ASSETS: Building a Model to Support Transfer Students in Engineering –Work in Progress

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***Abstract*— This Research to Practice work in progress paper presents a model to bridge the gap in community college engineering students successfully transferring to 4-year institutions. In 2015, the state of Tennessee (TN) launched TN Promise, a scholarship and mentoring program that enables tuition-free attendance at two-year community colleges for eligible Tennessee high school graduates. With over 18,000 students already enrolled in TN Promise, the number of students who may choose to transfer to four-year institutions is expected to grow exponentially in the coming years. To prepare for the expected influx of transfer students, and to address known barriers transfer students face, we have designed the Academic Intervention, Social Supports and Scholarships for Engineering Transfer Students program (ASSETS). While transfer students are ready for college, they often face institutional barriers to success that need addressing, particularly in Engineering.**

The ASSETS program is a comprehensive support ecosystem designed to improve retention and reduce time to graduation for engineering transfer students. In the second year of operation, with 23 enrolled ASSETS scholars, the program has implemented and begun studying the effectiveness of evidence-based strategies to reduce these institutional barriers to success, improve retention rates, and reduce time to graduation among engineering transfer students.

This paper presents the initial findings and outcomes of the ASSETS program to enhance opportunities and success of transfer students.

Keywords - Engineering transfer students; Institutional barriers; Transitional Curricula.

I. INTRODUCTION AND BACKGROUND

For decades, higher education has focused its efforts and resources in educating 'traditional college ready' students. Due to demographic shifts, the need to increase the workforce, and economic development pressures, higher education institutions are enrolling an increasing number of students who do not fit the "traditional" mold of old. Many of these students are underserved, underrepresented, first generation college students, from outside the traditional age group of college students (non-traditional). These students are more likely to be less 'college ready' due to contextual factors and institutional barriers that prevent opportunity and successful matriculation. According to the Organization for Economic Cooperation and Development (OECD), more than one-third of US students who begin a post-secondary degree never finish [1]. As academic institutions that seek to serve our communities, the responsibility goes beyond merely enrolling students, but also ensuring the successful graduation of those students, so that they are prepared for careers. This shift, from enrollment toward matriculation, has given rise to a new paradigm that requires educators to assume a larger responsibility for how students learn. As pointed out by [2]:

"Instead of focusing solely on students being college ready and on students' perceived deficits, educators must focus on what they can do to create educational environments that meet students where they are and eliminate barriers that hinder their success."

It is no longer appropriate to focus only on the'college ready' students, but rather to focus on how to prepare all students to become successful within our programs. Consequently, many institutions are retooling their educational infrastructure to

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become student-ready. Simply defined, student-ready institutions are those with faculty ready to teach a diverse group of students, measure learning outcomes to improve performance, and adapt practices and organizational structures to ensure that all students succeed [3].

In 2015, the state of Tennessee launched Tennessee Promise to provide open access to high school students at two-year community colleges.. The expectation is rapid enrollment increases at 4-year institutions, in the very near future, as these students transfer and complete their final two years, thus gaining four-year degrees. The ASSETS program at the University of Tennessee Chattanooga (UTC) is designed to address the challenges that these students and the institution are expected to face. The ASSETS program provides guidance and support to transfer students who enter UTC from community colleges across the state.

Transfer students, many of whom are non-traditional students, face unique barriers to success. Most students transferring from community colleges to 4-year institutions experience "transfer shock," manifested in a lower grade point average (GPA) their first semester at the receiving institution [4,5,6]. An additional factor that magnifies the shock of transitioning to a 4-year institution is entering a curriculum that is likely to be disconnected from the community college curriculum. When curricular mapping is misaligned, students face academic challenges such as not receiving full credit for all their community college courses which may extend the time required for degree completion [7,8]. Engineering transfer students, in particular, often arrive at 4-year institutions lacking prerequisite courses to take junior-level (or major-specific) courses, therefore they accumulate additional credit hours that extend time to graduation.

The demographics of the transfer student population tend to be similar. Many are ethnic minorities, low-income, and of nontraditional college-age [6], they face economic hardship, demands of employment, and therefore have little chance to develop a sense of community with their peers, faculty and degree program. Sense of community is vital for persistence in college generally [9], and particularly important in science, technology, engineering and math disciplines given the demands of the curriculum [10].

