

An Engineering Academic Success and Professional Development Class: The Influence of a Scholarship

Abstract

Recruitment and retention of engineering and computer science students is a well-known challenge. In spite of the increasing demand for students with these majors, the numbers in the United States remain low. President Obama has called for an increase in the number of engineers produced in the nation each year. The numbers of females and underrepresented minority students in engineering and computer science remain very low, less than 20% for females. Even when students choose these majors, around half of them will change their major out of engineering and computer science. A largely untapped source for additional engineers and computer scientists are the community colleges.

A two-credit semester Academic Success and Professional Development course has been developed at Arizona State University for native and transfer students to ensure that students thrive, not just survive, in engineering and computer science. Some of the students in the upper division class have scholarships which require their attendance in the class and other students do not. This paper examines a partial solution to the challenges posed above and further examines the role of a scholarship held by some of the students in the class, which requires their attendance in this class.

This paper will compare the various groups of students by their overall GPA, grade in the Academic Success Class, and their evaluation of the course done at the end of the course. Sixty-four of the 66 students in the class completed the evaluation. Of particular interest will be if the having a scholarship has influenced their decisions to consider and to attend graduate school, helped with study skills, and helped them learn about research. The students were also asked if learning about the “imposter syndrome,” “transfer shock,” and networking have benefited them as students. We also compare the percentage of students in each group who have had internships and done research, and note comments by the students on how the course influenced them.

I. Introduction

Since 2002, workshops on academic success and professional development have been offered to engineering and computer science students who received S-STEM or STEP scholarships from the National Science Foundation through grants to the Ira A. Fulton Schools of Engineering at Arizona State University. The most recent grants were an S-STEM grant (#1060226) for upper division native students and graduate students and a STEP grant (# 0856834) for upper division transfer students from five non-metropolitan community colleges. For the last several years, a two-credit Academic Success and Professional Development class has been required of the scholarship awardees. All of the class assignments have been designed to help the student do well academically, socially, and professionally. An academic guide on how to learn is provided with the use of the “Guaranteed 4.0 Plan” by Donna O. Johnson.¹ In Fall 2014, there were 32

scholarship students enrolled in this class (7 in graduate school); however, the class was also attended by 32 students who did not hold scholarships. Some of these students had held the \$4,000 scholarship, however the scholarship funding had ended in the spring 2014 semester. The same assignments were required of all students.

A question which is often asked in the review of such a program is, “How important is the scholarship?” in this case a \$4,000 scholarship for the academic year. The upper division students selected for the undergraduate scholarships had a minimum 3.0 GPA, were enrolled full-time in engineering or computer science, were U.S. citizens, permanent residents, or refugees, and had unmet financial need as determined by FAFSA. The graduate students satisfied the same requirements and all of them had graduated through either an S-STEM or a STEP program. The programs have an emphasis on females and underrepresented minority students: 60% of the scholarships went to females and underrepresented minority students, mostly Hispanic/Latino students, which reflects the Arizona population of 30% Hispanic.²

A general argument for the value of the scholarships is that student taking the course will do well on the assignments (will do the things they need to do to be successful) because they want to have their scholarship renewed at the end of the semester. The scholarship draws students to apply and then with the success class, the student learns how to better navigate engineering. The paper will attempt to evaluate the value of the scholarship, at least for this course and this group of students.

In this paper, the term “engineering” will also include computer science.

II. Background

The “Academic Success and Professional Development Program” is built on research and experience of over 15 years of working with engineering and computer science students. The primary foundation of the program includes a two-semester credit class, “Academic Success and Professional Development,” a Motivated Engineering Transfer Student (METS) Center including staff support, computers, and study and social space, and \$2,000/semester scholarships, which require the students to attend the Academic Success Class each semester they hold the scholarship. We believe that just giving money in the form of a scholarship does not guarantee success. The Academic Success class gives academic support, primarily through the “Guaranteed 4.0 Plan” and encouragement and sets high goals (graduate school expected). The course includes the following topics: resumes, interviewing, elevator speeches, how to work a career fair, research, detailed time management, how to learn, internships, portfolios, career planning, graduate school, what the engineering industry expects when hiring students, and how to negotiate a salary. The engineering Career Services assists in the presentation of some of these topics. Additional emotional and social support is given through the METS Center where transfer students can find other students like themselves and have experienced transfer students available to assist them in locating resources. The primary mission of the program is: to enrich the engineering student experience: to recruit, graduate, and send to graduate school students in engineering and computer science with unmet financial need, especially rural, women, and underrepresented minority students from community colleges (CCs). In addition to the main

thrust of working with upper division transfer students CCs, we also have a branch of the program working with native upper division engineering students and graduate students, either natives or transfers, who have graduated through the program. In the past, we also had a lower division program for ten years for native students which fed into the upper division program, but the funding for the lower division program has now concluded. Many papers have been published describing various aspects of the program. The following recent references give more details on the program.³⁻⁷

