Scholarship Programs for Vertical Transfers in Engineering and Engineering Technology

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Abstract

This paper introduces two scholarship projects funded by the National Science Foundation that focus on students who transfer at the 3rd year level from 2-year schools to the engineering and engineering technology BS programs at our university. The objectives of both the projects are: (i) to expand and diversify the engineering/technology workforce of the future, (ii) to develop linkages and articulations with 2-year schools and their S-STEM programs, (iii) to provide increased career opportunities and job placement rates through mandatory paid co-op experiences, and (iv) to serve as a model for other universities to provide vertical transfer students access to the baccalaureate degree.

The Transfer Pipeline (TiPi) project awarded 25 new scholarships per year from 2012 to 2014 to a total of 75 engineering and engineering technology transfer students. By the end of Fall 2017, 66 (88%) scholars have graduated, 5 (7%) are in process of completing their degrees, and only 4 (5%) left our university, for a 95% retention rate. The paper describes our successes and challenges.

The Vertical Transfer Access to the Baccalaureate (VTAB) project recruited its first group of 25 students in Fall 2017 with the goal of recruiting a total of 78 vertical transfers over the next three years. An additional goal of the VTAB project is to conduct research and generate knowledge about the VTAB project elements that will be essential for the success of vertical transfer programs at other universities. The paper describes the research instruments, and the results from an online survey and a focus group interview of the first cohort of VTAB scholars.

Introduction

The shortage of STEM workers with advanced degrees in the U.S. is not new. In the 1990s, the rules for H-1B visas given to foreigners to work in the U.S. were liberalized to accommodate the needs of the U.S. industry. Then, in 2001, in response to concerns about the adverse impact of H-1B on the U.S. labor force [1], the U.S. Congress allocated additional funds to the Computer Science, Engineering, and Mathematics Scholarship (CSEMS) program at the National Science Foundation (NSF) by making significant changes to the H1-B Visa allocations and fees [2]. Since then, CSEMS [3] and its replacement program - Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) [4] have been funded from H-1B Visa revenues collected from U.S. employers of foreign workers. The main goal of these programs is to set up a self-sustaining infrastructure to produce highly skilled STEM graduates. The programs require that scholarship recipients be low-income students with demonstrated financial need. S-STEM projects are encouraged but not required to seek applications from members of underrepresented groups in STEM [5].

This paper introduces two S-STEM projects that focus on students who transfer at the 3rd year level from 2-year schools to the engineering and engineering technology BS programs at our

university. The objectives of both the projects are: (i) to expand and diversify the engineering/technology workforce of the future, (ii) to develop linkages and articulations with 2-year schools and their S-STEM programs, (iii) to provide increased career opportunities and job placement rates through mandatory paid co-op experiences, and (iv) to serve as a model for other universities to provide vertical transfer students access to the baccalaureate degree.

TiPi project began in June 2012 funded by a four-year grant of $599,984 from NSF. In its program solicitation [6], NSF stated the goals to be (i) "Improved educational opportunities for students, (ii) Increased retention of students to degree achievement, (iii) Improved student support programs at institutions of higher education, and (iv) Increased numbers of well-educated and skilled employees in technical areas of national need". TiPi project provided scholarship support of $8,000 to 75 students ($8,000 × 75 = $600,000). In support of this grant, our university contributed $50,000 after the grant period to ensure that continuing TiPi scholars had adequate financial support to help them graduate on time. 95% (71 out of 75) of the TiPi scholars have been retained, and have either graduated or will soon graduate as per their individualized academic plan (IAP). The outcomes from the TiPi project are described in the next section.

VTAB project is funded by a five-year grant from NSF that began in September 2017. In its program solicitation [7], the new goals stated are: (i) to increase the number of low-income academically talented students in STEM, (ii) to improve the education of these STEM students, and (iii) to generate knowledge to advance understanding of factors that lead to the success of these students. VTAB is leveraging the lessons learned from the TiPi project to achieve the first two goals. Twenty six scholars were recruited from 2-year schools in Fall 2017 meeting one of the project's five objectives. However, one student deferred admission to the university due to personal circumstances. A later section describes the instruments designed and implemented to conduct research, and generate knowledge to achieve the third goal.

TiPi – Engineering and Engineering Technology Transfer Pipeline

A previous paper [8] compared the cumulative grade point average (CGPA) at the end of 2015 of the TiPi scholars relative to their peers for each of the five participating academic departments as well as their placements in paid cooperative employment. Tables 1 and 2 from this paper are adapted here to provide the context. The TiPi project is a collaborative effort of six academic departments from two colleges, the Enrollment Management and Career Services Division, and the Office of Financial Aid and Scholarships. Table 1 lists the participating departments in column 2, and their BS degree programs in column 3.

