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Strategies for Enhancing Diversity, Inclusiveness, and Engagement Among Graduate Engineering Students at one of the Nation's Historically Black Colleges and Universities (HBCU).

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Strategies for Enhancing Diversity, Inclusiveness, and Engagement Among International Graduate Engineering Students at one of the Nation's HBCUs

ABSTRACT

Inclusiveness, participation, and engagement are essential components for fostering positive academic success in graduate engineering programs. Historically Black Colleges and Universities (HBCUs) play a pivotal role in providing access to high-quality education for underrepresented groups in STEM fields, particularly in engineering. However, challenges persist in achieving optimal participation and engagement levels among these diverse graduate student populations. This research investigated strategies for enhancing diversity, inclusiveness, and engagement among International Graduate Engineering Students at an HBCU, aiming to provide actionable recommendations for improvement.

The study addressed the following research questions: What factors hinder engagement among diverse International Graduate Engineering Students? How do inclusiveness and engagement strategies impact student participation in graduate engineering programs? What strategies have been successful in fostering inclusiveness? How can current strategies for enhancing participation be improved to better support diverse graduate students in engineering? A mixed-method approach was employed, combining surveys, focus groups, and interviews to gather both quantitative and qualitative data from students, faculty, and administrators. The Global Diversity and Inclusion Benchmark (GDIB) and the Motivated Strategies for Learning Questionnaire (MSLQ) were used to assess diversity, inclusion, and engagement. Data analysis was conducted using Excel, focusing on descriptive statistics and percentage distributions to interpret findings.

The results indicated that while the graduate engineering program at the HBCU showed strengths in inclusiveness, such as an inclusive curriculum and support systems, there were notable challenges regarding intercultural experiences, international students' adaptation to weather, and limited collaboration across disciplines. Recommendations to improve diversity and engagement included enhancing intercultural exchanges, expanding faculty cultural competency training, and increasing field-based learning opportunities. This study concludes that fostering a more inclusive and supportive environment through these strategies will lead to improved student engagement, retention, and academic success, contributing to the broader goal of increasing diversity and inclusion in STEM fields at HBCUs.

Keywords: Diversity, Inclusiveness, Engagement, International Graduate Engineering Students, HBCU, Participation, STEM Education

INTRODUCTION

Historically Black Colleges and Universities (HBCUs) have been a vital resource for the students with diverse backgrounds [1]. Especially in science, technology, engineering, and mathematics (STEM) fields, HBCUs serve as the hub for diverse learners to feel included in the advanced learning, training, and workforce development effort in the United States and beyond. According to the findings in the literature review by Gonzales et al. [1], the several efforts towards diversity and inclusivity work in higher education may fall short due to cultural and educational community factors leading to potential harm, despite good intentions.

Historically Black Colleges and Universities (HBCUs) are also pivotal in providing access to quality education for underrepresented groups, particularly in STEM fields [2], [3], [4]. However, despite the critical role of HBCUs in cultivating a diverse student body, challenges persist in achieving optimal levels of participation and engagement among undergraduate and International Graduate Engineering Students [5], [6], [7]. Importantly, the population of graduate students consists of both local and international students. However, it was revealed that as much as HBCUs strategies are in place, there are still needs for improvement to optimal participation and engagement levels among these diverse graduate student populations [1], [8], [9].

Diversity, in the context of the present study, refers to the presence of varied identities and backgrounds within a student body, including race, ethnicity, gender, and socioeconomic status. Research shows that a diverse academic environment fosters critical thinking, creativity, and innovation [10], [11]. The advantages of this diversity are well-documented, suggesting that exposure to different perspectives enhances problem-solving abilities and enriches the learning experience. However, diversity alone is not enough; it must be accompanied by inclusiveness which is the practice of creating an environment where all students feel valued, respected, and supported. Inclusiveness encourages participation and engagements from all students, especially those from marginalized groups, allowing them to share their experiences and perspectives [12], [13], [14], [15].

Moreover, participation acts as a vital indicator of engagement and is closely tied to students' perceptions of diversity and inclusiveness within their academic environment. When students perceive their environment as inclusive, they are more likely to engage with peers, faculty, and institutional resources [16], [17], [18]. Conversely, a lack of participation can signal issues with diversity and inclusiveness, suggesting that some students may feel marginalized or disconnected from their academic community [14], [19], [20].

Engagement can be described as the level of participation and emotional investment that students demonstrate in their academic pursuits. It is critical for academic success, as engaged students are more likely to persist in their studies and achieve higher academic outcomes [21]. The connection between engagement and student success is particularly salient in engineering programs, where the rigor and complexity of the curriculum can be daunting. Engaged students are more likely to take advantage of networking opportunities, seek support from peers and faculty, and participate in collaborative learning experiences [22].

The importance of diversity, inclusiveness, and engagement in higher education, particularly within graduate engineering programs, cannot be overstated. These elements are not merely

strange words; they are fundamental cornerstones in modern engineering education which are essential components for fostering positive academic outcomes and enriching the educational experience [23], [24], [25]. The engineers are facing an increased need for global collaboration and are expected to be able to work in highly diverse environments and cultures. The adoption of new strategies are therefore essential components in the training of these future engineers [5], [26], [27].

The interrelationship among diversity, inclusiveness, and engagement is pivotal in understanding how to enhance the educational experience for International Graduate Engineering Students. Research indicates that diversity within organizations including academic environments contributes to enhanced problem-solving and innovation [28], [29]. Diverse groups bring varied perspectives, which can lead to more creative solutions, innovations and improved decision-making processes. However, merely having a diverse student body is not sufficient; institutions must also implement strategies that promote inclusiveness and actively engage students [30], [31], [32]. Engagement has been linked to higher retention rates, academic performance, and overall student satisfaction [33]. Therefore, understanding the dynamics that influence engagement among diverse International Graduate Engineering Students is crucial for their academic success and future career trajectories.

LITERATURE REVIEW AND MOTIVATION

Numerous studies revolve around the main keywords in the subject of this work and many have established the positive impact of diversity, inclusion, and engagement on educational outcomes. However, the most related ones will be mentioned in this section to highlight how our research fits in. Page [29] argues that diversity enriches the academic environment, fostering innovation and enhancing problem-solving capabilities. While Gurin, et al. [10] emphasized that diverse groups stimulate critical thinking and creativity, which can lead to improved academic outcomes. However, these benefits are contingent upon the presence of an inclusive environment. Research by Hurtado, et al. [19] demonstrated that the campus climate significantly influences student engagement, particularly for underrepresented groups. Their work underscores the necessity of cultivating inclusiveness to maximize the advantages of diversity.

Research has shown that engagement is critically related to academic success. Kuh [33] highlights that engaged students are more likely to participate in collaborative learning experiences, seek support from peers and faculty, and achieve higher academic performance. This is corroborated by Lawson and Lawson [34]; Masika and Jones [35], who identified that inclusiveness is a distinct and important factor influencing student engagement. Their studies suggest that when students feel included and valued within their academic community, they are more likely to engage in meaningful ways.