The program is based on research which has shown that the major tenants of the program are essential for success. Townsend and Wilson's research on community college transfers to a large research university confirm that most transfer students just need a little hand holding to get started and then can progress very well in spite of the major transfer shocks that occur.⁸ The ASU Academic Success Program does do a little hand holding to get transfer students started, but it is mixed with "tough love" and telling students what they need to do to survive well.⁹ As speakers at the NISTS conference reiterated, transfer students do not need to be given choices: the transfer is severe and the students need to be told what to do.⁹

More recently, Tinto has argued that the primary supports that are important for any student to complete college are: high expectations; academic, social, and financial support; frequent assessment and feedback; and involvement/engagement with faculty, staff, and peers.¹⁰ The Academic Success program includes most of these supports. The students are continually encouraged to go to graduate school to enhance their chances of having an interesting, challenging, and worthwhile career. The students are encouraged to do well in their classes so they can qualify for a "4+1" program, which due to the possibility of having two or three classes double count for a Bachelor's degree and a Master's degree, allows a student to complete a Master's degree in engineering or computer science in just one year. In this way, students without other financial support, need only take out a loan for about \$10,000 tuition to complete a Master's degree, an excellent investment given that typically students with a Master's degree command an increase of salary of \$10-15K over a student with the Baccalaureate degree. Master's degree students are also often given credit for two year's work experience.

We know from the students and tracking their GPAs that the Guaranteed 4.0 Plan (or similar plan) is an essential part of the students' academic success in the program. We also "know" that the program scholarships are very important, but this is harder to prove. The scholarships ostensibly help the students in several ways: having about 40% of the tuition covered by a scholarship allows some students to not have to work during the academic year or be able to reduce the number of hours they have to work. This in itself helps reduce stress and allows the student to spend more time on their academic course work. Many students would not take an Academic Success course unless they had to, as they do with the scholarship. Most students will report, in hind sight, that if they had known how much the course would help them, they would have taken the course without the scholarship incentive. Some students are convinced to take the course just based on word-of-mouth from friends and peers. In addition, since the scholarship can be renewed if the GPA stays above a 3.0 and the student earns an A in the course, the

scholarship students are more attentive to doing well academically in their classes and the Academic Success class so they can retain the scholarship.

The major proof that the Academic Success Program works are seen in the results. According to ASU records, on average, 70% of upper division transfer students in engineering and computer science graduate. This percentage is only about 64% for females. The 70% rate is also the national rate of graduation for all transfer students. The graduation rate for scholarship students in the Academic Success Program is 95%. In addition, about 11% of upper division transfer students into engineering and computer science at ASU go right on to graduate school. It is estimated that less than 20% of all engineering students who graduate go right on to graduate school full-time. For the Academic Success program, this rate is 50%.

We need to further qualify that the students who have been awarded scholarships in the past were 60% either female or underrepresented minority or both and all had unmet financial need. These students, in general, are not Honors College students, but a mix of students with a minimum 3.0 GPA when transferring in, usually from a CC. We believe that the mix of academic, social, and financial support makes it possible for many students, who might otherwise struggle, to be retained in good stead and to have the confidence to continue on to a graduate degree.

III. Survey and Demographics

The data in this paper were obtained from an end of semester survey completed by 64 of 66 students enrolled in the two-credit Academic Success and Professional Development class held in Fall 2014. The survey is similar to past semester class surveys.

The students in this class fall into four distinct groups:

1. Graduate students on scholarship
2. Undergraduate native students on scholarship
3. Undergraduate transfer students on scholarship
4. Undergraduate native and transfer students not on scholarship

Seven of the eight graduate students were on the program scholarship. The eighth graduate student had already held the scholarship as a graduate student for four semesters (maximum length of time) and was on other support, but attended the class. Most of the undergraduate native students had come into the upper division Academic Success program through the lower division program which also offered an Academic Success class and a scholarship. For Fall 2015, the undergraduate transfer students on a METSTEP scholarship were from five targeted CCs: Arizona Western, Central Arizona, Eastern Arizona, Cochise, and Mohave.

The undergraduate native and transfer students not on scholarship were made up of two types of students: transfer students who had held an NSF S-STEM scholarship the year before and students who had never held a scholarship from the program. The funding in the NSF S-STEM program for transfer students had concluded in Spring 2014. Among the non-scholarship students were those who had been advised to take the class due to low academic achievement (not a targeted group for this program) and students who had heard good things about the class by word-of-mouth from friends and peers.

