



Transfer Experience for Upper Division Engineering and Computer Science Students

Dr. Mary R. Anderson-Rowland, Arizona State University

Mary Anderson-Rowland, Arizona State University MARY R. ANDERSON-ROWLAND is the PI of an NSF STEP grant to work with five non-metropolitan community colleges to produce more engineers, especially female and underrepresented minority engineers. She also directs two academic scholarship programs, including one for transfer students. An Associate Professor in Computing, Informatics, and Systems Design Engineering, she was the Associate Dean of Student Affairs in the Ira A. Fulton Schools of Engineering at ASU from 1993-2004. Anderson-Rowland was named a top 5% teacher in the Fulton Schools of Engineering for 2009-2010. She received the WEPAN Engineering Educator Award 2009, ASEE Minorities Award 2006, the SHPE Educator of the Year 2005, and the National Engineering Award in 2003, the highest honor given by AAES. In 2002 she was named the Distinguished Engineering Educator by the Society of Women Engineers. She has over 180 publications primarily in the areas of recruitment and retention of women and underrepresented minority engineering and computer science students. Her awards are based on her mentoring of students, especially women and underrepresented minority students, and her research in the areas of recruitment and retention. A SWE and ASEE Fellow, she is a frequent speaker on career opportunities and diversity in engineering.

The Transfer Experience for Upper Division Engineering and Computer Science Students

Abstract

Since 2002 an academic scholarship success and professional development program has been held at Arizona State University for transfer and non-transfer students supported by National Science Foundation CSEM and S-STEM grants for scholars in engineering and computer science. These academic programs have grown to a two-credit hour class which now includes many students in addition to the scholarship students, especially transfers. In Fall 2007, there were a total of 25 transfer students in the program; in Fall 2010, 61 transfers; and in Fall 2012, 133 transfer students. The growth has largely been due to the word-of-mouth done by the students who attend the class and advertise how much the class has helped them. This study attempts to measure if the type of transfer student in the program is the same from 2007 to 2010 to 2012 in spite of changes in the group size and in the program.

This paper will primarily compare the 2007, 2010, and 2012 groups with data from a similar survey. Transfer program students in these groups were asked to identify basic demographics, family commitments before and after transfer, the number of hours worked before and after transfer, the amount of time spent commuting to school, when they knew they would enroll in a community college, why they chose their first college school, and when they knew they would attend a 4-year college or university. The results of the Fall 2012 study are analyzed by gender and compared with the results of Fall 2010 and Fall 2007 to look for trends. Most of the results between groups are consistent, but there are some statistically significant changes which we need to consider in order to continually improve our transfer program. A continuing challenge is to recruit more female transfer students.

I. Introduction

In recent years an increased attention has been directed to community colleges (CCs). President Obama has called for an increase of at least 10,000 engineers per year as an immediate short-term solution to the demand for more engineers in the United States.^{1, 2} As university tuitions have increased in recent years and unemployment has risen, many capable students are finding the cost of attending a university very difficult. Attending a CC and living at home for the first two years can save a student a considerable amount of money. At the same time, the CC offers small classes, classes at times to accommodate working students, free parking, and a short commute from home. A larger proportion of women and underrepresented minority students attend two-year colleges than four-year schools. The CC is a critical source for growing the engineering and computer fields in the United States. Henceforth in this paper, the word “engineering” shall include both engineering and computer science.

However, in order to increase the number of engineering students coming from CCs, there are three basic steps that must be taken: first, we need to get undecided CC students to be aware of and to consider engineering as a possible career; second, we need to have them choose engineering as a career; and third, we need to make sure that the student transfers to a four-year school and completes a Bachelor's degree in engineering. To help students complete college, Tinto tells us that there are four conditions for student success: high expectations; academic, social, and often financial support; assessment and feedback; and involvement or engagement.³

