Enhancing Engineering Talent in Tennessee

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Abstract

A summary of work in progress regarding the **Enhancing Engineering Talent in Tennessee**, National Science Foundation S-STEM Grant #1458735 sponsored by the Directorate for Education & Human Resource and the Division of Undergraduate Education.

Introduction

Starting in 2003, the State of Tennessee enacted a series of initiatives to improve access to higher education by:

- Providing scholarship funding for promising high school graduates through state lottery system.
- A harmonization of curricula between two-year and four-year state institutions.
- Free access to Tennessee community colleges, by means of a last dollar scholarship funding.

Through this S-STEM grant, the National Science Foundation has provided additional funding to specifically benefit engineering students making the transition from Tennessee community colleges to Lipscomb in order to complete their engineering degree.

Background

Over the last 14 years, the state of Tennessee has made several strategic moves to improve educational opportunities for Tennesseans through a number of initiatives. In 2003, the Tennessee Education Lottery Scholarship (TELS) program followed the lead of several other southern states by providing funding to first time college students in the form of *Hope* Scholarships. *Hope* scholarships and other initiatives have consistently provided over $300M per year to assist high performing secondary school graduates [1].

This was followed by the "Complete College Tennessee Act of 2010" enacting broad changes to higher education in Tennessee [2]. One of the most important provisions of this bill resulted in the Tennessee Transfer Pathways initiative, which had the overall goal of simplifying the process of transferring credits to Tennessee four-year colleges by:

- Establishing a university tract program that can be transferred from a community college to any state public university.
- Guaranteeing junior status to students who complete an associate degree at a Tennessee community college upon transferring to a Tennessee public university.
- Allowing dual-enrollment in both a two-year and a four-year college or university.
- Limiting remedial and developmental courses to be offered only by two-year community colleges.

Lipscomb University, like many private colleges and universities in Tennessee has also used this framework to improve the transfer process for community college students.

Most recently (2014) Tennessee Governor Bill Haslam launched the *Drive to 55* initiative. The stated purpose of this initiative is to increase the number of Tennesseans that have achieved a postsecondary degree or credential to 55% by 2025 [3]. As part of this initiative, the *Tennessee Promise* was created as a "last-dollar scholarship that allows recent high school graduates to complete an associate degree or certificate program free of tuition and mandatory fees at a public community college or College of Applied Technology (TCAT)." [4]

S-STEM Program Details

Enhancing Engineering Talent in Tennessee S-STEM grant is especially designed to provide tuition assistance to Tennessee community college students who have completed their "Engineering Pathways" requirements prior to transferring to Lipscomb University. This is accomplished by three program initiatives:

1. Engagement with "Engineering Pathways" students early in their academic career through enrichment activities and mentoring.
2. Scholarships funding for community college students that have completed the "Engineering Pathways" requirements and are likely candidates to complete their Bachelor's degree in engineering.
3. Continued support of S-STEM scholarship recipients through mentoring and academic support

A key part of this grant was to identify community college partners in the Nashville area. Three colleges were selected:

- Columbia State Community College (approx. 25 miles NE of Lipscomb's campus)
- Nashville State Community College, (approx. 4 miles W of Lipscomb's campus)
- Volunteer State Community College, (approx. 40 miles SSW of Lipscomb's campus)

Curriculum Challenges

One of the primary goals of the *Tennessee Transfer Pathways* initiative is to provide a framework within which an incoming community college student could be assured of transferring to a four-year institution with a reasonable expectation of completing their degree in an additional two years of academic course work.

As an example, the corresponding *Tennessee Engineering Pathways* for community college students intending to matriculate to a four-year institution and major in either Civil or Mechanical Engineering is listed in the table below (general education requirements are omitted in the interest of brevity).

One goal of **Enhancing Engineering Talent in Tennessee** S-STEM grant is to make it possible for *Transfer Pathways* students to graduate in two additional years of academic study. This goal has been complicated by a significant mismatch between the *Engineering Transfer Pathways* curricula and Lipscomb's engineering curricula. A student majoring in CE and ME at Lipscomb University (along with most engineering schools) are expected to have completed a first course in *Mechanics of Materials*, as well as a course introducing the student to appropriate CAD tools prior to starting her third year.