Further research has explored the mechanisms through which diversity and inclusiveness affect engagement. For instance, Johnson [16] posits that a strong sense of belonging is essential for enhancing student engagement and success. This notion aligns with Towles and Spencer [36] on Tinto's (1993) model of student retention, which emphasizes the importance of social integration in academic persistence. The interplay among these concepts is particularly relevant in the context of HBCUs, where creating an inclusive environment can significantly impact the experiences of International Graduate Engineering Students.

Despite the existing body of literature, there remains a gap in understanding the specific strategies employed by HBCUs to foster diversity and inclusiveness and their effectiveness in enhancing engagement. Recent studies indicate that while many institutions have implemented diversity initiatives, the outcomes are often inconsistent, and students from underrepresented groups may still feel marginalized [37]. This gap highlights the need for more and continuous targeted research that identifies successful strategies and addresses the barriers which hinder engagement among diverse graduate student populations. This is where the authors derived their motivation from, and focused on International Graduate Engineering Students at one of the nation's HBCUs.

THEORETICAL FRAMEWORK

This research was drawn on two theories. Social Identity Theory [38], [39] serves as one of the theoretical foundations for this study, positing that individuals derive a sense of identity from their group memberships. This theory underscores the importance of belonging and social networks in fostering engagement and success in academic settings [40]. For International Graduate Engineering Students, a strong sense of belonging can enhance motivation, leading to greater academic persistence. Moreover, the second theory, the Sense of Belonging Theory [16] posits that feelings of belonging are vital to students' academic experiences, influencing their engagement levels and their overall academic success.

These theoretical frameworks, framed in figure 1 links Social Identity Theory and Sense of Belonging Theory to provide valuable insights into the experiences of International Graduate Engineering Students at HBCUs.

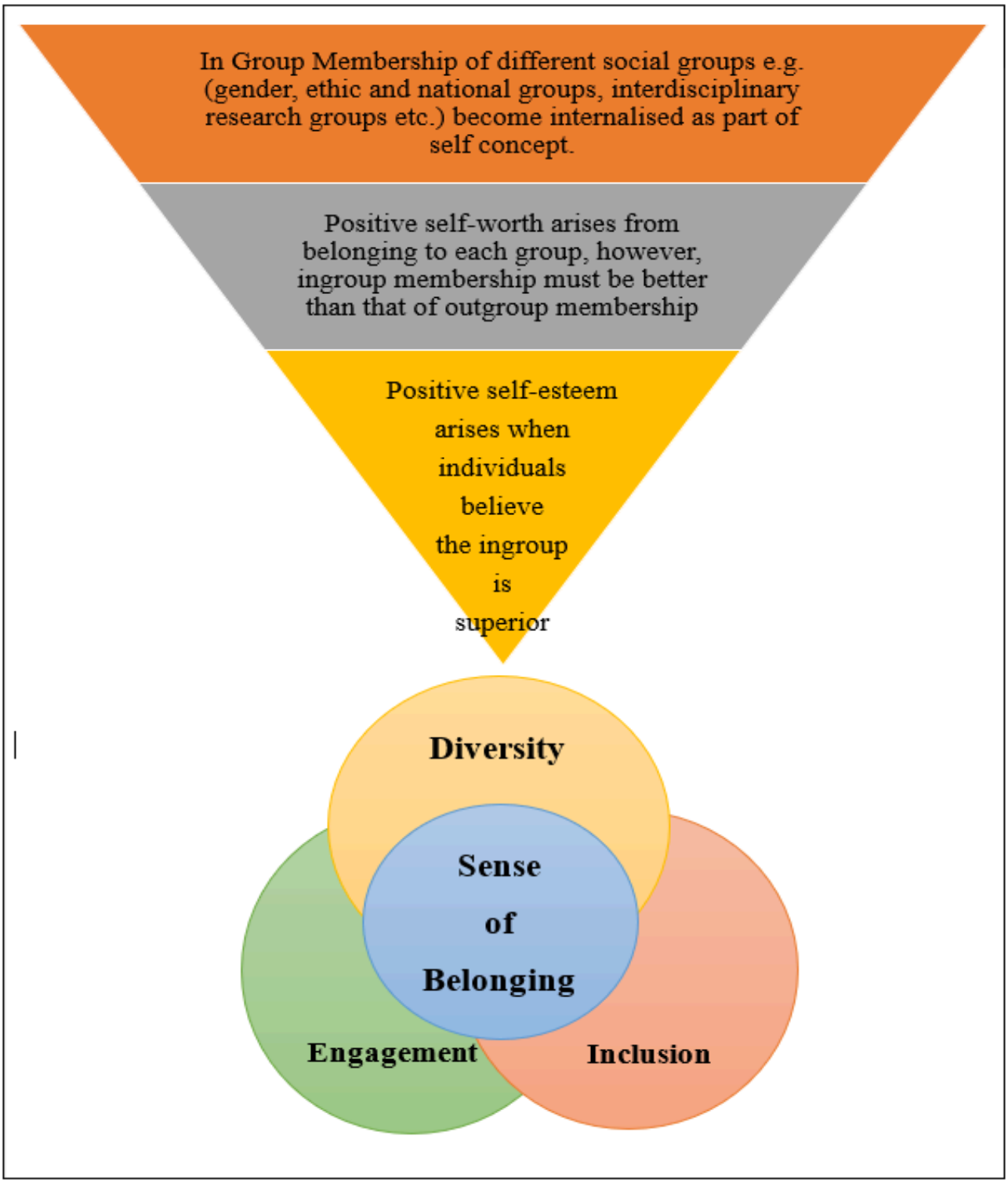

Figure 1. The Conceptual Framework for Enhancing Diversity, Inclusiveness, and Engagement Among International Graduate Engineering Students**.** Social Identity Theory and Sense of Belonging (Adapted from Tajfel & Turner, 1986; pinterest.co.uk).

Social Identity Theory suggests that people define themselves through their group memberships, which can shape their interactions in academic settings. For HBCU students, feeling a strong connection to their peers can enhance their engagement and participation. On the other hand, Sense of Belonging Theory highlights how feeling accepted and valued within a community is essential for academic success.

Together, these theories show that when students identify with their peers and feel included, they are more likely to engage actively well in their studies. This connection emphasizes the importance of creating inclusive environments that foster belonging, which can lead to greater academic success in graduate engineering programs. Hence, serves as the base for the conceptual framework used in this study.

Despite the potential benefits of fostering diversity, inclusiveness, and engagement, many HBCUs face significant barriers. These may include institutional policies that do not prioritize diversity initiatives, a lack of awareness among faculty and staff about the unique challenges faced by underrepresented students, and insufficient resources for student engagement programs [19]. Furthermore, existing strategies may not adequately address the specific needs of diverse International Graduate Engineering Students, leading to gaps in participation and engagement [41].

METHODOLOGY

This research aims to investigate strategies for enhancing diversity, inclusiveness, and engagement among International Graduate Engineering Students at an HBCU, figure 1. Valid instruments were used as a measure of yardsticks for learning elements; these instruments have been validated and reliable for different populations and in various contexts and sensitive to differences in the ability levels of respondents and as posited by [42], [43], [44], [45].

