

## **Performance of Engineering and Engineering Technology Scholars in the Transfer Pipeline Program**

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# Performance of Engineering and Engineering Technology Scholars in the Transfer Pipeline (TiPi) Program

## Abstract

This paper introduces the Transfer Pipeline (TiPi) Scholars' program funded by the National Science Foundation (NSF) that focuses on students who transfer at the 3<sup>rd</sup> year level from 2-year schools to our university. The objectives of the TiPi program are: (i) to address a national concern by helping to expand the engineering/technology workforce of the future, (ii) to develop linkages and articulations with 2-year schools and their S-STEM programs, (iii) to serve as a model for other selective universities to provide transfer students the access to the baccalaureate, (iv) to give scholars hands-on experience in the latest tools and technologies, and (v) to provide increased career opportunities and job placement rates through mandatory co-op experiences.

The TiPi program awarded 25 scholarships in each of the last three academic years for a total of 75 new transfer students in our engineering and engineering technology programs.

At the beginning of the Fall semester of 2015, the status of these 75 scholars was as follows: 19 had graduated, 33 were carrying full-time academic load, 19 were in paid co-op positions, and 4 had left the program. So, our retention rate has been approximately 95%.

This paper describes the characteristics of the 75 scholars, compares their academic performance relative to their peers, and their placement in paid cooperative employment positions.

## Introduction

Four years ago, the National Science Foundation<sup>1</sup> (NSF) awarded our university a four-year grant of \$599,984 with the grant period beginning in June 2012 for a project titled **TiPi: Engineering and Engineering Technology Pipeline**. The TiPi project focuses on students who wish to transfer at the 3<sup>rd</sup> year level from 2-year schools to a sub-set of the five-year engineering and engineering technology programs at our university, and provides scholarship support of \$8,000 per student for a total of 75 students. In support of this grant, our university is contributing \$50,000 to ensure that the TiPi transfer students have continuing financial support after the grant expires and help them graduate on time. In recent years, a number of both public and private institutions have focused on transfer students to expand and diversify their student populations in engineering and engineering technology programs<sup>2-8</sup>.

The TiPi project is a collaborative effort of five academic departments from two colleges, the Enrollment Management and Career Services Division, and the Office of Financial Aid and Scholarships. Table 1 lists the departments and their offerings.

<b>College*</b>	<b>Academic Department</b>	<b>BS Program in</b>
CAST	Civil Engineering Technology and Environmental Management and Safety (CET-EMS)	Civil Engineering Technology
		Environmental Management and Safety
CAST	Electrical, Computer, and Telecommunication Engineering Technology (ECTET)	Electrical Engineering Technology
		Computer Engineering Technology
		Telecommunication Eng. Technology
CAST	Manufacturing/Mechanical Engineering Technology, and Packaging Science (MMET-PS)	Manufacturing Eng. Technology
		Mechanical Engineering Technology
		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

The goals of the TiPi project are to: (i) recruit and graduate a total of 75 transfer students from our engineering/technology BS programs, (ii) identify scholars in academic trouble and help them through proactive intervention, (iii) prepare students with the skills, education and work experience to enter the high technology workforce, and (iv) perform regular and thorough assessment of the program. More details about the TiPi project can be found in a recent paper<sup>9</sup>.

Every transfer student who is offered admission to a program listed in Table 1, and has submitted FAFSA (Free Application for Federal Student Aid) is considered for a TiPi scholarship. The Office of Financial Aid and Scholarships calculates student's financial need and determines the eligibility for TiPi scholarship. Each eligible student is ranked on the basis of financial need first followed by academic achievement. The TiPi scholarship is in addition to the grants and aid awarded by the university.

In each of the first three years of the project, we wanted to recruit five transfer students in *each* of the five participating academic departments for a total of 25 scholars. We did recruit 25 transfer scholars in each of the first three years but were unable to achieve uniform distribution across the five departments. Table 2 lists the distribution of TiPi scholars among the five participating academic departments.

