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The Effectiveness of Periodic Workshops as part of an NSF S-STEM Support Ecosystem

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Abstract **The NSF S-STEM grant is a funding opportunity to recruit, retain, and promote low income (Pell-grant eligible), high-performing students in STEM disciplines. UMaine launched the NSF S-STEM funded Building Bridges to Engineering Students (BBEST) a program in 2023 to serve students studying in any of the 12-ABET accredited engineering programs. We have recruited two of our three student cohorts and have found that monthly professional development workshops are an effective vehicle to transcend disciplinary differences within the BBEST Scholar cohorts. Our current students are studying biomedical, chemical, electrical, and mechanical engineering all with distinct, minimally overlapping curricula; yet through monthly workshops we can facilitate a unique community where students and faculty have open dialog. The workshops are semi-structured but encourage students to share their own experiences. Topics to date have included: 1) Study Skills and Self-Reflection, 2) Goal Setting and Individual Development Planning, 3) Innovation and Entrepreneurship, 4) Undergraduate Research Experiences, and 5) Career Preparation. The mentorship team consists of the associate dean of the Maine College of Engineering and Computing, a full professor of mechanical and aerospace engineering, an associate professor of biomedical engineering, and a 34-year veteran high school teacher. Each member of the mentorship team has shared their own unique journey highlighting the opportunities, challenges, and setbacks. As we enter our third year of our program, senior students are mentoring incoming students and sharing their own defining experiences creating a positive-peer pressure loop of engagement and leading by example.**

Keywords: Academic workshops, Holistic mentoring, Pell-grant eligible

I. Introduction

The Bureau of Labor Statistics projects a 3.9% growth rate of engineering professionals in the United States over the next 8 years. Furthermore, engineers enjoy the second lowest unemployment rate (2.5%) of all occupations [1]. More locally in Maine, ~ 1,350 engineering positions are expected to be vacant in the next 10-years primarily due to an aging workforce. Collectively, there is a great need to train additional engineers both locally in Maine and nationally. Historically, PELL-grant eligible students from rural counties within Maine have disproportionately lower retention rates and graduation rates suggesting that rural and income-based pressures are compounding in this student population. To address these pressures, the Building Bridges to Engineering Student (BBEST) team seeks to create a targeted, personal approach to counteract the social and financial pressures associated with the perceptions of technology and advanced degrees in their communities [2]. As part of the BBEST program we have developed a support ecosystem (Fig. 1) for the scholars that includes peer-to-peer and faculty mentoring, direct presentation of research and other academic opportunities, as well as career and academic support. The Student Success Coordinator is central in facilitating the BBEST programmatic offerings and serves as the principal point of contact with the BBEST Scholars.

A primary component of this support ecosystem are monthly student workshops. These workshops provide unique opportunities for the cohorts to engage and connect with other students in the college that likely are facing similar challenges while also providing a scalable approach for the engineering faculty to multiply their impact on student retention, graduation and career preparation.

Fig. 1: BBEST support ecosystem.

The BBEST program is currently still in the ramp-up phase; we have successfully recruited our first two cohorts, each with approximately eight incoming students. In our first cohort, we recruited both sophomore (three students accepted) and freshman (four students accepted) to aid in establishing the program. We are actively recruiting our last cohort of BBEST scholars (we anticipated another eight incoming students). In total, 24 BBEST scholars will benefit from both the financial support and the support ecosystem over the course of the funded period.

II. Student Workshops

Student workshops are held monthly and scheduled based on the optimal availability of the BBEST student scholars. BBEST scholars are sent Google calendar invites and reminder emails from the Student Success Coordinator. While scholar attendance is strongly encouraged; it is not mandatory. We routinely have approximately 93% of the BBEST students in attendance using either in-person or hybrid (Zoom meeting) options. To encourage in-person attendance, the Maine College of Engineering and Computing (MCEC) Dean's office provides pizza. The entire BBEST leadership team comprising the Associate Dean of MCEC, two faculty members and the Student Success Coordinator regularly attend in-person student workshops for direct engagement with the BBEST scholars.

The themes of the student workshops are identified by the leadership team at the start of each semester, but we reserve flexibility to adapt to student feedback throughout the academic year. The goals of the student workshops are to provide ***holistic, wrap-around mentoring services*** to our BBEST students that are ***uniquely different yet complementary to other on campus mentoring and activities*** (i.e. MCEC student success programs and Engineering and Computing Student Chapters). Our goal in the student workshops is to provide a safe, supportive environment to reinforce students in their goals of becoming '***agents of their own learning***' [3]. To facilitate metacognition growth, our monthly student workshops are broadly focused on the following topics: 1) Study Skills and Self-Reflection, 2) Goal Setting and Individual Development Planning, 3) Innovation and Entrepreneurship, 4) Undergraduate Research Experiences, and 5) Career Preparation. The workshops are generally led by the leadership team; however, there are exceptions when outside speakers are invited to discuss unique opportunities for students. As our program matures, and our BBEST scholars progress through the program, we have also had 2nd year BBEST scholars lead the workshop topics for additional near-peer mentorships. This is particularly important for sharing the impact of research opportunities on their future career trajectory.

