BOARD # 448: SSTEM grant providing improved persistence through enhanced engineering identity

Dr. Gary Brooking, Wichita State University

GARY BROOKING received a BS in Electrical Engineering and worked in the process control industry. He then completed an MS in Bioengineering and a PhD in Electrical Engineering. He lectured at NUST, Zimbabwe in the Electronic and Computer Engineering Dept. and became Director of ITS. He left academics to start several regional companies focused on information systems and education. He then joined the University of Zimbabwe Electrical Engineering to establish research and industry links and was awarded tenure. He then moved to Wichita State University's Biomedical Engineering Dept. to assist in fostering an entrepreneurial mindset in students. He later became the inaugural chair of the Engineering Technology Dept., renamed to Applied Engineering. He also established the Applied Computing program, now part of the School of Computing.

Mrs. Samantha Corcoran, Wichita State University

SAMANTHA CORCORAN has a BS and MS in industrial engineering with experience in manufacturing, lean improvements, and quality control. She served the Wichita State University College of Engineering as Assistant Dean before joining the engineering faculty. She co-founded WSU GoBabyGo, created an Assistive Technology and Accessible Design undergraduate certificate, and is the program lead for the Shocker Design Experience.

Dr. Jacob Charles Mendez, Wichita State University

Engineering

SSTEM Grant:
Providing Improved Persistence Through Enhanced Engineering Identity

Introduction

With the increasing demand for skilled engineers, it is crucial to recruit high-achieving, economically disadvantaged students who may not traditionally consider pursuing a four-year degree. The SSTEM (NSF 22-527) Award #2221623 focuses on identifying and recruiting such students with an interest in the advanced manufacturing industry. The program employs Tonso's socialization theory of engineering identity development to foster academic success and retention among participants [1, 2]. Additionally, the adoption of a first-year seminar class [3] combined with peer mentoring are proving to be useful tools in enhancing engineering identity, further contributing to students' persistence and success [4].

Recruitment efforts primarily target local high school students, leveraging the recommendations of teachers to assess high-achieving candidates. Through this initiative, the SSTEM program aims to address the barriers faced by economically disadvantaged students by creating an environment that emphasizes connection, identity, and academic success. The significance of this work lies in its potential to bridge the gap for economically disadvantaged groups in engineering fields, thereby contributing to upward mobility and diversification of the workforce.

The program's approach includes a comprehensive strategy involving a common First Year Seminar cohort, regular student engagement on and off campus, integration with industry partners, and structured peer mentoring. The initial retention and success rates observed in the first cohort are promising. By the end of the program, we hope to highlight the impact of socialization and mentorship on engineering identity development and establish a replicable model for future cohorts. This poster describes Wichita State University's SSTEM program, with some very preliminary results. It also highlights the active engagement of students in the selection of new students and solidifying a community of SSTEM students.

Project Approach

The SSTEM program employs a multi-faceted recruitment and retention strategy centered on collaboration with local high school teachers. Teachers play a critical role in identifying potential candidates, with a selection emphasis placed on teachers' recommending students who demonstrate potential for high academic achievement and an interest in advanced manufacturing.

Program activities are designed to enhance engineering identity and academic success. Key components include:

- Common first-year seminar class: This included multidisciplinary team experiences, peer mentoring, and professional competency workshops.
- Regular Meetings: Students meet both on and off campus to build a sense of community and engage in programming activities.
- Industry Engagement: In spring 2024, students connected with industry partners and participated in co-op opportunities over the summer, gaining practical experience.
- Cohort Selection Involvement: Cohort 1 students actively participated in interviewing and selecting Cohort 2 candidates, which enhanced their engagement with the program.

- Peer Mentoring: After the selection process Cohort 1 students selected students from Cohort 2 to peer mentor. This was initiated and led by the students with oversight provided to ensure all students had peer mentors. Suggested guidelines were provided, like meeting at least once a month as well as lunch vouchers were provided if requested. This exercise fostered a supportive network and reinforcing their own engineering identities.