Table 1: Participating Colleges, Academic Departments, and Programs

College*	Academic Department	BS Program in
CAST	Civil Engineering Technology and Environmental Management and Safety (CET-EMS)	Civil Engineering Technology
		Environmental Management and Safety
CAST	Electrical, Computer, and Telecommunication	Electrical Engineering Technology
		Computer Engineering Technology

	Engineering Technology (ECTET)	Telecommunication Engineering Technology
CAST	Manufacturing/Mechanical Engineering Technology (MMET)	Manufacturing Engineering Technology
		Mechanical Engineering Technology
CAST	Packaging Science (PS)	Packaging Science
COE	Electrical and Microelectronic Engineering (EME)	Electrical Engineering
		Microelectronic Engineering
COE	Mechanical Engineering (ME)	Mechanical Engineering

*CAST ≡ College of Applied Science and Technology; *COE ≡ College of Engineering

Collectively, the six departments listed in Table 1 offer eleven BS degree programs that are five-year programs with a mandatory cooperative education component wherein students attend classes in Fall and Spring semesters in their first two years. During the third and fourth years, students alternate between on-campus study and off-campus co-op employment in industry. All students must complete ≥ 48 weeks of paid co-op employment. Each student finds co-op employment with help from an assigned co-op coordinator in the Office of Cooperative Education and Career Services.

The goal of the project was to recruit five transfer students in each of the five (now six) departments for a total of 25 scholars per year in each of the first three years of the project. We did recruit 25 scholars each year but the distribution across the departments was not uniform as shown in Table 2.

Table 2: Distribution of AY 2012-15 TiPi Scholars

Academic Department and Code	**AY 12-13**	**AY 13-14**	**AY 14-15**
Civil Engineering Technology, Environmental Management and Safety (CET-EMS)	7	7	3
Electrical, Computer and Telecommunications Engineering Technology (ECTET)	2	1	1
Manufacturing and Mechanical Engineering Technology, and Packaging Science (MMET-PS)	3	7	7
Mechanical Engineering (ME)	7	6	6
Electrical and Microelectronic Engineering (EME)	6	4	8
Total Number of TiPi Scholars	**25**	**25**	**25**

The paper [8] presented data that showed that the academic performance of all cohorts of TiPi scholars was comparable or better than their peers in each of the five academic departments. All cohorts of TiPi scholars were able to obtain paid cooperative employment for one or more academic terms as per degree requirements. Student reports and employer evaluations of co-ops indicated that TiPi scholars had meaningful and relevant technical assignments, and were performing well in these assignments.

The current academic status of the TiPi scholars in each of the three cohorts is shown in Table 3.

Table 3: Academic Status of TiPi Scholars at the end of Fall 2017					
Academic Year of Entry	**Number of TiPi Scholars**				
	Recruited	**Continuing**	**Graduated**	**Suspension**	**Left University**
AY 2012-13	25	0	23	0	2
AY 2013-14	25	0	24	0	1
AY 2014-15	25	5	19	0	1
Totals	**75**	**5** (7%)	**66** (88%)	**0** (0%)	**4** (5%)

Of the 75 TiPi scholars recruited, only four (5%) left the university resulting in a 95% retention, and meeting two of the project's five objectives. Sixty six (88%) scholars have graduated, and are either employed in industry or pursuing graduate education. The continuing five (7%) scholars will graduate as per their individualized academic plan. Two of these five scholars are in the combined BS+MS degree plans, and will therefore take an extra year to graduate.

The lessons learned from the TiPi project were that (i) recruiting 25 low-income students per year is challenging, (ii) the transfer orientation program can be improved further, (iii) individualized advising and academic monitoring is very effective in retaining scholars, (iv) academic performance of the scholars is similar or better than their peers, (v) scholars had no difficulty in obtaining meaningful paid coop employment, and employers reported their performance to be satisfactory, (vi) all graduated scholars have placements in industry or graduate schools, and (vii) encouraged by this project's success, two more engineering departments have begun accepting vertical transfers from 2-year colleges.

VTAB – Vertical Transfers' Access to the Baccalaureate in Engineering and Engineering Technology

With similar goals as those of the TiPi project, the VTAB project will build on the success of the TiPi project, and will also conduct research, and generate knowledge about each program element that will be essential to the success of a vertical transfer program at any private 4-year institution. Two engineering departments, Computer Engineering and Industrial Engineering, have begun to accept vertical transfers, and are now participating in the VTAB project in addition to those listed in Table 1.