The Global Diversity and Inclusion Benchmark (GDIB) is a comprehensive framework developed to help organizations assess and improve their diversity and inclusion practices [45]. It offers a set of standards for evaluating the effectiveness of diversity initiatives and creating an inclusive culture. GDIB consists of several dimensions within its framework structure which include; leadership, strategy, culture, workforce and community engagement and its assessment tool that can be used to conduct self-assessments or facilitate discussions about diversity and inclusion, identifying areas for improvement [45]. Hence, was adapted and used to assess the current state of diversity and inclusion within the graduate engineering program in the case study area.

Motivated Strategies for Learning Questionnaire (MSLQ) was an instrument developed using a social cognitive view of motivation and self-regulated learning which has since been a widely used instrument to assess students' motivational orientations, engagement and their use of learning strategies [46]. Developed by Pintrich [47], the MSLQ helps educators understand how motivation and learning strategies interact to influence academic performance [47], [48]. Within its key features contained two main sections which are; Motivation Scales and Learning Strategies Scales.

Within the MSLQ, intrinsic motivation, extrinsic motivation, self-efficacy for learning and performance, time and study management, peer collaboration with academic help seeking was adapted to measure student's engagement and participation.

Data Collection and Analyses

A mixed methods research approach (both quantitative and qualitative data) were used, survey results from 33 International Graduate Engineering Students at an HBCU show a generally positive response regarding diversity, inclusiveness, and engagement, the open ended questions and qualitative interview also helps to highlight some of the existing strategies in place and suggests notable areas for improvement.

Quantitative Data Collection

By utilizing these validated instruments, Global Diversity and Inclusion Benchmark (GDIB) and the Motivated Strategies for Learning Questionnaire (MSLQ), the research questionnaire was designed on a 5-likert scale of 1 to 5 (from Strongly disagree to Strongly agree) and served to International Graduate Engineering Students within one of the nation's HBCUs. The study questions seek among others to identify factors that hinder engagement and successful strategies that can foster an inclusive environment. Ultimately, the findings of this research contribute actionable recommendations for improving diversity, inclusion and engagement, not only at HBCUs but also can be applied at similar institutions across the nation. IRB approval was obtained with number: IRB #19/04-0062 to protect the identity of participants.

Qualitative Data Collection and Analysis

Qualitative Data Collection

The qualitative data source for this study includes semi structured interview sessions and open ended questions in the questionnaire. The semi structured interview was constructed to draw out the students' experiences on the existing strategies on diversity, inclusiveness and engagement among the international graduate engineering students. The students were asked questions about their experiences on diversity, inclusiveness and engagement in their engineering programs. The students were further asked to discuss how the current environment at the university supports or challenges their sense of belonging and engagement as an international graduate engineering student? They were also asked to describe specific strategies or initiatives they believe would help enhance diversity and inclusiveness in the graduate engineering programs among the international students. The semi-structured interviews were conducted with 10 participants, involving 8 students and 2 faculty members. The interview responses were transcribed and arranged alongside the open ended questions from the questionnaire in excel 2016, and then subjected to thematic analysis. The major themes that were gathered from the qualitative data of this study are explained below.

Support system: One major theme from the data of this study saw participants describing how institutional support and mentorship enhanced diversity and led to academic performance. One participant described this saying *"the mentorship programs have been invaluable in guiding my*

academic journey." Another participant mentioned that *"the university career services provide great support in helping students prepare for industry roles."* A participant also supported this theme saying *"the university's focus on sustainability & innovation, and support helps my personal goals and values."*

Community engagement and motivations: The qualitative data from this study showed that the participants experienced noticeable improvement and motivations due to utilizing different organized programs. A participant described this noticeable improvement saying that *"the tight-knit community in my program makes me feel more engaged and motivated to push the boundaries of my studies."* Another participant noted that *"the collaborative platforms to engage with faculties helps a lot in my program."* This theme buttresses the point of having a welcomed climate, an enabling environment.

Rooms for improvement: Another major theme that was obvious from the data of this study is 'Current experience of international graduate engineering students, challenges and sense of belonging'. In this theme, participants described how much effort the institution had put into promoting diversity and what could be done to improve. An excerpt of this theme is seen in a participant saying that *"the university provides a solid academic foundation, but there exists a lack of some extracurricular activities that limits my overall engagement."* Another participant mentioned that *"while there is support for international graduate engineering students, more events promoting professional development could further enrich the experience."* Also, a participant pointed out that *"more scholarship and exchange programs with other institutions should be introduced for students' diversity and cultural learning."* Another participant corroborated that "*partnering with industry leaders to provide internships specifically designed for students from underrepresented backgrounds.*" and another stated that *"introducing programs that promote work-life balance, addressing the challenges that underrepresented groups may face in academia."*

Quantitative Data Analysis

Based on the study, the students were overwhelmingly international, with 32 out of 33 students identifying as international graduate students, and all participants being enrolled in engineering graduate programs. Among them, 79% (26 students) were pursuing a Ph.D. or Doctor of Engineering degree, while 21% (7 students) were enrolled in Master's programs. The most common engineering disciplines were Civil Engineering (52%, 17 students) and Sustainable and Resilient Infrastructure Engineering (30%, 10 students), followed by smaller representations in other disciplines, see table 1 and the results section for more quantitative analysis.

Based on the qualitative analysis from the interview data and the quantitative findings, it is evident that while the graduate engineering program is already making strides in promoting diversity, inclusion, and engagement among international students, there are key areas that could be improved to enhance the overall experience for diverse students. The participants, including both students and faculty, expressed strong support for the program's current strategies, noting

that the curriculum is inclusive, and the faculty and administration are dedicated to fostering a diverse and welcoming environment.

RESULTS

Table 1 shows demographic information of the participants.

Table 1. Demographic information

Category	**Frequency (N=33)**	**Percentage (%)**
International Graduate Students / Domestic	32 / 1	97 / 3
Engineering Graduate Students	33	100
Degree Program (PhD or DEng)	26	79
Degree Program (Master's)	7	21
Engineering Disciplines		
Civil Engineering (CE)	17	52
Sustainable and Resilient Infrastructure Engineering (SRIE)	10	30
Computer and Electrical Systems Engineering (CESE)	3	9
Transportation and Urban Infrastructure Engineering (TUIE)	2	6
Industrial Engineering (IE)	1	3

Perception of International Graduate Engineering Students Towards Diversity and Inclusion (Adapted from GDIB)

The following tables and figures summarizes the perceptions of the responders regarding diversity and inclusion within the graduate engineering program using Global Diversity and Inclusion Benchmark (GDIB). Results show that most students strongly agree or agree with statements about an inclusive curriculum, learning environment, and support systems, although there were some neutral and dissenting responses.

Regarding perceptions of diversity and inclusiveness, the results were predominantly positive. In terms of the curriculum reflecting diverse perspectives and experiences, 28% (7 students) strongly agreed, and 68% (17 students) agreed, while only 4% (1 student) remained neutral. The students' perception of the learning environment's support for students from different cultural backgrounds was also favorable, with 36% (9 students) strongly agreeing and 48% (12 students) agreeing, while 12% (3 students) remained neutral, and only 4% (1 student) disagreed, see table 2 and figure 2.