These methods were refined based on the success of the initial cohort and will be adapted for the recruitment of Cohort 3. By involving current SSTEM scholars in the selection process, the program strengthened connections across cohorts and ensured the continued development of a cohesive community.

Initial Results and Discussion

The outcomes of the SSTEM program's first year are limited due to the small sample size (n=6), however they indicate some effectiveness in supporting economically disadvantaged engineering students. Cohort 1 achieved a 100% retention rate, significantly surpassing the college's average first-year retention rate of 64.8%. The cohort's average cumulative GPA was 3.57, compared to the college-wide average of 2.76. These metrics highlight the program's ability to foster academic excellence and persistence.

Table 1: Initial cohort spring survey showing students' perception of the SSTEM experience:

Field (n=6)	Max (1-5)	Mean	Standard Deviation
Has made me feel more like an engineer	5.00	4.71	0.45
Makes me feel like I belong	5.00	4.86	0.35
Helps me to see a future in engineering	5.00	4.86	0.35
Will help me persist when my courses get hard	5.00	5.00	0.00
Is a valuable experience	5.00	5.00	0.00
I believe that I will graduate with a degree in engineering	5.00	4.86	0.35
This degree will be difficult	5.00	4.57	0.49
I have the skills necessary for success in my program	5.00	4.57	0.49

The survey conducted in spring 2024 (Table 1) revealed that Cohort 1 students rated their SSTEM experience highly, expressing a strong connection to their career aspirations and confidence in overcoming future challenges. Group activities and participation in the selection of Cohort 2 further enhanced their engagement with the program.

The introduction of peer mentoring proved to be an important element, as it facilitated the development of strong engineering identities among both mentors and mentees. These

connections contributed to the formation of a supportive network that we believe assisted with retention and students' success.

The recruitment model was expanded to include additional schools, resulting in a higher number of strong candidates for Cohort 2. The inclusion and recognition of the impact of K12 teachers on the SSTEM program has contributed to the increased interest and involvement of high school teachers. This enhancement demonstrates the program's scalability and potential for broader impact.

Conclusion

An initial evaluation of the SSTEM program has demonstrated the critical role of high school teacher involvement in identifying and recruiting high-achieving, economically disadvantaged students. By integrating peer mentoring, industry engagement, and cohort-based activities, the program effectively enhances engineering identity and academic success. The 100% retention rate and strong academic performance of Cohort 1 validate the program's approach and provide a foundation for continued success.

Involving current SSTEM scholars in the recruitment and selection process not only strengthens inter-cohort connections but also fosters a culture of persistence and engagement. The program's methods offer a replicable model for addressing the underrepresentation of economically disadvantaged students in engineering, contributing to a more diverse and inclusive workforce.

Acknowledgement

We would like to acknowledge the support of the NFS SSTEM (NSF 22-527) for their Award ID 2221623 which has created the opportunity for this work.

References

[1] Tonso, K. L. (2006a). Teams that work: Campus culture, engineer identity, and social interactions. Journal of Engineering Education, 95(1), 25.

[2] Tonso, K. L. (2006b). Student Engineers and Engineer Identity: Campus Engineer Identities as Figured World. Cultural Studies of Science Education, 1, 273-307.

[3] Corcoran, S., Birkner, J., & Brooking, G., (2025) A Multi-tiered Strategy to Increase Freshman Retention, to be presented 2025 ASEE Annual Conference & Exposition, Montreal, Canada.

[4] Gehreke, L., Schilling, H., & Kauffeld, S. (2024). Effectiveness of peer mentoring in the study entry phase: A systematic review. Review of Education, 12, e3462.

[5] Morelock, J. R. (2017) A systematic literature review of engineering identity: definitions, factors, and interventions affecting development, and means of measurement, European Journal of Engineering Education, 42:6, 1240-1262, DOI: 10.1080/03043797.2017.1287664.