To mitigate these known barriers faced by many community college transfer students, the UTC Engineering program has designed a comprehensive support ecosystem that incorporates financial, community, mentoring, academic, and career support.

II. THE ASSETS MODEL

Driven by research and the lessons learned from UTC and other STEM programs [11, 12, 13, 14], evidence-based strategies have been adapted to create a comprehensive support ecosystem to ensure transfer students persist through UTC and graduate with an engineering degree within three years of their transfer date.

Additionally, research strongly promotes the development of partnerships with feeder community colleges [15, 16, 17, 18, 19]. Therefore, the ASSETS model includes an Advisory Board consisting of representatives from UTC's primary feeder schools. The Advisory Board meets with the project team twice per year to help guide project implementation to ensure the needs of transfer students are effectively addressed and to lay the foundation for a future regional alliance.

UTC's ASSETS model addresses common transfer-related issues, including financial need, transfer shock, poor curricular alignment between UTC and the students' feeder colleges, academic hardships, and career awareness, through the following evidence-based strategies:

A. Financial Support

At the heart of the ASSETS model is financial assistance. Currently in the second year of operation, with 23 enrolled ASSETS scholars, each of whom has received an average of $7,400 per year in tuition support. Scholars will receive two years of support. A third year of support will be available to a small number of eligible scholars, if needed. Three scholars per cohort will receive summer tuition stipends to support those who are most behind on prerequisites prior to their first fall semester as a scholar.

B. Transfer Learning Community

Research shows that students participating in living learning communities (LLCs) are more likely to succeed academically, persist through a program of study, and report a positive university experience [11, 13, 20, 21, 22, 23, 24]. Because transfer students often choose not to live on campus due to family or other obligations, establishing a cohesive living community is not practical. As a result, LLC practices were adapted to establish a Transfer Learning Community (TLC) designed to enrich the scholar's educational environment as they transition into the university environment. The TLC provides many of the same social and academic benefits as LLCs, including reduced social isolation through cohort bonds, shared experiences, and academic support through cohort study sessions and shared academic experiences..

C. Faculty Mentors

Pre-emptive advising and mentoring has been shown to increase the sense of belonging, academic motivation, and persistence [11]. Scholars will have the proactive support of faculty and student mentors beyond what all Engineering students receive via College of Engineering & Computer Science's (CECS). Each ASSETS scholar is assigned a CECS Faculty Mentor from their program of study. Progress review check-ins with their ASSETS mentor at three key points each semester help scholars stay on track. Faculty Mentors maintain contact with the ASSETS scholars at least once per month [11, 12].

D. Peer Mentors

Each scholar is paired with a peer mentor majoring in the same engineering concentration to provide ongoing guidance and encouragement. Peer mentors are academically and professionally successful junior and senior level students. Peer mentors provide study tips, social support, and professional guidance, shown effective in facilitating scholar engagement [25]. Peer Mentors are selected by the faculty and receive mentor training and receive academic recognition and a stipend at the conclusion of the academic year.

E. Summer Boot Camp

A best practice identified in prior programs [11,26,27], a summer boot camp is held for incoming cohorts to ease the transition from community college to university life and to boost academic abilities [28]. The curriculum is tailored to each cohort based on the academic needs and barriers identified during the application process to support student mastery of skills and academic content that is required of junior level students.

F. Peer Tutoring

Scholars participate in peer tutoring through the CECS peer-to-peer tutoring program and UTC Student Support Services.

G. Career Development

Authentic STEM experiences are vital to boosting student engagement and persistence [29, 30]. In collaboration with industry partners, UTC ASSETS has provided several career development activities to facilitate professional preparedness, career readiness, internships/co-op opportunities, participation in undergraduate research and graduate school preparation.

III. Research Questions

A growing body of research suggests that STEM intervention programs are most effective if they are implemented in an integrated framework [31]. Implementation, investigation, and evaluation of the efficacies of the program strategies are executed through the following primary research questions that guide the ASSETS project for mentoring, academic and career support: which activities (such as peer tutoring) reduce 'transfer shock;' does the Boot Camp improve academic performance and matriculation among transfer students; and which activities most improve post-graduation employment?