Table 2. Perception Towards Diversity and Inclusion

Statement	Strongly Agree (SA)	Agree (A)	Neutral (N)	Disagree (D)	Strongly Disagree (SD)
Inclusive Curriculum and Learning Environment					
Curriculum reflects diverse perspectives and experiences	9 (27%))	14 (42%)	6 (18%)	3 (9%)	1 (3%)
Learning environment supports students from different backgrounds	11 (33%)	13 (39%)	7 (21%)	2 (6%)	0
Support Systems for Diverse Students					
Academic support systems are adequate for diverse students	9 (27%)	15 (45%)	6 (18%)	2 (6%)	1 (3%)
Support encourages engagement with the program	9 (27%)	15 (45%)	6 (18%)	2 (6%)	1 (3%)
Leadership and Representation					
Diverse faculty/staff serve as role models	6 (18%)	16 (48%)	7 (21%)	3 (9%)	1 (3%)
Leadership promotes diversity and inclusion	8 (24%)	16 (48%)	7 (21%)	2 (6%)	0
Campus Climate					
Climate makes me feel valued as a diverse student	6 (18%)	17 (51%)	7 (21%)	3 (9%)	0
I can express my cultural identity in my academic community	10 (30%)	15 (45%)	6 (18%)	2 (6%)	0
Participation and Collaboration					
Opportunities for collaboration with diverse peers	9 (27%)	14 (42%)	6 (18%)	2 (6%)	0
Encouraged to participate in group activities	8 (32%)	16 (48%)	6 (18%)	2 (6%)	0

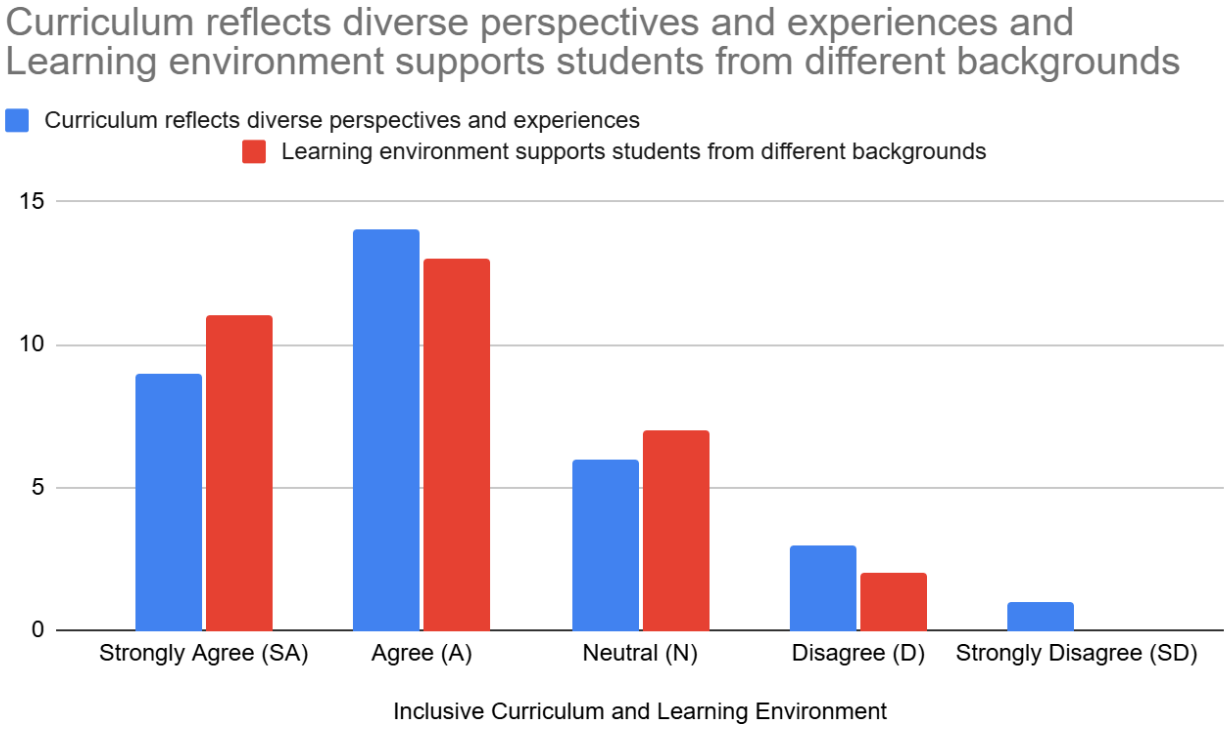

Figure 2. Perception towards Inclusive Curriculum and Learning Environment

When a question was asked about academic support systems for diverse students i.e. *"Support Systems for Diverse Students [The program provides adequate academic support systems for students from diverse backgrounds (e.g., mentoring, tutoring).]"*, 32% (8 students) strongly agreed, and 48% (12 students) agreed that there were adequate support systems in place. However, 20% (5 students) remained neutral on this matter. Notably, a high percentage (96%) of students (8 strongly agreed and 16 agreed) felt that the available academic support encouraged engagement with the program, see figure 3.