<b>Academic Department and Code</b>	<b>AY 12-13</b>	<b>AY 13-14</b>	<b>AY 14-15</b>
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
<b>Total Number of TiPi Scholars</b>	<b>25</b>	<b>25</b>	<b>25</b>

All five departments listed above require students to complete  $\geq 48$  weeks (typically two semesters and two summers) of paid co-op employment before graduation. The Office of Cooperative Employment and Career Services (OCE) in the Enrollment Management and Career Services Division supports the university's special emphasis on learning through experience. OCE assigns each student a program coordinator who provides assistance with career counseling and the job search process from the beginning of the co-op process right through career entry upon graduation. OCE services remain available to alumni for a lifetime. OCE staff spends considerable time developing opportunities with employers nationwide, as well as monitoring and fostering current relationships. These linkages with business and industry enhance our university's ability to provide an education that meets the needs of the job market, and aids students in their pursuit of successful careers. During their first academic term, all TiPi scholars are required to take an existing non-credit course in which they learn to prepare resumes and cover letters, practice interviewing, and become familiar with the services of OCE to conduct the job search for their first co-operative employment experience.

This paper compares the cumulative grade point average (CGPA) at the end of Summer 2015 of the TiPi scholars listed in Table 2 relative to their peers, and their placement in cooperative employment. AY 2012-13 scholars have completed 3 years at the university including co-op experience, and many graduated in August 2015. AY 2013-14 scholars have completed only 2.5 years at the university including co-op experience, and are expected to graduate by August 2016. AY 2014-15 scholars have completed only 1.5 years including co-op experience, and are expected to graduate by August 2017. The CGPA is based solely on their academic work at RIT.

### **Department of Civil Engineering Technology and Environmental Management and Safety**

Table 3 compares the CGPA statistics of TiPi scholars in each of the three cohorts to their peers in the Department of Civil Engineering Technology and Environmental Management & Safety at the end of Summer 2015.

<b>Cohort →</b>	<b>AY 2012-13</b>		<b>AY 2013-14</b>		<b>AY 2014-15</b>	
<b>Item ↓</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>
<b># of students</b>	6	105	6	68	3	51
<b>Mean CGPA</b>	3.47	3.13	3.63	3.12	2.80	3.04
<b>Median CGPA</b>	3.61	3.14	3.70	3.19	2.92	3.02
<b>Std. Deviation</b>	0.44	0.53	0.34	0.45	0.78	0.49

One TiPi scholar of the seven in the AY 2012-13 cohort left our university after his first co-op experience when offered a full-time job by his co-op employer. The remaining six scholars have graduated already from our university. Five graduates are employed in full-time positions, and one is pursuing an MBA degree.

One TiPi scholar of the seven in the AY 2013-14 was on academic suspension, and has left our university. One has graduated, and is employed in a full-time position. The remaining five scholars have completed one or more semesters of paid co-op employment as required by the

university. The academic performance of the six scholars in this cohort is better than their peers who started at our university as first-year students.

One of the three scholars in the AY 2014-15 cohort was on academic probation and lowered significantly the mean CGPA of the cohort. Otherwise, the performance of the remaining two TiPi scholars in this cohort is comparable or better than their peers who started at our university as first-year students. All three scholars have completed one or more semesters of paid co-op employment as required by the university.

### **Department of Electrical, Computer, and Telecommunications Engineering Technology**

Table 4 compares the CGPA statistics of TiPi scholars in each of the three cohorts to their peers in the Department of Electrical, Computer and Telecommunications Engineering Technology at the end of Summer 2015.

<b>Cohort →</b>	<b>AY 2012-13</b>		<b>AY 2013-14</b>		<b>AY 2014-15</b>	
<b>Item ↓</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>
<b># of students</b>	2	43	1	25	1	11
<b>Mean CGPA</b>	3.84	3.11	3.42	3.01	3.78	2.71
<b>Median CGPA</b>	3.84	3.13	3.42	2.83	3.78	2.73
<b>Std. Deviation</b>	0.18	0.42	NA	0.53	NA	0.29

Both scholars in the AY 2012-13 cohort have graduated from our university, and are employed in full-time positions.

