

Increasing the Success Rates of Engineering Students After Transferring into Four Year Colleges from Community Colleges: It's Much More Than Dollars

ASSETS - Academic Intervention, Social Supports, and Scholarships for Engineering Transfer Students is an NSF sponsored program at the University of Tennessee Chattanooga designed to help engineering transfer students overcome known academic and social barriers that impede retention or prolong graduation time following transfer from two-year community colleges into four year colleges. ASSETS is now in its fourth year of implementation. Several focus groups conducted among these scholars have consistently ranked the scholarship received as the number one contributing factor to their success. Other secondary but important factors have also emerged, suggesting that these students perceive the four-year institutions as lukewarm at best and hostile at worst to their ability to acclimate. These secondary factors indicate that these institutions need to become more welcoming by adopting strategies that are intentional in addressing the needs of these students, given current situational needs placing all the burden on them to adapt to their new environment. We conducted attitudinal surveys among students and faculty to gauge how pervasive these negative perceptions are among engineering transfer students. The survey analysis revealed that many faculty members do not differentiate between transfer students and traditional students and may therefore not be sensitive to their unique needs. However, faculty members associated with the ASSETS scholars, through serving as faculty mentors, were found to be aware of these differences and are already implementing measures that reflect a shift in mindset benefitting transfer students. This paper presents the findings of the surveys and the outcomes of the new mindset toward providing support to and enhancing the success of engineering transfer students.

Introduction

The responsibility for successfully attending and graduating colleges has traditionally often rested with the students whereby the question we usually ask is “are students ready for college?”, but a growing trend is putting the onus on colleges by asking if “colleges are ready for students” [1],[2]. Transfer students face unique barriers to success, including “transfer shock,” lack of curricular mapping, and economic hardships that require at least part time employment. Engineering students in particular often arrive at four –year colleges without adequate prerequisites to take junior-level (or major-specific) courses. As a result, these students often take as long as four years to graduate following transfer, increasing the likelihood of attrition.

In 2015, the state of Tennessee launched Tennessee Promise, a scholarship and mentoring program that makes attendance at two-year community colleges essentially tuition-free. With over 18,000 students already enrolled in TN Promise, the number of students transferring to four-year universities is increasing and will grow exponentially in the coming years. Are four-year colleges ready for the expected influx of transfer students? ASSETS is a NSF-funded program designed to create a model to get UTC and other four –year colleges ready for these transfer students. The ASSETS program has implemented and is studying the effectiveness of several evidence-based strategies [3], [4], [5], [6] to reduce barriers to transfer, improve retention rates, and reduce time to graduation among UTC engineering transfer students. These strategies range

from tuition assistance to summer boot camp, to professional development activities, to cohort enhancing activities to mentorship, including peer and faculty mentoring.

The ASSETS Model

The ASSETS model has been developed to address the barriers faced by transfer students. These barriers can be categorized into two broad areas, namely academic barriers, and institutional barriers and academic culture. Academic barriers include (1) The lack of access to rigorous math and science courses/curriculum in high school often follows students throughout college journey, and (2) “Watershed” courses that require foundational math and science skill sets (i.e., calculus 1 & 2, fluid dynamics, thermodynamics, etc.) are more problematic for transfer students. Institutional Barriers and Academic Culture include (1) Transfer students often feel more isolated, are slower to acclimate & develop relationships with faculty and peers than students who enter as “traditional freshmen” (2) Transfer students tend to be “non-traditional students” who work more hours outside of school, have family obligations, and are older than peers, and (3) Faculty may not be aware of and/or understand the unique challenges transfer students face and the additional support that may be needed to be successful.

The ASSETS model is structured to provide solutions around these barriers and is accordingly organized around two themes: (1) Providing academic resources and support such as tuition scholarship dollars, peer tutoring, summer boot camp modules, professional development activities and experiences, and workforce development activities and experiences; and (2) Establishing an inclusive sense of community by Cohort Transfer Learning Community (TLC) events and activities, peer mentoring, and faculty mentors for entire career at UTC. These strategies are making significant strides in meeting the objectives of the ASSETS model and account for the success of the students as shown by the differences in three performance measures in Table 1. The comparisons have been calculated between ASSETS students and non-ASSETS students.