For the past 10 years, the author and colleagues have been collaborating with CCs, working with their students, and helping them to transfer. We visit the CCs and speak with their students in the mathematics and science classes, make high school visits with CC representatives to encourage more students to consider engineering and attend their local CC, help provide scholarships both at the CC and the university for transfer students, smooth the transfer process, and work to meet Tinto's four conditions for student success. Our expectations of the CC transfer students are high. We encourage them from day one to consider going full-time to graduate school right after they earn their Bachelor's degree. We tell the students that a Master's degree is very valuable in industry. With a Master's degree a student is more likely to start at a project manager position equivalent to two years of experience, as well as beginning with a higher salary. Many engineering students report that they needed a Master's degree to give them a much firmer hold on their engineering field to feel comfortable going out as an engineer and to enable them to participate in exciting industrial projects. Through our National Science Foundation (NSF) S-STEM and STEP programs (#0728695, #1060226, and #0856834), we have been able to give scholarships to transfer students to help with their financial support.⁴ During the 2012-2013 academic year, scholarships were also sponsored through a grant from the ASU Women & Philanthropy group (<http://www.asufoundation.org/womenandphilanthropy>). Through the Academic Success and Professional Development class, the students receive academic support through the Guaranteed 4.0 Plan.⁵ The METS Center provides mentoring and tutoring help, as well as informal counseling.⁶ We stress academic success in our meetings such as: join two student organizations, one in your academic field and in one such as SHPE, SWE, NSBE, or ASISES; visit and get to know the professor of each of your classes; get into a study group for each class, and spend as much time on campus as you can.

As a part of our program with transfer students, we continually try to learn more about the students in order to better support them. In Fall 2007, we surveyed all 25 academic scholarship transfer students in our program.⁷ At that time the students were encouraged to attend six workshops per semester, but attendance was not required and there was no academic credit given. In Fall 2008, a one-credit hour class was scheduled for the workshops and 39 students enrolled. The grade from this class counts in the overall GPA of the student, but does not count in a program of study for a degree. Assignments were given in the class and enrollment was voluntary. By Fall 2010, scholarship students, both transfer and non-transfer, were required to enroll in the Academic Success and Professional Development class, now labeled FSE 394. The

class included both scholarship students and students who had heard good things about the class. In the Fall of 2010, a survey was taken of all 61 transfer students who were enrolled in FSE 394 for that semester.⁸ We wanted to determine why and when they decided to go to a two-year college, and when they decided that they would transfer to a four-year school. The average age of the students was 24.5 years. Over 60% of the students knew “from the beginning” that they would attend a four-year college. However, 21% did not know this until they had attended a CC for up to three years. The survey showed that the late decisions of CC students to major in engineering meant that it was very important for four-year schools to reach out to CCs to encourage their students to consider engineering majors and to continue on to a four-year school if we are to grow more engineers.⁸

In Fall 2012, we had 133 transfer and 46 non-transfer students enrolled in the FSE 394 Academic Success class. We wondered if, with many more transfer students and two years later, the characterizations that we found in the Fall 2010 survey still held. Therefore the Fall 2012 transfer students were asked to complete the same survey given in 2010. We received 111 survey responses (83.5%).

The 2007 and 2010 surveys were given in hard copy for the students to complete during a meeting. Follow-up was needed to obtain completed surveys from students who missed that meeting. We put the 2012 survey on-line, which made calculations much easier, but which took much more time in reminders and encouragements to get the students to complete the surveys.

II. The Survey Results and Comparison

First, we looked at the general demographics of gender and ethnicity. In 2007, the 25 students were distributed as in Table I07. In 2010, the 61 students were distributed as seen in Table I10 and the 2012 students in Table I12. Of the 2007 students, 72% of the students were female or underrepresented minority students. In 2010 this percent was 62.3% and in 2012, this percentage was 50.5%.

2007	Female	Male	Totals
Minority	4	9	13 (52%)
Non-Minority	5	7	12 (48%)
Totals	9 (36%)	16 (64%)	25 (100%)

Table I07. Gender and Ethnicity Distribution of 2007 Survey of Scholarship Transfer Students

2010	Female	Male	Totals
Minority	5	20	25 (41%)
Non-Minority	13	23	36 (59%)
Totals	18 (29.5%)	43 (70.5%)	61 (100%)

Table I10. Gender and Ethnicity Distribution of 2010 Survey Transfer Students Enrolled in the Academic Success and Professional Development Class

2012	Female	Male	Totals
Minority	9	35	44 (39.6%)
Non-Minority	12	55	67 (60.4%)
Totals	21 (18.9%)	90 (81.1%)	111 (100%)

Table I12. Gender and Ethnicity Distribution of 2012 Survey Transfer Students Enrolled in the Academic Success and Professional Development Class