In Fall 2017, we recruited 26 VTAB scholars meeting one of the project's five objectives. However, one student deferred admission to the university due to personal circumstances. Instead of modifying the transfer orientation program offered to new students when the Fall semester begins, the project administrator created and taught a zero-credit VTAB Orientation course that met for 50 minutes each week for the first six weeks of the Fall semester. In the first four weeks, the course instructor arranged to have local experts conduct workshops focusing on academic integration, social integration, financial discipline, and personal well-being. At the beginning of the semester, the external evaluator of the project did an online survey of the 25 scholars. At the end of the course, we had a Friday social with pizza and cookies, and the external evaluator invited a group of scholars for a focus group interview.

Twenty of the 25 scholars responded to the semester-end course evaluation survey. 90% or more respondents found the course to be well organized, and advanced student understanding. The following text statement summarizes the positive comments: "The course is seminar style class for transfer students who won a scholarship. The information I learned during the class was way more than any open house information provided to me. A lot of things I wanted to know and didn't know about (university) was obtained by professor (name)". Some suggestions for improving the course included: "Material more targeted to relevant majors", and "Possible find a more efficient class time".

A 28 question online survey with free comment space was designed with a few questions adapted from past surveys [9] – [12]. The survey was organized to examine the participants' experiences at their 2-year institutions, their experiences during the transfer process, as well as their experiences while enrolling at our university. Additional surveys will be administered throughout the scholars' experience that will build on this first survey, and provide a complete picture of their experience in the VTAB project. 100% of the VTAB scholars responded to most or all of the questions on the survey.

The most interesting results from this survey came in the section concerning their 2-year program as they support the need of the VTAB grant. Most of the students always planned to go to a 4-year school after completing their 2-year program (22 out of 24 respondents or 92%). However, as one would expect, the biggest issue for their going to a 2-year institution initially was financial concerns. Question #5 of the online survey asked "What were your main reasons for enrolling in the 2-Year college instead of a 4-Year college or university? (*Check all that apply*): (a) Academic, (b) Financial, (c) Personal, and (d) Other", 20 out of 25 respondents (80%) listed financial concerns as one of their main reasons for enrolling initially in the 2-year college. In addition, half of those responding said that their biggest challenge while at the 2-year institution came from family issues.

Overall, there were very few concerns raised about the transfer process. Since our university has a long history with transfer students and most 2-year institutions routinely transfer students to 4-year ones, these findings would be expected. Findings on students' perceptions of the admission and financial aid application processes are presented in Figures 1 and 2.

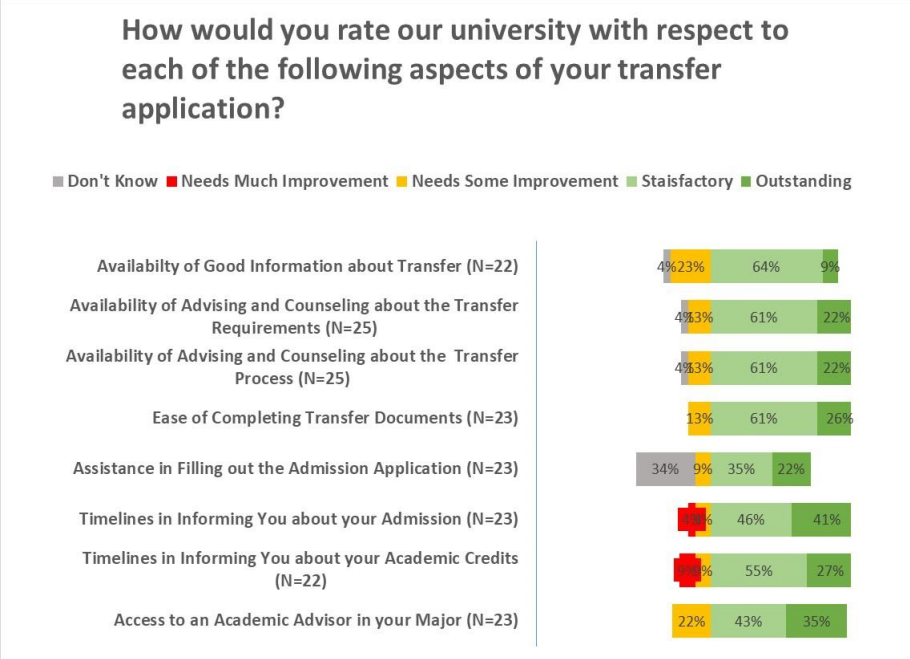

Figure 1: Responses to survey question about the transfer application process

Figure 1 shows that overall students were satisfied with the application process, although there is definitely some room for improvement. A couple of students thought that the timeliness of the information needed much improvement. While a few students thought that some improvement was needed in every category In addition, a number of students (35%) were uncertain about assistance with filling out the university admission application. This probably meant that they had no help with the application.