AY 2013-14 scholar's academic performance is better than his peers who started at our university as first-year students. The scholar has completed three blocks of paid co-op employment as required by the university.

AY 2014-15 scholar's academic performance is better than his peers who started at our university as first-year students. The scholar is now completing a semester of paid co-op employment as required by the university.

### **Department of Manufacturing and Mechanical Engineering Technology, and Packaging Science**

Table 5 compares the CGPA statistics of TiPi scholars in each of the three cohorts to their peers in the Department of Manufacturing and Mechanical Engineering Technology at the end of Summer 2015.

<b>Cohort →</b>	<b>AY 2012-13</b>		<b>AY 2013-14</b>		<b>AY 2014-15</b>	
<b>Item ↓</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>
<b># of students</b>	2	123	6	127	7	85
<b>Mean CGPA</b>	3.30	3.09	3.04	3.11	3.30	2.87
<b>Median CGPA</b>	3.30	3.05	3.00	3.11	3.24	2.80
<b>Std. Deviation</b>	0.33	0.44	0.40	0.46	0.32	0.43

One of the three scholars in the AY2012-13 cohort has graduated from our university, and is employed in a full-time position. Academic performance of the remaining two scholars is better than their peers who started at our university as first year students. Both have completed one or more semesters of paid co-op employment as required by the university.

One of the seven scholars in the AY2013-14 cohort has graduated from our university, and is employed in a full-time position. Academic performance of the remaining six scholars is comparable to their peers who started at our university as first year students. All have completed one or more semesters of paid co-op employment as required by the university.

Academic performance of the seven scholars in the AY 2014-15 cohort is better than their peers who started at our university as first year students. All have completed one or more semesters of paid co-op employment as required by the university.

## **Department of Mechanical Engineering**

Table 6 compares the CGPA statistics of TiPi scholars in each of the three cohorts to their peers in the Department of Mechanical Engineering at the end of Summer 2015.

<b>Cohort →</b>	<b>AY 2012-13</b>		<b>AY 2013-14</b>		<b>AY 2014-15</b>	
<b>Item ↓</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>
<b># of students</b>	1	223	6	170	6	148
<b>Mean CGPA</b>	3.55	3.29	3.27	3.21	3.25	3.22
<b>Median CGPA</b>	3.55	3.31	3.17	3.21	3.39	3.22
<b>Std. Deviation</b>	NA	0.40	0.39	0.43	0.51	0.44

Six of the seven scholars in the AY2012-13 cohort have graduated from our university, and are either in graduate school or employed in full-time positions. Academic performance of the remaining scholar is better than his peers who started at our university as first year students. The scholar has completed one or more semesters of paid co-op employment as required by the university.

Academic performance of the six scholars in the AY 2013-14 cohort is comparable to their peers who started at our university as first year students. All have completed one or more semesters of paid co-op employment as required by the university.

Academic performance of the six scholars in the AY 2014-15 cohort is better than their peers who started at our university as first year students. All have completed one or more semesters of paid co-op employment as required by the university.

## Department of Electrical and Microelectronic Engineering

Table 7 compares the CGPA statistics of TiPi scholars in each of the three cohorts to their peers in the Department of Electrical and Microelectronic Engineering at the end of Summer 2015.

<b>Cohort →</b>	<b>AY 2012-13</b>		<b>AY 2013-14</b>		<b>AY 2014-15</b>	
<b>Item ↓</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>	<b>TiPi</b>	<b>Peers</b>
<b># of students</b>	3	193	4	114	8	92
<b>Mean CGPA</b>	3.35	3.23	2.97	3.11	3.47	3.08
<b>Median CGPA</b>	3.11	3.16	2.93	3.10	3.54	3.01
<b>Std. Deviation</b>	0.53	0.44	0.16	0.48	0.44	0.46

Two of the six scholars in the AY2012-13 cohort have graduated from our university, and are either in graduate school or employed in full-time positions. One scholar left our university for unspecified reasons. Academic performance of the remaining three scholars is comparable to their peers who started at our university as first year students. The three scholars have completed one or more semesters of paid co-op employment as required by the university.