The 2007 survey includes only scholarship students. The program has an emphasis on females and underrepresented minority students with a goal of at least 60% of the scholarships going to these two underserved groups. The 2007 survey included both scholarship and non-scholarship transfer students, and the percentage of the underserved groups is less than in 2007. By Fall 2012, more and more students were learning about the scholarship program, applying for scholarships, and enrolling in the success class. Also included in the 2012 survey were transfer students (primarily male and Caucasian) directed to the class by academic counselors, so there was an even lower percentage of females and underrepresented minorities in the class. Many of these transfer students were advised to take our academic success class in place of a required freshman orientation class. As can be seen from these tables, the percentage of females, especially, has declined with each survey. However, the 19% of females in Fall 2010 was still higher than the average female percentage of 15 for incoming transfer females. We still have close to double the percentage of minorities since about 21% of upper division transfer students are minorities. We have added five non-metropolitan CC students to our program and less of them are female or underrepresented minority.^{9, 10}

In the 2007 survey, the average age for females was 24.67 and the average age for males was 26.25. In the 2010 survey, the range of female ages was 17-35 with an average of 24.5 years. The range of males was 18-39, with an average of 24.6 years. For the 2012 transfers, the range of female ages was 18-53 with an average of 25.43 years and the range of males was 19-48, with an average of 25.03 years. The average age of the 2012 students is roughly a half year older than the 2010 students. The average age for males was highest in the 2007 study. There does not seem to be any pattern here and the average age among the groups is quite consistent.

The family commitments for the 2007 students are shown in Table II07. The number of students with family commitments increased after transfer, especially among males.

2007	Pre-ASU	Now (time of survey)
Females	6 (66.7%)	7 (77.8%)
Males	2 (12.5%)	6 (37.5%)
Totals	8 (32%)	13 (52%)

Table II10. 2007 Transfer Student Family Commitments Before and After Transfer

The family commitments for the 2010 students are shown in Table II10.

2010	Pre-ASU	Now (time of survey)
Females	12 (66.7%)	9 (50%)
Males	15 (34.9%)	18 (41.9%)
Totals	27 (44.3%)	27 (44.3%)

Table II10. 2010 Transfer Student Family Commitments Before and After Transfer

In 2010, the number of females with family commitments decreased after transfer, but the number of males with family commitments increased. Over 44% of the transfer students had family commitments at the time of the survey, which is a smaller percentage than the 2007 transfer students, but not statistically significant.

The family commitments for the 2012 students are shown in Table II12.

2012	Pre-ASU	Now
Females	10 (47.6%)	10(47.6%)
Males	21 (52.4%)	37 (78.7%)
Totals	31 (27.7%)	47 (42.0%)

Table II12. 2012 Transfer Student Family Commitments Before and After Transfer.

In 2012, a smaller percentage of the females had family commitments than in 2007 (p-value = .087) and the number of females with commitments stayed the same after transfer. The percentage of males in 2012 with family commitments increased sharply after transfer (p-value = .009). In 2012 approximately the same percentage (42%) of transfer students had family commitments as in 2010. Since we are not testing hypotheses, but rather looking for trends of change, we will generally report any statistical difference at a p-value < .15.

We next asked about the number of hours worked per week during the academic year before and after transfer. We often find that transfer students work too many hours per week after transfer. They assume that they can work just as much and take just as many hours as they did at the CC.

In 2007, 9/9 (100%) of the females worked before transfer and only 6/9 (66.7%) worked after transfer. In the same year, 14/16 (87.5%) of the males worked before transfer and 11/16 (68.8%) worked after transfer. These totals are not that different from the next two surveys. In Table III10 we see the 2010 results.

Hours Worked/Week During Academic Year 2010

Females, n=18			Males, n=43	
Hours	Pre-Transfer	Fall 2010	Pre-Transfer	Fall 2010
0-8	4 (22.2%)	7 (38.8%)	13 (30.2%)	17 (39.5%)
10-15	0	6 (33.3%)	5 (11.6%)	9 (20.9%)
16-20	5 (27.8%)	4 (22.2%)	5 (11.6%)	12 (27.9%)
21-25	4 (22.2%)	1 (5.6%)	5 (11.6%)	2 (4.7%)
26-30	1 (5.6%)	0	4 (9.3%)	2 (4.7%)
31-40	2 (11.1%)	0	10 (23.3%)	0
40+	2 (11.1%)		1 (2.3%)	1 (2.3%)

Table III10. Transfer Student Hours Worked/Week Before and After Transfer, 2010

We note from Table III10 that none of the females in 2010 worked more than 25 hours per week after transfer and only one male student worked more than 30 hours per week, while 11 of them had been before transfer. Of the females pre-transfer, 77.8% worked 10 hours or more per week and only 60.5% of the males worked 10 hours or more.