Table 1: Comparison of Performance Measures Among ASSETS and Non-ASSETS Scholars

Support Students' Academic Performance	Non-ASSETS Comparison Sample	ASSETS
Transfer GPA (mean)	3.235 (<i>SD</i> = 0.4673)	3.458 (<i>SD</i> = 0.3668)
UTC Institutional GPA (mean)	2.993 (<i>SD</i> = 0.6261)	3.351 (<i>SD</i> = 0.5378)
Overall Earned GPA (mean)	119.96 (<i>SD</i> = 33.87)	142.75 (<i>SD</i> = 47.36)

In comparing the differences between the transfer GPA to the UTC Institutional GPA for non-ASSETS transfer students, a significant difference was observed $t(128) = -5.023, p = .001$ (95% *CI*, -.3373 to -.1467). In comparing the overall differences between the ASSETS versus non-ASSETS transfer students' UTC Institutional GPA, there was homogeneity of variances, as assessed by Levene's test for equality of variances ($p = .743$). A significant statistical difference was observed $t(162) = 3.083, p = .002$ (95% *CI*, 0.1286 to 0.5867). In terms of earned hours overall, ASSETS scholars were compared to non-ASSET transfer students. Homogeneity of

variances was violated per Levene's test for equality of variances ($p = .015$) and the adjustment was made to the t-test statistic. A significant difference was detected $t(43.867) = 2.667, p = .011$ (95% *CI*, 5.5635 to 40.003).

Lessons Learned

While several focus groups conducted among these scholars have consistently ranked the scholarship received as the number 1 contributing factor to their success, other secondary but important factors have also emerged suggesting that these students perceive the four-year institutions as lukewarm at best and hostile at worst to their ability to acclimate, indicating that these institutions need to become more welcoming by adopting strategies that are intentional in addressing the needs of these students where they are rather than placing all the burden on them to adapt to their new environment. Establishing such a community involves more than just adopting established best practices. It requires a shift in mindset on the part of faculty who must embrace cultural competency principles that allow for setting reasonable expectations of incoming students and crafting creative approaches to support their learning [7].

An attitudinal survey was conducted among the students and faculty to gauge perceptions of the academic environment. From these surveys, students identified two program elements beyond the scholarship dollars that help them adjust to life in a 4-year college as secondary but important factors contributing to their success. One element is the Transfer Learning Community (TLC), and adaptation of the Living Learning Community (LLC); and the other is peer mentoring.

By developing a cohort approach to the learning community, each group of Scholars has immediate access to a peer community. One student stated, "Activities during the ASSETS cohort class [TLC] during the first semester helped quite a bit. The relationships I've developed with cohorts and faculty has been wonderful and I feel supported through both". Another noted, "Being around other transfer students helps bring the realization that nobody is alone, but rather experiencing similar "transfer" difficulties". Finally, "[ASSETS] gave me a "ready-made" community at UTC where I was able to ask peers questions. It also allowed me to get to know my professors more quickly and become comfortable enough to ask questions" [7].

Another program element that contributed to sense of belonging was peer mentoring. Mentor Collective [8] is a dedicated third party platform that was used to assess the impact of peer mentoring as shown in Tables 2 and 3.

Table 2 ASSETS Mid-Program Monitoring Using Mentor Collective

ASSETS Mid-Program Update: Sense of Belonging and Self Efficacy				
	Sense of Belonging*		Self-Efficacy**	
	Pre-Program	Mid-Program	Pre-Program	Mid-Program

First-Year Average (N=5/ 31% response rate)	4.3/5	4.2/5	4.5/5	4.1/5
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Please note: Received 1 of 7 mentor mid-program surveys so this data is omitted due to a low response rate

**Average of responses to three peer-reviewed sense of belonging questions, measured on a five-point Likert scale. (Ex: "I feel like an important member of my school community")*

*** Average of responses to three peer-reviewed sense of belonging questions, measured on a five-point Likert scale. (Ex: "Once I've decided to accomplish something that is important to me, I keep trying to accomplish it, even if it is harder than I thought")*