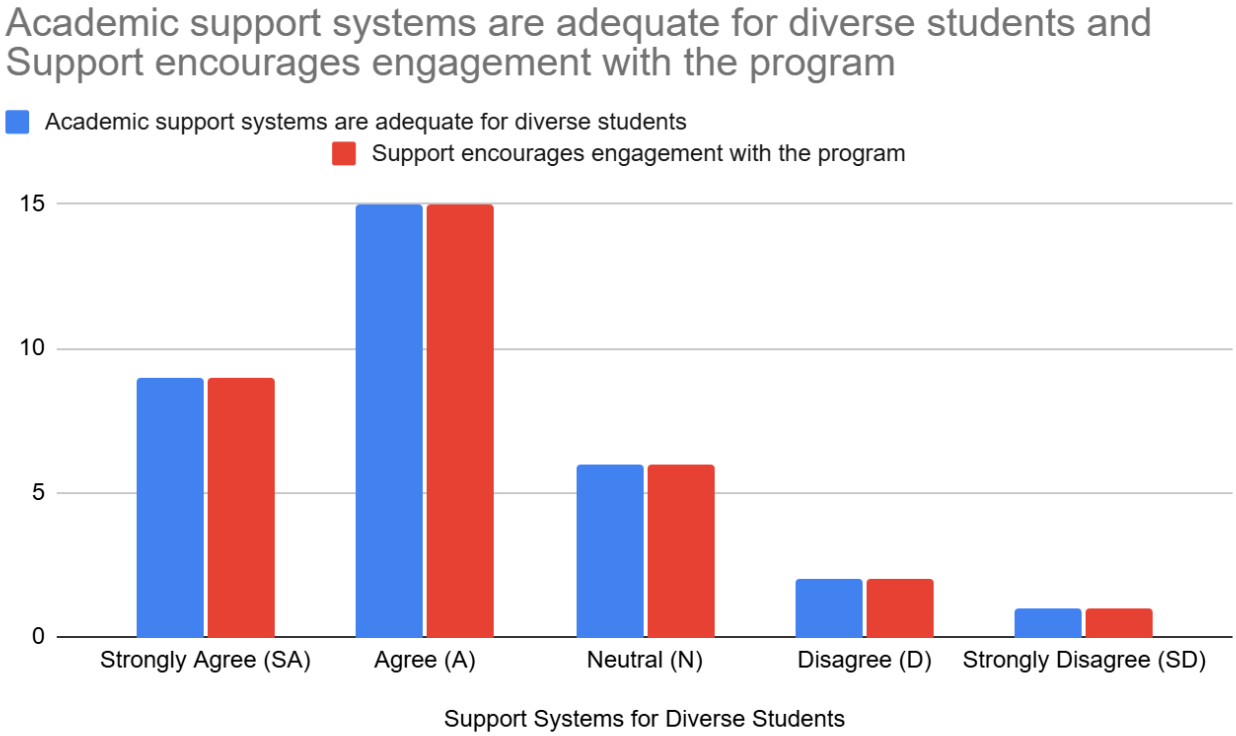

Figure 3. Perception towards Support Systems for Diverse Students

On leadership and representation questions, *"Leadership and Representation [The leadership in my program promotes and prioritizes diversity and inclusion in all activities.]"*, the responses were somewhat mixed. While 24% (6 students) strongly agreed and 48% (12 students) agreed that diverse faculty and staff serve as role models, 12% (3 students) disagreed, and 16% (4 students) remained neutral. Regarding leadership promoting diversity and inclusion, 36% (9 students) strongly agreed, and 36% (9 students) agreed, with 28% (7 students) remaining neutral. This suggests some dissatisfaction with the visibility and commitment of leadership regarding diversity efforts, see figure 4.

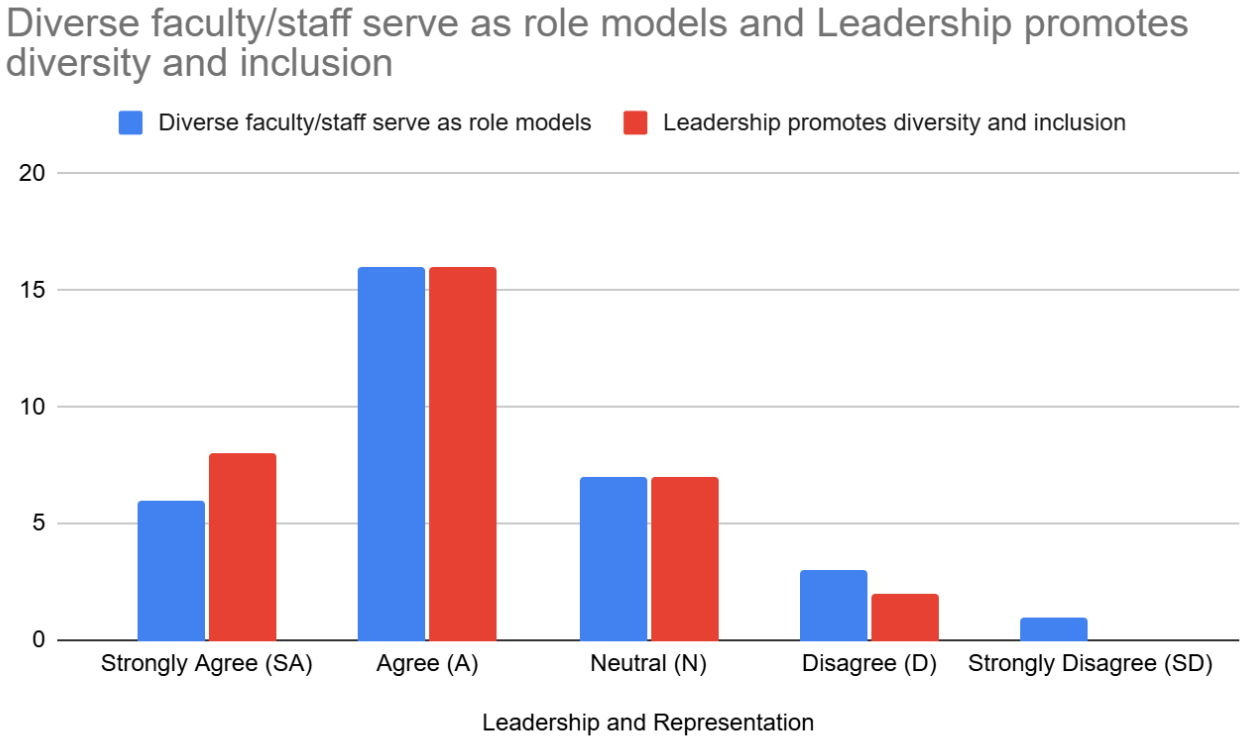

Figure 4. Perception towards Leadership and Representation

In terms of the campus climate, 20% (5 students) strongly agreed and 56% (14 students) agreed that the environment made them feel valued as diverse students. However, 24% (6 students) remained neutral, indicating room for improvement. When asked about the ability to express cultural identity, 36% (9 students) strongly agreed, and 48% (12 students) agreed, with 16% (4 students) remaining neutral. This shows that while a majority felt comfortable expressing their cultural identity, a few students still felt hesitant, see figure 5.

For participation and collaboration, the results again showed mostly positive responses. Regarding opportunities for collaboration with students from diverse backgrounds, 40% (10 students) strongly agreed, and 48% (12 students) agreed, with 4% (1 student) strongly disagreeing and 8% (2 students) remaining neutral. Similarly, 32% (8 students) strongly agreed and 52% (13 students) agreed that they felt encouraged to participate in group activities, discussions, and projects, while 4% (1 student) strongly disagreed, and 12% (3 students) remained neutral.