By contrast we see in Figure III12 that 4 females in the 2012 cohort worked more than 25 hours per week and 12 males worked more than 30 hours per week after transfer. The students were warned not to work more than 20 hours per week. Before transfer 6 females were working over 20 hours per week and after they matriculated to ASU only 4 females worked over 20 hours. We see that during the 2012 academic year 14/21 = 66.7% of the women worked 10 hours or more per week and that 51/90 = 56.7% of the men worked 10 hours or more per week. These percentages are roughly the same as in 2010 (no statistical significant difference) except a smaller percentage of females worked 10 hours per week or more.

Hours Worked/Week During Academic Year 2012				
Hours	Females, n=21		Males, n=90	
	Pre-Transfer	Fall 2012	Pre-Transfer	Fall 2012
0-8		6	7	33
10-15		2	8	10
16-20		7	2	16
21-25		0	0	6
26-30		4	1	12
31-40		2	1	7
40+		0	2	6

Table III12. Transfer Student Hours Worked/Week Before and After Transfer, 2012

We wondered about commute time, which we had not queried in 2007. Some of the transfer students continue to live in the same place they did when they went to the CC. We also wondered if they could study while the commuted. The information for 2010 is in Table IV10.

2010 One-Way Commuter Time and Ability to Study Enroute				
Commuter Time	Females, n=18	F - # Who Can Study	Males*, n=41	M - # Who Can Study
≤ 30 minutes	8 (44.4%)	3	27 (65.9%)	2
31 minutes – 1 hour	6 (33.3%)	0	10 (24.4%)	7
≥ 1 hour	4 (22.2%)	2	4 (9.7%)	1
Totals	18 (100%)	5	41*	10

Table IV10. Transfer Student Commuter Time by Gender and Ability to Study Enroute, 2010

*Two males did not report.

In the 2010 study, over 50% of the females had a one-way commute longer than 30 minutes. In the 2012 study, only 9 or 42.9% of the females had a commute longer than 30 minutes as seen in Table IV12. However, this difference is not statistically significant. The comparable percentages for males were 34% in 2010 and 40% in 2012, which are about the same. In looking at these last

two tables, we see that fewer students percentage-wise (11.7%) in 2012 find that they can study enroute than did students in 2010 (24.6%). This is statistically significant with a p-value of .033. Some of these students take the light rail and therefore can reasonably do some reading on the commute.

2012 One-way Commuter Time and Ability to Study Enroute				
Commuter Time	Females, n=21	F - # Who can study	Males, n=90	M - # Who can study
<= 30 minutes	12 (57.2%)	1	54 (60%)	5
31 minutes - 1 hr	7 (33.3%)	2	18 (20%)	4
>= 1 hr	2 (9.5%)	0	18(20%)	1
Totals	21 (100%)	3	90 (100%)	10

Table IV12. Transfer Student Commuter Time by Gender and Ability to Study Enroute, 2012

Since we do outreach trips to CC, we wondered about the background of the students. When did they know that they would attend a CC? We did not ask this question in the 2007 survey. Table V10 shows the decision times for the 2010 transfer students. Table V12 shows the decision times for the 2012 transfer students.

2010 When did you know you would go to a CC?			
When	Females, n=18	Males, n=43	Totals, n=61
From the beginning	1 (5.6%)	7 (21.2%)	8 (13.1%)
Middle School	3 (16.7%)	1 (2.3%)	4 (6.6%)
High School: Freshman/Sophomore Year	0 (0%)	6 (3.0%)	6 (9.8%)
High School: Junior/Senior Year	8 (44.4%)	12 (36.4%)	20 (32.8%)
Other	6 (33.3%)	17 (51.5%)	23 (37.7%)

Table V10. CC Decisions to Attend a Community College by Time and Gender, 2010

2012 When did you know you would go to a CC?			
When	Females, n=21	Males, n=90	Totals, n=111
From the beginning	2 (9.5%)	12 (13.3%)	14 (12.6%)
Middle School	0	2 (2.2%)	2 (1.8%)
High School: Freshman/Sophomore Year	2 (9.5%)	9 (10%)	11 (9.9%)
High School: Junior/Senior Year	8 (30.1%)	40 (44.4%)	48 (43.3%)
Other	9 (42.9%)	27 (30%)	36(32.4%)

Table V12. CC Decisions to Attend a Community College by Time and Gender, 2012

The general distribution of when a student knew that they would go to a CC is almost the same for both females and males and for 2010 and 2012. It is surprising to see that 30% or more of both genders did not know until they were out of high school that they would be going to a CC.