IV. Survey Results

Tables 1, 2, 3, and 4 show results from the survey. The students were asked to measure their agreement to 14 statements. The student could choose to Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree with each statement. If the student chose to Strongly Disagree, the answer was awarded 1 point. If the student chose to Strongly Agree, the answer was given 5 points. Table I gives the results by group.

Statement	Graduate Students Scholarship (n=8)	Native UG Scholarship (n=7)	Transfer Scholarship (n=18)	No Scholarship (n=31)
1. FSE 394 has made me think about attending graduate school.	4.63	4.71	4.61	4.45
2. FSE 394 has helped or made me decide to attend graduate school.	4.8	4.3	4.2	4.0
3. Information on diet, health (sleep), and financial affairs was a helpful topic.	4.0	4.0	3.5	3.52
4. I was relieved to hear that many people have “imposter syndrome.” (Think that I really don’t know anything and people will soon find out)	4.13	4.57	4.0	3.9
5. The FSE 394 class helped me learn about research.	4.5	4.14	4.61	4.03
6. The FSE 394 class helped me network better.	4.25	4.0	4.0	3.71
7. The class has helped me explore career options and/or increased my knowledge of engineering careers.	4.4	4.143	4.0	4.258
8. Being involved in study groups has been instrumental in my academic achievement.	4.125	3.571	3.667	3.806
9. Participating in this program has helped me avoid “transfer shock.” (GPA going down after transfer)	4.25	3.0	3.78	3.26
10. Designing my portfolio contributed to my self-awareness or has helped in an interview.	3.8	4.1	3.73	3.7
11. FSE 394 has helped me understand how engineers have contributed to solving problems in the world.	4.13	4.14	4.0	3.7
12. I am confident in my overall communication skills.	4.5	4.57	4.11	3.97
13. Participation in this class has helped me with my study skills.	4.125	3.857	3.944	3.806
14. I am a more competent engineer due to FSE 394 and the program.	4.375	4.0	4.111	4.065

Table 1. Average Degree of Agreement for 14 Statements by the Academic Success Program by Group. A rating of 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, and 1=Strongly Disagree.

The students were also asked several questions to which the students were to answer “Yes” or “No.” The results of three questions pertinent to this paper are given in Table 2.

Questions Answered “Yes”	Graduate Students Scholarship (n=8)	Native UG Scholarship (n=7)	Transfer Scholarship (n=18)	No Scholarship (n=31)
1. Would you have enrolled in FSE 394 if you did not have a scholarship?	3 (37.5%)	2 (28.6%)	7 (38.9%)	28 (90.3%)
2. Would the program be beneficial to you if there was no scholarship?	8 (100%)	6 (85.7%)	15 (83.3%)	27 (87.1%)
3. Have you ever participated in an internship, research, or an REU*?	7 (87.5%)	6 (85.7%)	11 (61.1%)	13 (41.9%)

Table 2. Number of Students Who Answered “Yes” to the First Three Survey Questions by Group.

*REU = NSF Research Experience for Undergraduates Program

Next additional data gathered from this survey included information about the Guaranteed 4.0 Plan. The students were asked to answer Yes or No if participating in the program helped them improve their grades. In addition, the students were asked to estimate what percentage they used of the 4.0 Plan or equivalent for this semester. Lastly on this topic, the students were asked to predict their GPA for the semester. Additionally, the actual GPA the students received was recorded for this study, as well as the grade the student received in the FSE 394 class.

Category	Graduate Students Scholarship (n=8)	Native UG Scholarship (n=7)	Transfer Scholarship (n=18)	No Scholarship (n=31)
Participation in program helped improve grades: Yes	7 (87.5%)	6 (85.7%)	16 (88.9%)	20 (66.7%)*
% 4.0 Plan Used	57%	69%**	59.7%***	67.23%****
Semester GPA Predicted	3.7	3.85	3.50	3.41
FSE 394 Grade	All A+	A, A-, rest A+	I, I, A, A-, B, rest A+	9 I's, 8 A's, 3 A-'s, 1 B+, 10 A+'s
Actual Semester GPA	3.75	3.89	3.53	3.33

Table 3. Additional Academics by Student Group

*n=30, **1 student recorded 0, ***n=17, 2 students recorded 0, ****n=26

Since some of the students did not give an estimate of the percentage of the 4.0 Plan or a predicted semester grade, the appropriate same sizes are noted with the table.