Generally, our meetings include a short icebreaker activity (i.e. STEM/Engineering trivia) followed by a quick round-robin check-in. During the check-in round robin, frequently useful tidbits between students of various resources are shared and the team does not impede the length of these discussions. Once the round-robin check-in is completed, the topic of the workshop is introduced primarily using an informal conversational approach; in combination with PowerPoint presentation slides and/or websites to relay information. At the completion of each workshop, we conclude with a summary round-robin asking the students what they found the most valuable part of the workshop theme. A representative list of student workshop themes and activities is found in Fig. 2.

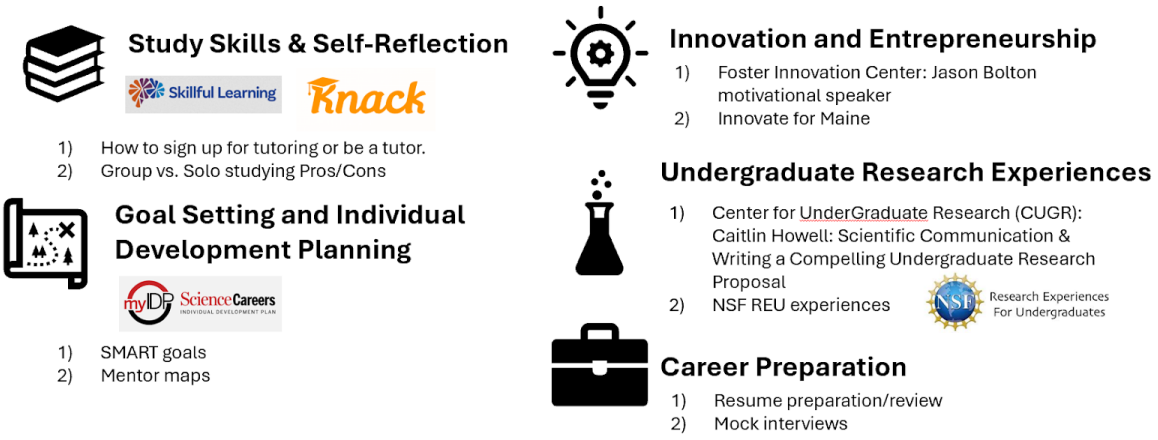

Fig. 2 Key topics of workshops and representative topics presented for each of the topical areas.

III. Data Collection

All data is collected by an external evaluator via end-of-year student surveys or semi-structured student interviews. All student surveys and interview questions were approved by the University of Maine Institutional Review Board (IRB) 2022-07-03. BBEST scholar participation is completely voluntary and all BBEST scholar responses are anonymously shared with the BBEST leadership team.

IV. Preliminary Results and Discussion

Our BBEST program is in its second year; therefore, we are only reporting on the data collected in May 2024. Our student cohort at this time (first cohort of students) was seven students and six students reported for an 86% response rate. The six completed surveys were evenly distributed between first and second year students. The gender distribution of six students were as follows: four male, one female, and one transgender. Several engineering disciplines including Chemical and Biomedical Engineering (one student), Computer Engineering (1 student), Electrical Engineering (one student), Mechanical Engineering (two students), and Mechanical Engineering and Mathematics Minor (one student) were represented in the sample. The students were asked the following questions using a 5-point Likert scale where 1 is extremely bad/not at all and 5 is extremely good/a great deal.

1. What is your overall experience in the program?
2. To what extent do monthly workshops develop their engineering skills?
3. To what extent do monthly workshop help guide a career in STEM?

Overwhelmingly, the students rated the program extremely good (5 students) or somewhat good (one student). In terms of the monthly workshops in particular, 83% (five students) found little or moderate development of their engineering skills; whereas 75% of students (three students) indicated that the monthly workshops helped a lot in guiding them toward a career in STEM. It is not surprising that BBEST scholars find little development in their engineering skills during the monthly workshops as we are not focusing on any specific academic component or engineering design skills. We anticipated that most students would identify the monthly workshops as useful in terms of preparing them for STEM careers as several of the themes, i.e. resume building, SMART goals, individual development plans, and mentoring are well-aligned with this process. One student wrote, *"Faculty does a great job of listening to us and I feel if there is anything in specific that's missing then it hasn't really been brought up."*

Although all workshops are optional, attendance has been excellent (93%). Students specifically cited the value of the mentoring process in helping them navigate their way through the semester. Direct quotes from students are:

"The best part of being a BBEST Scholar is the connection to faculty who understand the system and can help in situations that you have little experience with"

The best thing about being a BBEST scholar is the connections you make with the other scholars.

The best part has been the mentorship, guiding me to the betterment of my career

The best thing about being a BBest Scholar has been having a mentor for everything from research to finding an internship.

V. Conclusion

As a result of our preliminary data collection, our key observations on the monthly workshops with a hybrid format support strong attendance fostering peer-mentoring relationships between the BBEST scholars to share academic and social experiences to aid in the transition from high school to college. Furthermore, the students appreciate the mentoring of the BBEST leadership team. In the future, we hope to support new student-driven initiatives to further strengthen the UMaine BBEST scholar cohort identity.

Acknowledgments

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