These research questions cannot be fully addressed at the current project stage. Therefore, the scope of this paper is to address leading indicators about ASSETS students' sense of community, mentoring, commitment and overall program experience to date. The research questions examined in this paper employ an integrated approach by evaluating the combined effects of the strategies simultaneously. We present and discuss current findings, following a description of the methodology.

IV. Methodology

The overall study design is mixed-methods, incorporating quantitative and qualitative measures. Quantitative measures include activity participation tracking, periodic check-ins and repeated measures surveys. Qualitative measures include focus groups of all participants (students, peer mentors, faculty) and open-ended comments from check-ins and surveys. Ethical research practices are followed and compliance maintained via institutional review board.

Participants: The first cohort was enrolled in Fall 2018. The second cohort was enrolled in Fall 2019 for a total of 23 participants. The third cohort of students will begin in Fall 2020. Three academic semesters of data are reported in this paper. The majority of ASSETS students are from rural backgrounds, and 73% work 20 hours on average per week, which is different than our Engineering students overall. Additionally, 35% of our scholars are female.

V. Initial Findings

Students in both cohorts were surveyed to determine their level of participation in the ASSETS program. All scholars engaged in the academic, personal and professional development activities offered via the ASSETS program.

A. Quantitative Findings

Boot Camp: The Summer of 2019 was the inaugural year of the camp. The academic modules presented to the entering 2019-20 cohort were determined based upon faculty's anecdotal evidence of previous transfer students' poor performance and/or lack of competence in these areas. Thirteen of the 14 ASSETS scholars attended the 2019 Boot Camp. A post-participation survey was administered. Of the 13 participants, 12 completed the survey. Seventy-five percent of respondents attended all three of the Saturday sessions and participated in all activities. Overall survey themes indicate that Boot Camp participation enabled the entering scholars to feel connected to one another and with professors. Scholars indicated that the amount of time for each activity, and the 3- hour session length was appropriate. However, holding the camp on Saturdays was undesirable. Overall, the group was slightly negative (2.92 on 5 -point scale 5=SA; 3= Neutral; 1=SD) as to whether Boot Camp was an important academic support activity. It should be noted that focus group discussion indicated that the Boot Camp was deemed "extremely supportive" by the students. The focus groups occurred months after the camp, during the fall term, suggesting that students developed appreciation of the camp benefits with the onset of the semester. Open-ended responses yielded several constructive suggestions which will be incorporated into the 2020 Boot Camp restructure. For example, the redesign of the day and time of camp delivery, and the possibility of academic modules being more focused upon students' majors rather than on general overall skills.

Transfer Learning Communities: Cohorts 1 and 2 were asked to complete a Post First Semester participation survey at the conclusion of Fall 18 and Fall 19 semesters respectively to determine in which of the various activities students had participated and which they felt had been the most and least effective in supporting their academic success. Additionally, students were asked to indicate their level of agreement with 10 statements that focused on the programs' impact upon; their ability to successfully transition into the UTC environment; their overall academic success; their career development and their post-completion employment opportunities.

In Cohort 1, 90% (n=9) of participants responded to the survey, 86% (n=12) of cohort 2 participants responded. Across both cohorts the themes were very similar both in terms of what participants deemed to be the most and least effective of the TLC activities. 100% of respondents, across both cohorts agreed that, "participating in ASSETS has enabled me to be a better and/or more successful student", with every participant indicating that receiving tuition support from the scholarships was the most effective TLC activity. All respondents "agreed" or strongly agreed" that "The tuition scholarship supported my ability to be an academic success". Faculty mentors and participation in

professional and career development activities were also seen as important and supportive TLC activities.

Peer mentoring received a mixed reaction across both cohorts in terms of its effectiveness in easing the transition to UTC from the 2-year institutional environment, as did their participation in the ASSETS seminar course. Both cohorts did express some level of dissatisfaction with peer tutoring in supporting their academic success.

Upon comparison group sampling, no statistically significant differences have been obtained that would indicate a difference between ASSETS Scholars and other transfer students. However, based upon the qualitative findings, the ASSETS scholars have clearly benefited from this program, and in particular, reported the mentoring support to be critical for their success in Engineering.