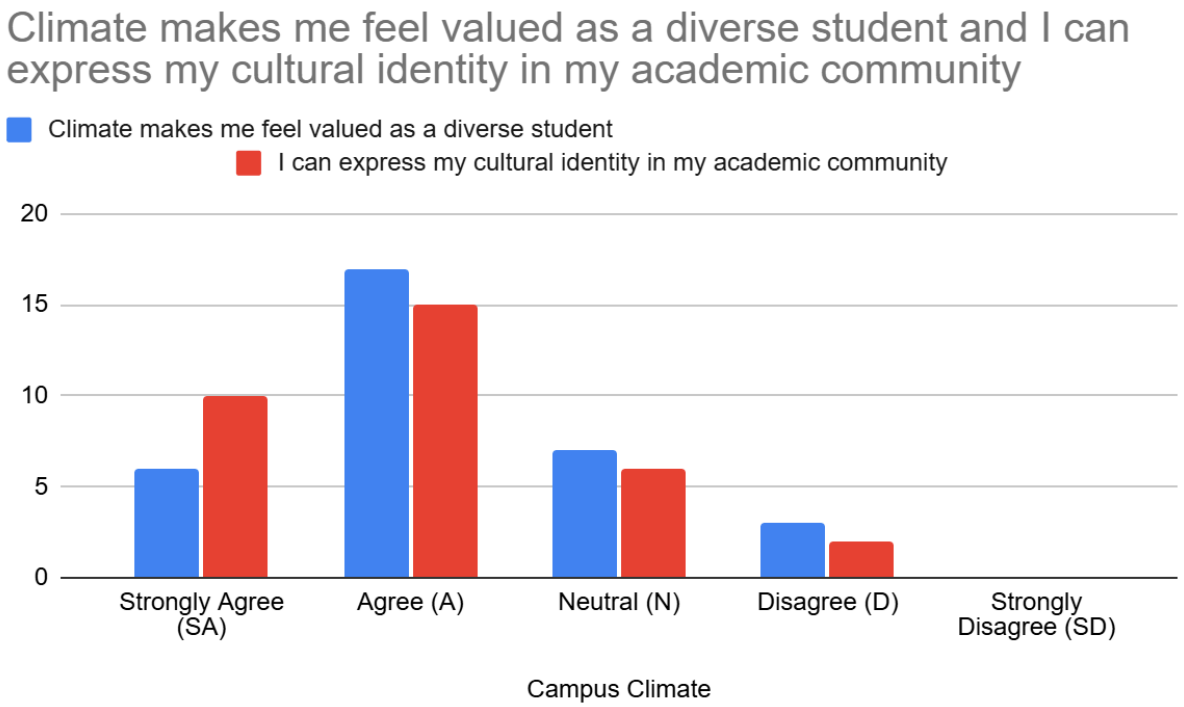

Figure 5. Perception towards Campus Climate

Perception of International Graduate Engineering Students Towards Engagement (Adapted from MSLQ)

The survey also measured student engagement using the Motivated Strategies for Learning Questionnaire (MSLQ). The results reveal strong levels of self-efficacy and engagement, with students feeling confident in their ability to perform academically and motivated to participate in class discussions.

Table 3. Perception Towards Engagement

Statement	**Strongly Agree (SA)**	**Agree (A)**	**Neutral (N)**	**Disagree (D)**	**Strongly Disagree (SD)**
Self-Efficacy for Learning and Performance					
I feel confident in my ability to perform well in my graduate engineering courses.	15 (45.5%)	18 (54.5%)	0	0	0
Can overcome challenges in courses	17 (51.5%)	16 (48.5%)	0	0	0
Intrinsic Motivation					
Find topics in graduate courses engaging and interesting	14 (42.4%)	17 (51.5%)	2 (6.1%)	0	0
Motivated to participate in class discussions	12 (36.4%)	18 (54.5%)	3 (9.1%)	0	0
Extrinsic Motivation					
Participate in class discussions mainly for grades	10 (30.3%)	12 (36.4%)	7 (21.2%)	4 (12.1%)	0
Engage in coursework to meet professors' and peers' expectations	8 (24.2%)	17 (51.5%)	5 (15.2%))	3 (9.1%)	0
Time and Study Management					
Manage time effectively to stay on top of coursework	12 (36.4%)	15 (45.5%)	4 (12.1%)	2 (6.1%)	0
Balance academic responsibilities with other commitments	10 (30.3%)	16 (48.5%)	6 (18.2%)	1 (3.0%)	0
Peer Collaboration, Learning, and Social Engagement					
Participate in study groups or academic collaborations	10 (30.3%)	17 (51.5%)	4 (12.1%)	2 (6.1%)	0

Working with peers from diverse backgrounds enriches learning	15 (45.5%)	15 (45.5%)	2 (6.1%)	1 (3.0%)	0
Academic Help-Seeking					
Seek help when not understanding something in courses	16 (48.5%)	13 (39.4%)	3 (9.1%)	1 (3.0%)	0
Feel comfortable reaching out to professors or peers for help	13 (39.4%)	14 (42.4%)	5 (15.2%)	0	1 (3.0%)

As regards the measure of student engagement, the results from the Motivated Strategies for Learning Questionnaire (MSLQ) reflected strong feelings of self-efficacy. *"I feel confident in my ability to perform well in my graduate engineering courses"*. 45.5% (15 students) strongly agreed, and 54.5% (18 students) agreed that they felt confident in their ability to perform well in their graduate courses. Similarly, 52% (17 students) strongly agreed, and 55% (18 students) agreed that they could overcome any challenges they faced in their courses, even as students from diverse backgrounds. This indicates high levels of confidence in their academic abilities, see figure 6.

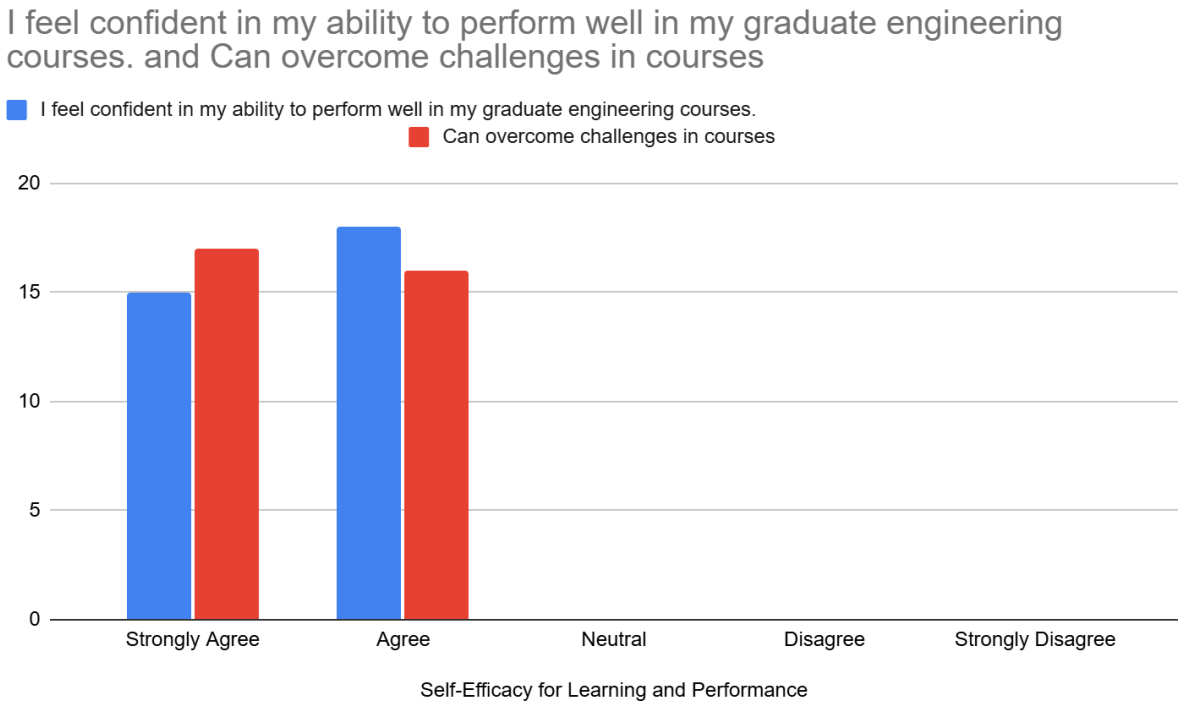

Figure 6. Perception towards Engagement through Self-Efficacy for Learning and Performance

Regarding the intrinsic motivation question *"Intrinsic Motivation [I find the topics in my graduate engineering courses engaging and interesting.]"*, 42% (14 students) strongly agreed, and 52% (17 students) agreed that they found the topics in their graduate courses engaging and interesting. 36% (12 students) strongly agreed, and 55% (18 students) agreed that they were motivated to participate in class discussions due to the exciting nature of the material. However, when asked about extrinsic motivation *"I engage in coursework primarily to meet the expectations of my professors and peers"*, the results were 76% agreeing. 30% (10 students) strongly agreed and 36% (12 students) agreed that they participated in discussions and activities mainly to get good grades, while 12% (4 students) disagreed, and 21% (7 students) remained neutral. See figure 7 and 8.