In order to analyze the survey results, some additional information was needed. In particular it was helpful to know how many students were in the class for the first time and the number of students who received Incompletes. It is also of interest to then look at the GPAs of the students who received incompletes versus those who did not and also of those who did not have a scholarship versus those who did. See Table 4 for a summary of these statistics between the transfer group and the no scholarship group. We were also interested in comparing the percentage of students in each class who were taking the class for at least the third time.

Category	Transfer Scholarship (n=18)	No Scholarship (n=31)
Enrolled in Academic Success Class for first time	6	17
First-timers received an Incomplete	2 (33.3%) GPA: 3.34	7 (41.2%) GPA: 2.58
First-timers w/o Incomplete	4 (66.7%) GPA:3.6775	10 (58.8%) GPA: 3.5
Enrolled in class at least 3 rd time	11 (61.1%)	10 (32.3%)

Table 4. Comparison of Academic Success Class Students With and Without Scholarships for Fall 14.

V. Survey Analysis and Conclusions

First we will look at Table 1 to see if there are any trends that can be seen between the students without a scholarship and the groups of students with a scholarship. The first two questions were about the impact of the course to encourage the student to go to graduate school. We note that all of the student groups agreed with the statements quite strongly. The students without a scholarship believed this statement a little less strongly than the other groups but this was probably due to the fact that the “no scholarship” students had been in the class less times, in general, than the other groups and therefore had not heard the “graduate school message” as many times. Those in graduate school gave the program credit for helping them decide on graduate school.

The graduate and native undergraduate students seemed to be more interested in learning about diet, good health, and financial matters than the other students. Interestingly, the native undergraduate scholarship students were the most relieved to learn about the “imposter syndrome.” The award or non-award of a scholarship did not seem to have any effect on either of these topics. On the research and networking topics, the “no scholarship” group agreed that these topics helped them, but not as much as the scholarship groups. For over half of the scholarship group, this was their first semester and their first time in the class. Getting students interested in research the first time is difficult. In the past some students without a scholarship have dropped the course due to this assignment. Those with a scholarship know they have to stick with the course and the assignments or they will lose their scholarship. We assume that this is a factor in their diligence to do the assignments. We have tried different versions of a first “research” paper with the students so the assignment is not as overwhelming.

The “no scholarship” group actually believed that the class had helped them explore career options and/or increased their knowledge of engineering careers more than did the native and transfer scholarship undergraduate students. They also believed more strongly that being involved in study groups had been instrumental in their academic achievement than the two other undergraduate groups, but not as strongly as the graduate group. It also should be noted that their belief was a little less than strong agreement. The “no scholarship” group was close to neutral in agreeing that their program participation had helped them avoid “transfer shock,” which is usually largely measured by the comparison of the first semester university grades with the average CC grades. We note that at the time of the survey, over half of the students in the “no scholarship” group had not yet received their first semester grades at ASU, and therefore would understandably be cautious about answering this question. The native undergraduate group were neutral on “transfer shock” since they did not transfer.

The “no scholarship” group’s belief in designing a portfolio contributed to their self-awareness was a little below “agree” and about the same as the other groups. Their agreement was also a little below “agree” and a bit less than the other groups on “FSE 394 has helped me understand how engineers have contributed to solving problems in the world.” This is probably a function of over half of the “no scholarship” group being in their first semester in FSE 394. Similarly, the “no scholarship” group had the lowest agreement of the groups on confidence in their overall communication skills. This confidence seems to have a positive correlation with how long the students have been in the program.

“Participation in this class has helped me with my study skills” was generally agreed upon by all four groups. The graduate group at a 4.125 rating was a little ahead of the other three groups who agreed at the 3.8-3.9 level. “I am a more competent engineer due to FSE 394 and the program was agreed upon at the 4.375 level by the graduate students (as we would hope). The next confident was the transfer scholarship group at 4.11 and the native undergraduate scholarship students were close in agreement with the no scholarship students at 4.0 and 4.065 respectively.

Next we turn on attention to the data displayed in Table 2. About 2/3 of the scholarship students would not have taken the course if they had not had a scholarship. Only three of the eight graduate students would have enrolled if they had not had the scholarship which required enrollment. This is understandable because all of the graduate students had taken the class several times. An advantage for the instructor and the other students in the class is to have graduate students as role models, mentors, and givers of advice to the newer students. Only two of the seven native undergraduate students would have enrolled in the course again without the scholarship. Each of these students had been at ASU for at least 5 semesters and was taking the class for at least the third time (four were taking it for at least the fifth time).

Of the 18 METSTEP scholarship transfer students, six were taking the course for the first time. Three said they would not have taken the class without the scholarship. The student taking the class for only the second time said he would have enrolled without the scholarship. Other students who said “Yes” were taking the course for the third time and one was taking the class for the sixth time.