Table 3 UTC Engineering Mid-Program Monitoring

UTC Engineering Mid-Program Update: Sense of Belonging and Self Efficacy				
	Sense of Belonging*		Self-Efficacy**	
	Pre-Program	Mid-Program	Pre-Program	Mid-Program
First-Year Average (N=32/ 32% response rate)	3.7/5	3.8/5	4.0/5	3.8/5
Mentor Average (N=7/ 23% response rate)	4.1/5	4.4/5	4.4/5	4.6/5

**Average of responses to three peer-reviewed sense of belonging questions, measured on a five-point Likert scale. (Ex: "I feel like an important member of my school community")*

*** Average of responses to three peer-reviewed sense of belonging questions, measured on a five-point Likert scale. (Ex: "Once I've decided to accomplish something that is important to me, I keep trying to accomplish it, even if it is harder than I thought")*

The results from the Mentor Collective platform indicate,

- Mentee sense of belonging remained relatively high (Table 2)-- The high pre-program responses for sense of belonging, the fact these are maintained as the year continues, and that these values are higher than student's peers in the general UTC Engineering program (Table 3) suggest the ASSETS program does contribute positively to sense of belonging.
- However, mentee self-efficacy is decreasing (Table 2)-- Mentee self-efficacy often falls pre-program to mid-program as some students "bounce back" from difficult grades or failures in their first semester at UTC. While ASSETS scholars' pre-program levels were

high, they have fallen to closer to even with their peers in the general UTC Engineering program (Table 3).

- All things considered, absolute sense of belonging and self-efficacy numbers are quite strong-- average responses above 4/5 for sense of belonging and self-efficacy are quite strong, as compared with other first-year student and engineering college populations.

Faculty responses to the survey indicate that the ASSETS faculty mentorship program has enabled them to develop an awareness and deeper understanding of the unique challenges transfer students face and the additional academic supports that may be needed to support their success. One hundred percent of ASSETS mentors “agreed” or “strongly agreed” that, as a result of their training and experiences as an ASSETS Mentor they, “*appreciate the importance of transfer students feeling like they are part of the academic community*”, with 100% “agreeing” or “strongly agreeing” that they “*engage in open and candid conversation with their mentee*”. Eighty percent indicated that they are now able to identify the risk factors and academic struggles that are unique to transfer students.

Of the UTC Engineering faculty survey respondents who were not ASSETS mentors, 57% agreed that they provide support for students transferring into the UTC environment, with only 42% indicating that they provide “*additional resources or help to support transfer students*”. When asked what they believe a transfer student needs to be successful in UTC’s Engineering program, one faculty respondent stated, “How do I know what they need to be successful? I do not differentiate between transfer and non-transfer students. The expectations for the class and how I help them is no different than that of a non-transfer student.”

These findings have led to initial efforts to institutionalize corrective strategies across the college of engineering and computer science to benefit all transfer students. For example, an awareness training module is being developed to help shape faculty mindset and aid them in setting and managing expectations around transfer students needs; changes in the program of study have been proposed so that students can take high risk/watershed courses in the summer; and revisions in the requirement of full-time credit hours offered which are now only in the Fall and Spring semesters and to enable spreading credit hours to include summer to better meet the needs of the non-traditional working student.

Conclusion

Based on the observations of the project team and feedback from ASSETS scholars, scholarship dollars play a most important role in helping the students succeed specifically as it enables them to reduce the number of hours that they must work to meet their needs; however, these students do not only face financial hardships but also face other barriers that fall into two recognizable categories: (1) academic preparation; and (2) institutional culture. In terms of academic preparation, lack of access to a quality math and science curriculum in high school often follows students throughout their college journey. In particular, “watershed” courses that require foundational math and science skill sets (e.g., calculus 1 & 2, fluid mechanics, thermodynamics, control systems) are more problematic for transfer students. Regarding institutional culture, faculty may not be aware of and/or understand the unique challenges transfer students face and

the additional support that may be needed to be successful. For instance, transfer students often feel more isolated and are slower to acclimate and develop relationships with faculty and peers than students who enter as “traditional” first-year students [9], [10]. Strategies to address these barriers such as fostering a cohort based learning community, building a sense of belonging and effective mentorship are not financial in nature but have emerged as equally important.

Acknowledgement: ASSETS is funded by the National Science Foundation – DUE Award #174169

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