Academic performance of the four scholars in the AY 2013-14 cohort is somewhat lower but comparable to their peers who started at our university as first year students. All have completed one or more semesters of paid co-op employment as required by the university.

Academic performance of the eight scholars in the AY 2014-15 cohort is better than their peers who started at our university as first year students. All have completed one or more semesters of paid co-op employment as required by the university. After summer, one scholar out of the eight left our university for unspecified reasons.

## Student Intervention and Support Programs

Our university has a well-established infrastructure of student intervention and support programs. Each of the five participating academic departments has one or more designated faculty members involved in the transfer application evaluation process. The designated faculty member reviews transcripts of all students who apply for transfer from a 2-year school, evaluates program-specific transfer credits and sends his/her recommendation to the Office of Undergraduate Admissions. Upon admission to our university, each transfer student is assigned a specific faculty advisor.

Our university has an Early Alert System (EAS). EAS identifies students who may be struggling with a particular class or area of study. It ensures that struggling students receive timely

intervention, direction and additional tutoring needed to get them back on track. All instructors are asked to notify each student online as to how he or she is performing in a class by the 5<sup>th</sup> and 10<sup>th</sup> week of each semester. The evaluation and “alert” notice is automatically copied to the student’s academic advisor and department head. If appropriate, the academic advisor puts the student in contact with the Academic Support Center (ASC). In ASC, the student receives training in study skills and time management, and is tutored to strengthen weak academic foundations. In a few cases, students have been accurately diagnosed with learning disabilities for the first time as a direct result of EAS and intervention by ASC. These students are then able to receive appropriate help and support such as in-class note-takers and extended time for quizzes and exams.

ASC offers courses in reading, writing, math and study skills as well as a math and writing lab that are open on a drop-in basis including evening hours. It has an array of programs and services that teach students how to improve their study techniques and how to assess and make the most of their individual learning abilities. Faculty and staff of ASC work closely with university faculty members to determine how they can best provide support for academic courses. This collaboration has led to team-teaching, specialized labs, and effective referral systems. ASC also maintains liaisons with other support programs on campus such as Women in Engineering (WE) / Technology (WIT), Multicultural Center for Academic Success (MCAS) to provide a comprehensive network of services.

A brochure on the TiPi Scholarship Program was designed and produced in-house describing the program, scholar selection process and criteria, S-STEM articulation with regional two-year schools, and a brief frequently-asked-questions (FAQ) section. The brochure is mailed to all constituents in the regional two-year schools as well as distributed during recruiting visits and at regional conferences to publicize the program. The Office of Financial Aid and Scholarships also sends the brochure along with the letter of scholarship award to each TiPi Scholar.

Each academic term except summers, we hold a social event such as a pizza party to help build a sense of community among the TiPi scholars and their faculty advisors. The five departments take turns in hosting this event. It is an opportunity for informal conversations in a small group setting. During this event, we can determine how the new scholars are acclimatizing to our university, and ask continuing scholars to provide guidance in resolving any problems or concerns. It is also a good opportunity to have a recent co-op returnee or graduate share his/her experiences.

## **Conclusions**

1. The data in Table 2 shows that we have met the goal of recruiting 25 transfer scholars per year in the first three years of the TiPi project for a total of 75 scholars.
2. The data in Tables 3 through 7 shows that we have been able to retain 71 of the 75 TiPi scholars (95% retention) thus far in our engineering and engineering technology programs.
3. 19 of the 71 scholars have already graduated from their respective programs. All are either employed in full-time positions or pursuing graduate studies.

4. The data in Tables 3 through 7 shows that the academic performance of all cohorts of TiPi scholars is comparable or better than their peers in each of the five participating academic departments.
5. All cohorts of TiPi scholars were able to obtain paid cooperative employment for one or more academic terms as required.
6. Review of student reports and employer evaluations of co-ops indicates that the TiPi scholars had meaningful and relevant technical assignments, and performed well in these assignments.
7. The university has a number of student intervention and support programs that helped us in retaining and graduating students.
8. Informal conversations with the TiPi scholars during the social get-togethers indicate that they have acclimatized well to our academic and living environments.

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