Most of the “no scholarship” students said they would take the course even without the scholarship, which is what they were doing. Seventeen of these students were first semester transfer students, who had been told they were required or strongly urged to take a transfer success class. However, the Ira A. Fulton Schools of Engineering also offers a one-credit, one-semester academic success class, so the students could have chosen another success class.

Each group generally agreed that the program would be beneficial even if there was no scholarship. The approval rate was the lowest (83.3%) for the undergraduate transfer scholarship students, while 100% of the graduate students saw its benefits.

The percentage of participation in internships, research, or a research experience for undergraduates was roughly correlated to the number of years in the program and at ASU. The percentage was the highest for graduate students and native undergraduates (87.5% and 85.7%, respectively), 61.1% for transfer scholarship students, and lowest for those with no scholarships

(17 of whom were in their first semester at ASU and in the success class). Only 41.9% of this last group of students had participated in an internship, research, or research experience.

Next, we look at the data in Table 3. In response to the statement “participation in program helped improve grades,” each group had over an 85% yes rate, except the students without a scholarship. Again over half of this group had not yet seen their grades from their first ASU semester. On average, the “no scholarship” group said that they followed 67% of the Guaranteed 4.0 Plan. This percentage is comparable to the native scholarship group and higher than the other two groups. The accuracy of this estimate is questionable. Some students have learning habits that are very similar to the 4.0 Plan, but the students do not connect them as the same. For example, some excellent students with very high GPAs will claim that they do not follow the 4.0 Plan at all. This is difficult to believe since the 4.0 Plan covers a lot of activities normally associated with good learning.

The students were asked to predict their semester grade for Fall 14. Surprisingly, each group did quite well, on average, at this estimate. The “no scholarship” group overestimated their GPA by a little (3.41 compared to 3.33), while the other groups were very close in their estimate, but a bit under. See Table 3 for the comparisons. Table 3 also shows the distribution of grades in each group. Seven of the 17 new transfer students in the “no scholarship” group still had an Incomplete in the class nearly a year later.

In order to directly compare Academic Success class students with or without a scholarship, our best possibility is between the Transfer Scholarship Group and the No Scholarship Group. Refer to Table 4 for some of these statistics. Of the 31 students without scholarships, 17 of the students were transfers in their first semester at ASU and their first semester in the Academic Success Class. Ten of the students had been at ASU for three semesters or longer and also in the Academic Success Class for at least three times. Most of this last subgroup of students had had an NSF S-STEM scholarship before the funding ended. The reason they did not have a scholarship did not imply that they were no longer academically qualified. Of the 17 first semester transfer students, 7 received Incompletes (GPA = 2.58) which still stand nearly a year later. On the other hand, there were 6 new transfer students who received a scholarship and were enrolled in the Academic Success class. Two of the six students received an Incomplete for the course (GPA = 3.34). The first-timers who completed the course in the transfer scholarship group had a semester GPA of 3.6775, and the ten no scholarship first-timers who completed the course had a GPA of 3.5. The scholarship students did better academically. Eleven of the 18 students (61.1%) in this group had attended the Academic Success class either 3, 4, 5, or 6 times, compared with 10 students (32.3%) in the no scholarship group.

Limitations of this study include the small sample size for two of the groups, the inexactness of student estimates of their use of the Guaranteed 4.0 Plan, and the fact that most of the native students had an FSE 194 academic success class before taking the FSE 394 class. Some of the students may have determined that if they learned something in FSE 194, then it did not apply with the FSE 394 course. Since these two courses were taught in collaboration, we should have instructed the students to consider both courses as FSE 394. Additional study on this topic could include differentiation by gender and ethnicity and a comparison of GPAs with transfer students

who did not take an academic success class. Another aspect of this to be studied is how many hours the scholarship students worked compared with the no scholarship students. Perhaps the reason the scholarship students did better is that they were working less.

VI. Summary

It is difficult to pull out the exact influence of the scholarship in the students who take the FSE 394 Academic Success Class. We do know that about two-thirds of the students in this class with a scholarship said they would not have enrolled in the class if they were not required to do so. The percentage of Incompletes in the course among students new to ASU and to the course, was higher in the no scholarship group. Among those who received an Incomplete in the course, the GPA of the scholarship students (3.34) was higher than the GPA (2.58) of those without a scholarship. For the students who completed the course, again the scholarship students had a higher GPA (3.6775) than those without a scholarship (3.5). We do need to note that the percentage of transfer scholarship students enrolled in the class for at least the third time was nearly double the percentage of transfer non-scholarship students.

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