We were interested in learning why the students chose their first college school which was a CC in most cases. Tables VI07, VI10, and VI12 show the reasons that the 2007, 2010, and 2012 students chose their first school. It is interesting to note that over 28% of the students in 2010 had other reasons for attending a CC in addition to this long list. Some of these “other” reasons

include illness in a family or the loss of family income. Table VI12 displays the reasons that 2012 students gave for their first school choice. Students were asked to check all reasons that applied. The 2007 data was compiled with the genders combined, but Table VI07 shows that the reasons for going to a CC have not changed much in recent years. “Less expensive” and “Close to home” were the first and second most popular answers.

2010 Why did you choose your first college school? Please check all that apply.

Reason	Females n=18	Males n=43	Total n=61
Low Tuition	14 (77.8%)	34 (79.1%)	48 (78.7%)
Close to Home	10 (55.6%)	30 (69.8%)	40 (65.6%)
Smaller Classes	11 (61.1%)	21 (48.8%)	32 (52.5%)
Friendly profs who enjoy teaching	6 (33.3%)	17 (39.5%)	23 (37.7%)
Individual assistance/Interaction with profs	7 (38.9%)	14 (32.6%)	21 (34.4%)
Didn't know major	5 (27.8%)	14 (32.6%)	19 (31.1%)
Education is good/better	4 (22.2%)	13 (30.2%)	17 (27.9%)
Ample free parking	4 (22.2%)	10 (23.3%)	14 (23.0%)
Attended school while in HS	5 (27.8%)	5 (11.6%)	10 (16.4%)
No HS diploma/Did poorly in HS	1 (5.6%)	5 (11.6%)	6 (9.8%)
Step to preferred school/^GPA	1 (5.6%)	5 (11.6%)	6 (9.8%)
Can carry full load while work full-time	3 (16.7%)	3 (7.0%)	6 (9.8%)
Not sure could make it at 4-year school	1 (5.6%)	4 (9.3%)	5 (8.2%)
Little or no homework for some classes	2(11.1%)	2 (4.7%)	4 (6.6%)
Scholarships	1 (sports) (5.6%)	3 (1 sports) (7.0%)	4 (6.6%)
Needed to improve English	1 (5.6%)	0	1 (1.6%)
Other	5 (27.8%)	12 (27.9%)	17 (28.3%)

Table VI10. Choice of First College by Reason and Gender, 2010

2012 Why did you choose your first college school? Please check all that apply.

Reason	Female, n=21	Male, n=90	Total, n=111
Low tuition/less expensive	16 (76.2%)	69 (76.7%)	85 (76.6%)
Close to home	12 (57.1%)	57 (63.3%)	69 (62.2%)
Smaller classes	12 (57.1%)	43 (47.8%)	55 (49.5%)
Friendly professors who mainly enjoy teaching	10 (47.6%)	29 (32.2%)	39 (35.1%)
Education is good/better	8 (38.1%)	28 (31.1%)	36 (32.4%)
Individualized assistance/Interaction with profs	9 (42.9%)	26(28.9%)	35 (31.5%)
Ample free parking	5 (23.8%)	29 (32.2%)	34 (30.6%)
Didn't know what I wanted to major in	2 (9.5%)	21 (23.3%)	23 (20.7%)
Can carry full load while working	4 (19.0%)	14 (15.6%)	18 (16.2%)
Took classes there during high school	5 (23.8%)	7 (7.8%)	12 (10.8%)
Didn't know/Wasn't sure if I could make it at a four-year	3 (14.3%)	6 (6.7%)	9 (8.1%)
Step to preferred school (raise GPA)	3 (14.3%)	5 (5.6%)	8 (7.2%)
Needed to improve English	0	6 (6.7%)	6 (5.4%)
Little or no homework for classes	0	5 (5.6%)	5 (4.5%)
No HS diploma or did poorly in high school	0	4 ((4.4%)	4 (3.6%)
Athletics	0	3 (3.3%)	3 (2.7%)
Athletic Scholarship - Women's Golf, Basketball	3 (14.3%)	0	3 (2.7%)
Only had a GED	1 (4.8%)	0	1 (0.9%)
Good engineering classes	0	1 (1.1%)	1 (0.9%)
Lot of minority students/programs at County College	1 (4.8%)	0	1 (0.9%)