Lipscomb ME majors are also expected to have mastered basic programming skills prior to their third year, while CE majors are expected to have completed a basic surveying course.

Science	*Calculus Based Physics I & II*	8 credit hours
	General Chemistry I	4 credit hours
Mathematics	*Calculus I, II, & III*	12 credit hours
	Linear Algebra	3 credit hours
	Differential Equations	3 credit hours
Engineering Topics	*Statics*	3 credit hours
	Dynamics	3 credit hours

Table 1, *Tennessee Engineering Pathways* course framework

Experience has shown that early advising of community college students is essential to overcoming this academic mismatch. Lipscomb Engineering faculty interacts with community college students on their home campus through enrichment activities and academic guidance sessions, followed by an open invitation to visit Lipscomb's campus for more in-depth advising. Students expected to major in Mechanical Engineering are advised to take an introductory programming course and to complete a first course in *Mechanics of Materials* before starting the fall of their third year. Potential Civil Engineering majors are advised to take *General Chemistry II* along with a first course in *Mechanics of Materials*.

Preliminary Outcomes

To date, National Science Foundation funds have provided $114,000 of scholarship funding matched by $75,000 from Lipscomb University plus approximately $24,000 of Hope Scholarship funding from the State of Tennessee (figure 1).

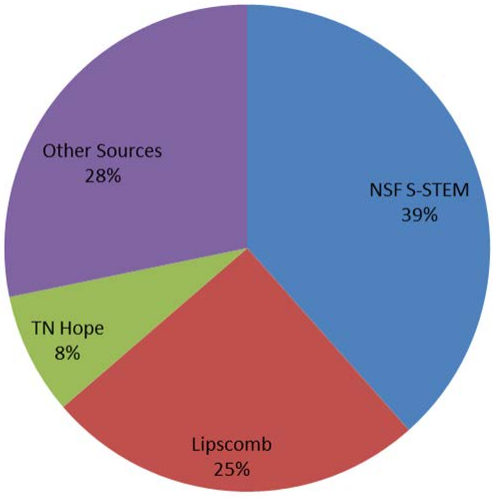

Figure 1, Cost Sharing Distribution
Note: Other sources include Federal Pell grants, as well as subsidized and unsubsidized assistance.

The first cohort of **Enhancing Engineering Talent in Tennessee** S-STEM students started summer 2016 and consisted of two ME students from Columbia State University and one CE from Nashville State. As of Spring 2018, there are a total of eight (8) **Enhancing Engineering Talent in Tennessee** S-STEM students in the program. All eight are making good progress towards graduation and consist of five Mechanical Engineers, two Civil Engineers, and one Electrical/Computer Engineer. The first member of the 2016 cohort will be graduating in May 2018.

.Conclusions

Prior to funding by NSF S-STEM, Lipscomb University's College of Engineering had limited experience with Tennessee community college transfers. NSF funding has resulted in very positive results with regard to the level of success for the recipients of S-STEM funding.

Enhancements to the program that are being implemented include:

- Expanded summer class offerings in basic engineering courses (Mechanics of Materials, Dynamics, etc).
- Opportunities to develop specific skills to bridge the gap between community college requirements and those needed to be successful at Lipscomb University via not-for-credit on-line courses in SolidWorks® and MATLAB® provided by a third party.
- Transfer student scholarship funding by Lipscomb University has increased significantly since the inception of the grant.

References

[1] Tn.gov. (2018), Tennessee Higher Education Commission. [online] Available at: https://www.tn.gov/content/dam/tn/thec/bureau/research/other-research/hope/Suppressed_2016_TELS_Fact_Book_Final.pdf

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[3] Tennessee Board of Regents. (2018). Governor's Drive to 55. [online] Available at: https://www.tbr.edu/initiatives/governors-drive-55.

[4] Tennessee Promise Annual Report 2017. (2017). Nashville, Tennessee: Tennessee Higher Education Commission, Tennessee Student Assistance Corp, p.4.