

Biomedical Engineering Education

DEI and Engineering Identity

Identification of Different Attitudes and Perceptions among Different Ethnic Student Groups in Mechanical Engineering

Thursday, October 12, 2023 3:30 PM – 3:45 PM PDT Location: 340 (Center, Level 3)

Presenting Author(s)



Liang Zhu, PhD (she/her/hers)
Professor of Mechanical Engineering
University of Maryland Baltimore County
BALTIMORE, Maryland, United States

Co-Author(s)

SS

Shuyan Sun
University of Maryland Baltimore County, Maryland, United States

CE

Charles Eggleton
University of Maryland Baltimore County, Maryland, United States

tT

topoleski Timmie
University of Maryland Baltimore County, Maryland, United States

rM

ronghui Ma
University of Maryland Baltimore County, Maryland, United States

dM

deepa Madan
University of Maryland Baltimore County, Maryland, United States

Introduction:: Our institution has been awarded an NSF S-STEM grant to provide scholarships and educational activities to undergraduate students. Aligning with previous studies,¹ we believe that providing additional academic support beyond scholarships is beneficial and will improve retention and graduation rates. However, additional activities and services should be carefully designed to enrich and intensify student learning, promote confidence and performance, improve retention and graduation rates, and facilitate career or graduate school placement. The activities should align with psychosocial theory to address specific needs of students, especially students in different economic and/or ethical backgrounds.² The focus of this preliminary study is to understand whether there are significant differences between traditional students and students underrepresented in STEM (i.e., female, African America, Hispanic), especially in research self-efficacy (defined as students' perceived abilities in conducting research) and academic integration (defined as skills and activities that are important for academic success).

Materials and Methods:: A survey was developed by our research team containing measurable items regarding their attitudes, perspectives, science/engineering identity, and research self-efficacy in 2019. The survey questions were entered in QualtricsXM, and the students were invited via emails to participate in the online survey. The first section of the survey consisted of 10 questions focusing on students' demographic information including race, gender, family economic status, GPAs, whether they originally matriculated at UMBC or transferred from a community college, etc. The second section contained Likert-scaled items to include Research Self-Efficacy (9 questions), Science/Engineering Identity (5 questions), Expectations and Goals (4 questions), Academic Integration (5 questions), and Senses of Belonging to Program and Campus (8 questions). The data collected in the study was numerically coded, at a scale from 0 to 100, with 100 indicating more positive levels of variables being measured, i.e., "Absolutely Confident" or "Strongly Agree" or "Very Easy". Twenty five surveys were received. The data were tabulated and analyzed using the Statistical Package for Social Sciences (SPSS). Statistically difference between groups was evaluated using ANOVA and student t-test.

Results, Conclusions, and Discussions:: Overall, students feel that "Academic Integration" is very difficult, with a score around of 67±20.74. "Research Self-Efficacy" scored slightly higher, 70.8±19.5 (Figure 1a). However, these scores varied by ethnicity, gender, and transfer status. For "Academic Integration", Hispanic, Male, and African American groups received the lowest scores (58±22.6, 60.33±18.92, 63.33±16.17, respectively). Asian (77.50±14.17) and female students (77.00±18.30) scored higher (Figure 1b). The average scores for the transfer (65.58±19.05) and non-transfer student (70±24.09) groups are similar to that of all groups (67±20.74). Among the five questions asked in "Academic Integration", "Q2: develop effective skills", "Q4: manage time effectively" and "Q5: develop friendships with peers" received the lowest scores if the answers of all the students in the survey are included, especially in the three student groups who ranked the lowest scores among all groups (Hispanic, male and Transfer students). In contrast, in the category of "Research Self-Efficacy", Hispanic students (84.44±15.9), male students (76.14±18.97), and Asian students (70.55±17.81) ranked much higher than female students (62.99±12.27), African America students (66.66±16.28), or transfer students (66.94±24.24) (Figure 1c). Female, African American, and transfer students scored low in the following three questions in the category: "Use technical science skills", "Generate a research question to answer", and "Use scientific literature". The results of the study suggest that there are different needs among different student groups when helping them integrate into academic program and improve their research self-efficacy. One-size-fits-all activities may not work to provide targeted and effective support to students, especially underrepresented students in STEM (e.g., female, African American, and Hispanic students).

Acknowledgements (Optional): : This research was supported by an NSF S-STEM grant (DUE-1742170).

References (Optional): : 1. Zhu et al., ASME Journal of Biomechanical Engineering, 143(12): 121006 (1-7), 2021.
2. Lent et al., J. Vocational Behavior, 45(1):79–122, 1994.