Table VI12. Choice of First College by Reason and Gender, 2010

2007 Why did you choose your first college school? Please check all that apply.

Reason	Total n=25
Less expensive	15 (60.0%)
Close to Home	8 (32%)
Education is good/better	4 (16%)
No HS diploma or did poorly in HS	3 (12%)
Smaller Classes	3 (12%)
More interaction with instructors	1 (4%)
Needed to improve English	1 (4%)
Took classes there during HS	1 (4%)

Table VI07. Choice of First College by Reason, 2007

An even more important question for those visiting a CC for outreach is “When did you know you would go to a four-year school?” When is the best time to talk to CC students about going to a 4-year school? Tables VII07, VII10, and VII12 show the results. We note that 52% of the 2007 students, over 21% of the 2010 students, and 36% of the 2012 students decided while they were in the CC that they would go on to a 4-year school. Other students did not decide to go to a 4-year school until after they left the CC. These percentages make a good argument for 4-year colleges and universities to go to CCs and talk about engineering, since there are many students who are deciding if they will go for a 4-year degree at that time.

2007 When did you know you would go to a 4-yr College/University?

When	Females, n=9	Males, n=16	Totals, n=25
From the beginning	0	2 (12.5%)	2 (8%)
Middle School	0	0	0
High School: Freshman or Sophomore	0	0	0
High School: Junior or Senior	1 (11.1%)	4 (25%)	5 (20%)
Between HS/CC	0	0	0
1st Year CC	3 (33.3%)	3 (18.75%)	6 (24%)
2nd Year CC	3 (33.3%)	4 (25%)	7 (28%)
3rd Year CC	0	0	0
College Junior	2 (22.2%)	3 (18.75%)	5 (20%)

Table VII10. Decision to Go to a 4-year College/University by Time and Gender, 2007

2010 When did you know you would go to a 4-yr College/University?

When	Females, n=18	Males, n=43	Totals, n=61
From the beginning	13 (72.2%)	24 (55.8%)	37 (60.7%)
Middle School	0	0	0
High School: Freshman or Sophomore	1 (5.6%)	3 (7.0%)	4 (6.6%)
High School: Junior or Senior	0	4 (9.3%)	4 (6.6%)
Between HS/CC	1 (5.6%)	1 (2.3%)	2 (3.3%)
1st Year CC	2 (11.1%)	3 (7.0%)	5 (8.2%)
2nd Year CC	1 (5.6%)	5 (11.6%)	6 (9.9%)
3rd Year CC	0	2 (4.7%)	2 (3.3%)
After working	0	1 (2.3%)	1 (1.6%)

Table VII10. Decision to Go to a 4-year College/University by Time and Gender, 2010

2012 When did you know you would go to a 4-yr College /University?			
When	Females n=21	Males n=90	Totals n=111
From the Beginning	11 (52.4%%)	36 (40%)	47 (42.3%)
Middle School	1 (4.8%)	4 (4.4%)	5 (4.5%)
High School:			
Freshman/Sophomore	2 (9.5%)	4 (4.4%)	6 (5.4%)
High School: Junior/Senior	1 (4.8%)	10 (11.1%)	11 (9.9%)
Between HS/CC	0	0	0
1st Year CC	1 (4.8%)	14 (15.6%)	15 (13.5%)
2nd Year CC	4 (19.0%)	14 (15.6%)	18 (16.2%)
3rd Year CC	1 (4.8%)	6 (6.7%)	7 (6.3%)
After Working	0	0	0
Parent died	0	1 (1.1%)	1 (0.9%)
After ESL course completed	0	1 (1.1%)	1 (0.9%)

Table VII12. Decision to Go to a 4-year College/University by Time and Gender, 2012

Less students percentage-wise (42.3%) in the 2012 group knew “from the beginning” that they would attend a 4-year college or university than in the 2010 group (60.7%) at a p-value of .019. However, at the same time, over a third of the transfer students in the 2012 study had not made these career plans by the time they enrolled in a CC. Only 8% of the 2007 students knew “from the beginning.” The difference of the 2007 cohort from the 2010 and 2012 cohorts is significant at the $p=.000$ level. In the 2012 group, 36% of the students decided to go to a 4-year school while at the community college, while only 22% did so in 2010 cohort. This difference is significant at the $p=.034$ level. In the 2007 cohort, 52% decided on a 4-year school while at the CC. This result is statistically different from the 22% of the 2010 cohort at the .007 p-level. At the same time, the 2007 cohort is only different from the 2012 cohort by a p-value of .146. We note from Table VI12 that 20% of the 2012 students said that not knowing their major was a factor for their first college choice, usually a CC.