B. Qualitative Findings

Four focus groups were conducted in Fall 2019 with Scholar Cohorts 1 and 2, Faculty and Peer Mentors to capture attitudes and experiences. A total of 17 students, 10 peer and 5 faculty mentors participated. The goals of the focus groups were to understand how students perceive the program, challenges and supports they were experiencing, and to glean formative evaluation feedback from the peer and faculty mentors. Overall, the findings indicate the program components are effectively supporting students. The qualitative findings suggest that the ASSETS model is achieving the objectives of providing appropriate support to transfer engineering students. Financial support is critical for Scholars to be able to engage in the academic program without distraction. Community support, provided through TLC and mentoring has been beneficial. Faculty have learned from their experience as mentors and have become aware of the power differential as a possible impediment to mentoring relationships.

Of the Cohort 1 and 2 students who began Fall 2019, all have been retained in the Engineering program. Two members of Cohort 1 graduated at the end of the Fall 19 semester, the remaining eight students enrolled in the Spring 19 semester. At this time, it is too soon to measure time to degree completion as the majority of Cohort 1 is still in their senior year of the program.

VI. DISCUSSION

Initial data and leading indicators of sense of community, mentoring, commitment coupled with overall program satisfaction seem to indicate that the ASSETS model is achieving the goals of mitigating 'transfer shock,' by building a supportive community for incoming engineering students. Although some scholars have experienced a dip in their overall GPA, ASSETS participants, in both cohorts, indicated the financial support was essential, as was the connection to peer and faculty mentors in providing the necessary support to achieve academic success. A central concern among the Scholars was the academic challenge and time commitment necessary to perform well. An interesting difference between Scholar Cohort 1 and 2 shows promise in that both noted this challenge, yet the first cohort, well into their second academic year at UTC, expressed tolerance and perseverance. This signifies that Scholar Cohort 2 was experiencing the initial shock of the demanding curriculum at the time of the focus groups while simultaneously expressing collegiality with their peers, persistence, and hope.

Faculty mentors developed an awareness of the disconnect between student scholar perceptions of their abilities, and concurrent reality of academic performance. By providing mentoring, and directing the peer mentoring and tutoring, faculty derived sustainable solutions for implementation of the ASSETS model. The model has undergone transformation based upon lessons learned, resulting in the following pivots.

Revisions will be made to the Boot Camp based upon participant feedback regarding the effectiveness and appropriateness of the various modules and activities as related to the ASSETS Scholars' preparation and academic needs. More structure was deemed necessary for student activities to prepare faculty and peer mentors, as well as provide continuity across the program. In the required seminar course scholars take the first semester on campus, students are now given a choice of 3 prompts to choose from when writing reflections about their experiences in the program as newly transferred students. This activity proved useful for the students, as reflection is a proven teaching-learning tool, and provided the project team with timely formative information. Mentor training was developed to ensure consistency and clarity of program knowledge. Formal training for peer and faculty mentors occurred at the start of the 2019 academic year. These trainings provided consistency in expectations, clarity of information, and provided new tools to aid them in mentoring activities, such as email calendar prompts and structured reports and documentation. Additionally, team communication was enhanced. The leadership team met more frequently, and the evaluation team began sharing discussion points with the leadership. The Advisory Board has been regularly convened, and is actively engaged with the project leadership team. This partnership is essential to maintaining a collaborative and monitoring approach to support transfer students bridging to 4-year institutions.

VII. CONCLUSION

Formative evaluation and project pivots have proven to be an invaluable part of the programmatic improvement process and has enabled the development of a sustainable ASSETS scholar model. This model includes engaged partnership with regional community colleges, structured and on-going TLC activities, structured faculty and peer mentoring programs, intentional academic support strategies, and communication strategies.

Though early, the NSF funded ASSETS program has generated encouraging findings that demonstrate how an integrated approach employing a combination of evidence-based strategies is contributing to a student-centered educational approach to support transfer students. The emergent themes from the focus groups show a net positive impact, suggesting that a holistic approach to student support does facilitate persistence in Engineering.

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