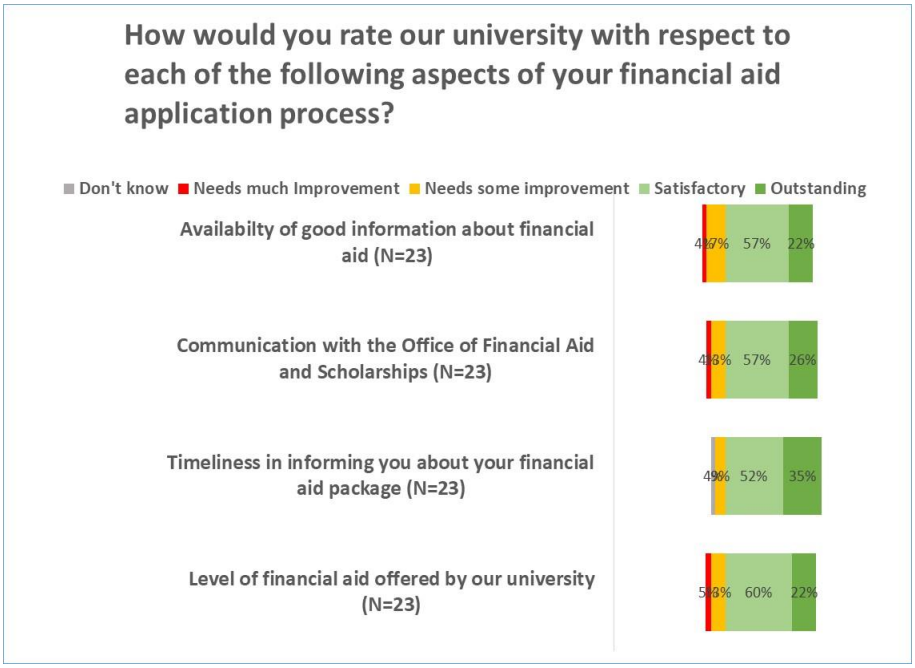

Figure 2: Responses to survey question about the financial aid application process

Figure 2 shows that students were overall satisfied with the financial aid application process. Again there were some minor issues with some of the scholars concerning the financial aid process. It appears that a single student had some major issues across the board and few thought it needed some improvement. Unfortunately, the process is outside of our control to change. However, overall it seems to be working fairly well.

The final section on their early experiences at our university were generally positive with very little issues raised at this point. The main reason was that (our university) was very new to them at that point, and the additional surveys will hopefully illuminate their experiences more. For our purposes the most useful finding was that only a little over half (57%) attended the Institute orientation program, and 69% of those found it useful. This was the generic university program, and not an orientation program specifically designed for VTAB scholars, though the focus group provided more useful information.

A focus group protocol was developed based on the results of the survey, and a group of scholars were interviewed at the conclusion of the orientation course. The focus group findings corroborate the survey findings. For example, when asked "What was your feeling when you were informed of receiving VTAB scholarship?", a few students said *Surprised* or *Confused*, because they didn't apply for this scholarship." When asked about their experiences at our university so far, many responded positively. Some responses were: "Relatively positive; great experience; fine;", "Professors are always willing to help whatever they are doing; professors are very helpful; enjoying talking with the professor."

During the focus group, students also made some suggestions for future improvement. Suggestions include:

1. Weekly course meetings should not be held on Friday night.
2. Split students to half and half instead of trying to get all in one class and gather at two times, maybe morning and afternoon.
3. Make a checklist of the people that we will need to talk to, department services, your advisor, faculty advisor for each department and where those locations are.
4. Add another engineering club for the transfer student group.
5. Too many emails from the university before it started. Students felt overwhelmed and would care about only a few of those emails. The university should improve to send some pointed email which included all the information needed there rather than sending hundreds of emails.
6. Prefer to listen to students who just graduated from the transfer program about their experiences;
7. Have a focus group and ask junior students to share their experiences with the new students.

Future Plans

We hope to recruit 27 new VTAB scholars from 2-year schools in Fall 2018. Based on the feedback from the past semester, we will improve the VTAB Orientation course for the new cohort. The new cohort will be administered the online survey, and will be asked to participate in

the focus group interview. An online survey will again be administered to the current VTAB scholars.

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