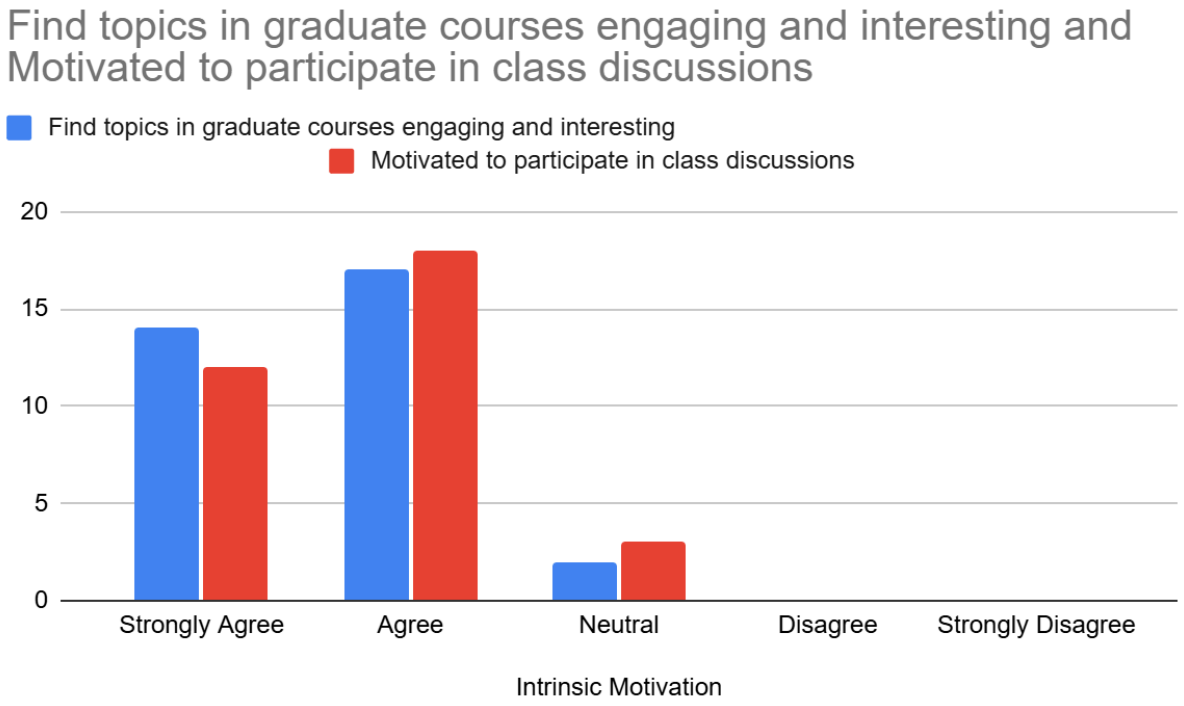

Figure 7. Perception towards Engagement through Intrinsic Motivation

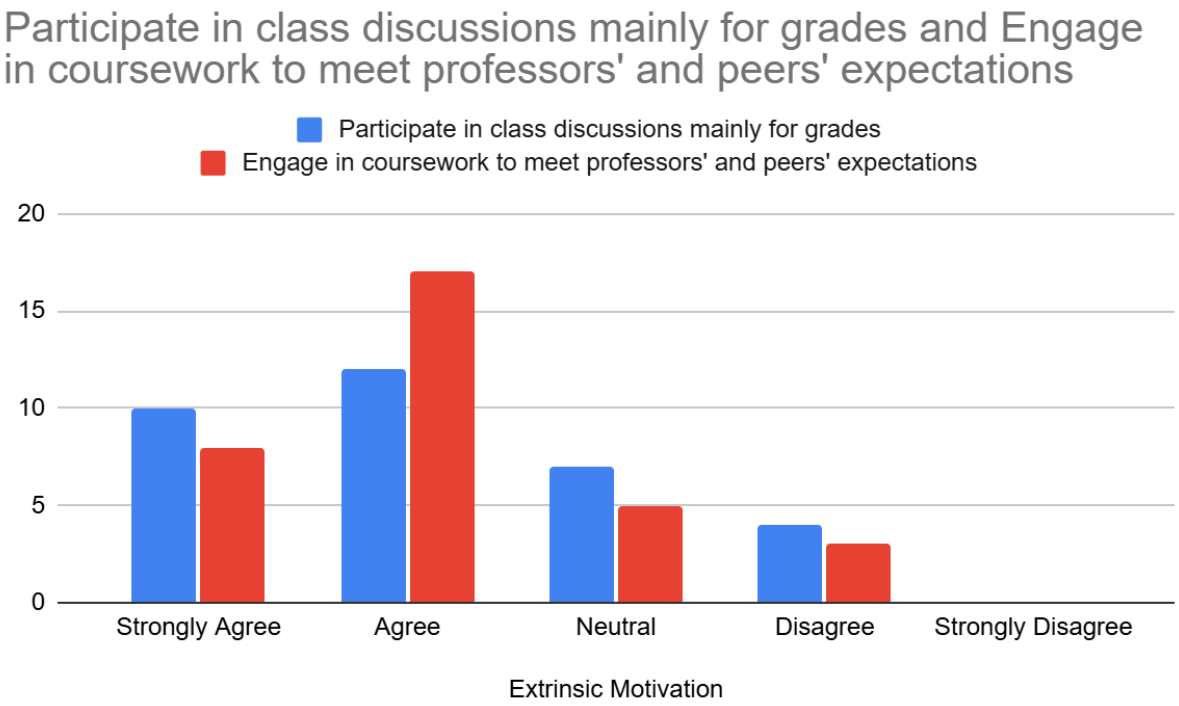

Figure 8. Perception towards Engagement through Extrinsic Motivation

For time and study management, 36% (12 students) strongly agreed, and 45% (15 students) agreed that they managed their time effectively to stay on top of their coursework, while 6% (2 students) disagreed and 12% (4 students) remained neutral. On the question *"I balance academic responsibilities with other commitments"*, 30% (10 students) strongly agreed, and 48% (16 students) agreed, with 3% (1 student) disagreeing, and 18% (6 students) remaining neutral.

In terms of peer collaboration *"I participate in study groups or academic collaboration"*, 30% (10 students) strongly agreed, and 52% (17 students) agreed that they actively participated in study groups or academic collaborations. However, 6% (2 students) disagreed, and 12% (4 students) remained neutral. When asked about the value of working with peers from diverse backgrounds, 45% (15 students) strongly agreed, and 45% (15 students) agreed, with 3% (1 student) disagreeing, and 6% (2 student) remaining neutral. This indicates that students see the value in peer collaboration and appreciate the enrichment that comes from learning with diverse peers.

