing linguistic practices in the field.

Finally, we will include all digital and printed materials used in the recruitment and presentation of engineering programs. This encompasses screenshots of departmental and program websites, faculty profiles, advertisements, brochures, and multimodal communications through print and social media platforms with the public and engineering students. Students' own multimodal artifacts will include materials for classes such as notes, books, and information provided to them by the engineering department, including that from their professors, which they deem relevant to the study. Analyzing institutional multimodal artifacts will provide insights into how norms and racialized ideologies may adversely affect Latino/a/x students.

IV. Contribution to the Field

This project makes a valuable contribution to the field of engineering education research by addressing the need to dismantle raciolinguistic discourses that create systemic barriers for marginalized communities, preventing them from actively participating and being fully acknowledged as knowledge holders and creators. The project aims to generate information that describes the impact of raciolinguistic ideologies on engineering cultures and discourses. Specifically, it seeks to identify how systemic barriers are manifested through everyday language in recruitment, retention, instructional materials, and practices. In the realm of applied linguistics, this project aims to further investigate how raciolinguistic ideologies contribute to the systemic discrimination faced by culturally and linguistically diverse populations, particularly in the U.S. Southwest.

V. Acknowledgements

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