In terms of academic help-seeking "*I seek help when not understanding something in courses"*, 48% (16 students) strongly agreed, and 39% (13 students) agreed that they seek help when they don't understand something in their graduate courses, with 3% (1 student) disagreeing, and 9% (3 students) remaining neutral. Additionally, 39% (13 students) strongly agreed, and 42% (14 students) agreed that they felt comfortable reaching out to professors or peers for help, especially as diverse students, with 3% (1 student) disagreeing and 15% (5 student) remaining neutral, see figure 9.

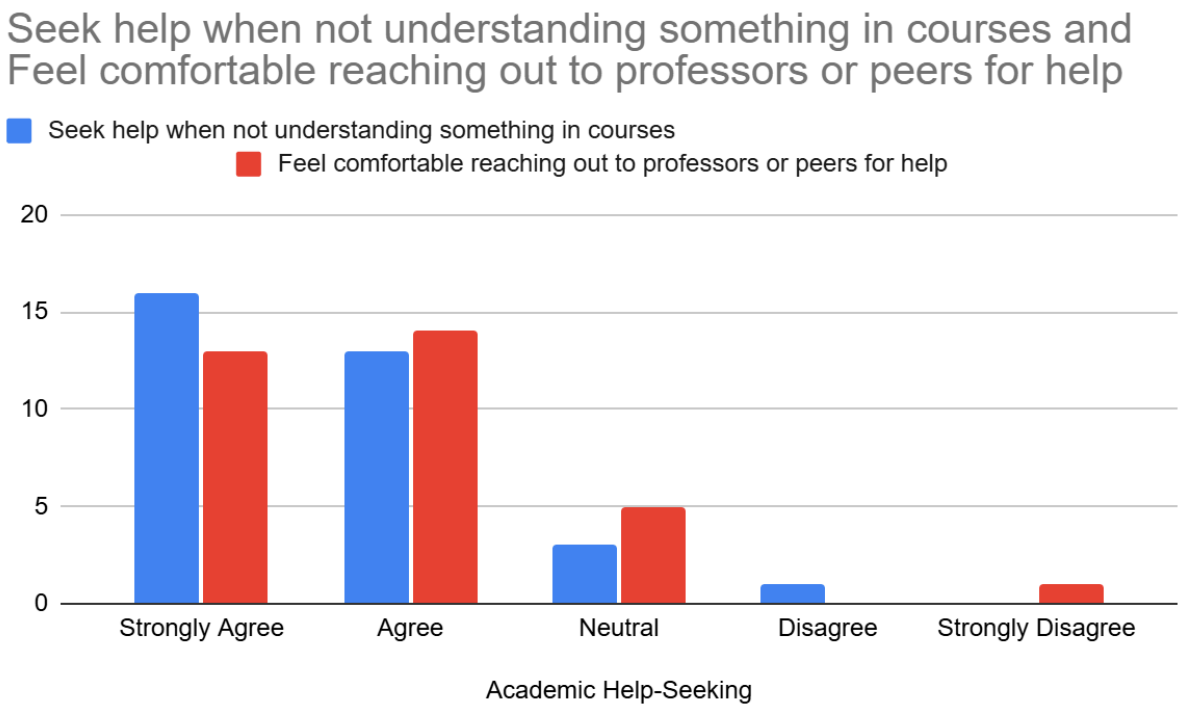

Figure 9. Perception towards Engagement through Academic Help-Seeking

DISCUSSION

The overall results of the study indicate a positive perception of diversity, inclusion, and student engagement within the graduate engineering program table 2 and table 3 which aligns with the emphasis of Bielefeldt, et al, [28], Page [29]; and Kuh [33] on diversity, inclusion, and engagements within organizations including academic environments that contributes to enhanced problem-solving and innovation. According to both the quantitative data and qualitative feedback, students generally feel supported by the institution's inclusive curriculum and learning environment . The majority of participants expressed confidence in their academic abilities, with many indicating that they are motivated by intrinsic factors, such as interest in the subject matter. Additionally, students reported a sense of belonging and engagement within the program, with a strong emphasis on peer collaboration and a supportive academic atmosphere [16]. These findings reflect the program's commitment to fostering an inclusive and engaging environment that encourages academic success [30], [31], [32]; and [33].

Also, both students and faculty members highlighted several areas for improvement in terms of further enhancing diversity, inclusion, and engagement. One key issue that emerged from the qualitative interviews was the difficulty international graduate students face in adapting to harsh weather conditions, which can hinder their participation in on-campus activities. To address this, it was suggested that the program consider offering remote work options during extreme weather conditions, which would provide these students with more flexibility. Furthermore, interviewees emphasized the importance of incorporating more intercultural experiences into the curriculum. Suggestions included organizing excursions and student exchange programs, as well as collaborating more closely with industries for internship opportunities. These initiatives would

provide students with diverse cultural perspectives and practical experiences, further enriching their learning and engagement.

Faculty members also expressed the need for increased emphasis on culturally responsive pedagogy, with recommendations for training sessions before each semester to help faculty integrate diverse cultural perspectives into their teaching practices. The interviews also pointed to the value of study abroad programs and exchange opportunities for students, as these would strengthen students' sense of belonging and provide them with firsthand exposure to different cultures and learning environments..

Responding to the interview, the importance of bridging the gap between theory and practice was emphasized, recommending that the program bring in more field experts to provide real-world perspectives, enriching the learning experience for students [10]. Furthermore, increasing sponsorships and scholarships would help motivate students and further promote diversity. The interviewees also advocated for more collaboration between students from different engineering disciplines to spark innovative ideas and enhance their overall learning experience.

Additionally, increasing support for scholarships and internships was viewed as a way to motivate and retain diverse students, fostering greater academic success. While the program has made strides in promoting diversity and inclusion, the findings suggest that targeted initiatives and suggestions, such as those outlined above, would significantly enhance the overall experience for International Graduate Engineering Students at the institution. These strategies, combined with the existing strengths of the program, would provide a more holistic and supportive educational experience for all students, particularly those from diverse backgrounds and support the views of Hurtado, et al. [19] on improving diverse learning environments.

CONCLUSION

In conclusion, this research examined the perceptions of International Graduate Engineering Students at an HBCU regarding diversity, inclusion, and engagement. The findings revealed that while students felt confident and supported by an inclusive curriculum, areas such as collaboration, intercultural experiences, and specific challenges like weather adaptation for international students still needed attention. These insights answered the first research question by identifying both strengths and areas for improvement in current diversity strategies.

The qualitative interviews further highlighted strategies to enhance diversity and engagement, such as expanding international student programs, enhancing faculty cultural competency, and increasing field-based learning. These suggestions addressed the second and third research questions by identifying factors that hinder or support student engagement and success, offering actionable recommendations to improve existing programs.

Ultimately, the research emphasizes the need for a supportive, inclusive environment that fosters a sense of belonging and engagement among all students. Implementing the recommended strategies could significantly enhance the academic and professional success of International Graduate Engineering Students at HBCUs.

LIMITATIONS

The study focuses on a single HBCU, and International Graduate Engineering Students, future research could expand to multiple institutions and explore the long-term effects of diversity strategies on student outcomes. Likewise, comparing how the views in this research line up or differ from a cohort of HBCU engineering graduate students that are primarily domestic would be intriguing.

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