III. Analysis

The first three tables, I07, I10, and I12, clearly show that the percentage of women transfers in the program has been declining. The percentage of women transfers in our program now (18.9%) is about the same as the percentage of all females in the Ira A. Fulton Schools of Engineering and is higher than the percentage of upper division females transferring to the Fulton Schools of Engineering (15%). Since four transfer women did not take the survey, the actual percentage of transfer women in the program during Fall 2012 is 18.8%. A reason that the percentage has been declining is due to a larger percentage of non-scholarship students being in the program. We have generally kept the percentage of scholarships going to women and underrepresented minority students to at least 60% as a way of providing access to underserved students, all with unmet financial need. However, we do want to bring in more female transfer students, on scholarship or not, and will be looking for ways to do that through our CC outreach visits.

The average age of the program transfer students is approximately 25 for both females and males and all years. We hear from the transfer students that because of their age, they do not appreciate being in an orientation class with freshmen whose primary focus is on what happened in the dorm last night or what TV programs were on. For this reason, the transfer students appreciate being in a success and orientation class with students approximately their age.

It is important to understand that many “older” transfer students have family commitments. In 2012, a smaller percentage of the female transfer students had family commitments than in 2007 ($p = .087$). The other statistically significant event was that the number of males in 2012 with family commitments after transfer is significantly higher ($p = .009$) than before. Perhaps the conclusion to be drawn here is that students need to be reminded of good time management when their commitments increase significantly. The “Guaranteed 4.0 Plan” is an excellent tool for this purpose.⁵ This plan is stressed at the beginning of each semester of FSE 394.

The comparisons and analysis with hours worked pre and post transfer did not reveal any unusual information. The general pattern was that students in the program work less than before transfer. This is an important step for students who have been used to working full-time and going to school full-time with good grade averages at a CC. In over 10 years of running these programs, we have only seen one student who was able to do this at ASU successfully. The surveys show that some students continue to work full-time after they transfer, however, these students may be enrolled part-time. While scholarship students need to be full-time, part-time students are allowed to enroll in the academic success program. In general, in our experience, working too much while carrying a full class load is the main reason that students get into academic difficulty. We want to see the percent of working students decrease after transfer, especially for those with scholarships. We seem to be partially successful.

We encourage the students to use whatever time they can to be learning and working on their coursework. One suggestion is to do reading while on the light-rail or possibly carpooling. Some students have never thought of these possibilities. Unfortunately, a smaller percentage of the 2012 students reported being able to study while they commuted to school than did the 2010 students at a p -value of .033.

The patterns for when students knew they would attend a CC were similar by study year and gender. Although not statistically significant, a smaller percentage of students in the 2012 study knew they would attend a CC by their junior or senior HS year than those in the 2010 study. It would be interesting to explore this more fully to understand if the students did not intend to go to college at all or intended to go to a 4-year school before deciding on a CC. If capable CC students are hesitating to go to a 4-year school because they do not have confidence in themselves, as may especially be the case with underserved students, bringing them to campus for an orientation might help them have the confidence to continue their schooling.

The primary reasons that a student chooses to attend a CC are quite clear. Although only 60% of the 2007 students chose “less expensive” as a factor, the students in the 2010 and 2012 cohorts chose “less expensive” as their major reason at over a 76% rate. “Close to home” was chosen as a major reason for attending a CC by over 60% of both the 2010 and 2012 groups. For both of these groups, “smaller classes” ranked third and “professors who enjoy teaching” was fourth. In the 2010 cohort, 31.1%, and in the 2012 cohort, 20.7% of the students said that they did not know what they wanted to major in as a reason to be at a CC. This is good information for those who would consider outreach to community colleges. We have found in the state of Arizona that we were the first professors from an engineering college to ever visit the five non-metropolitan CCs with whom we are now partnering. It makes a big difference to a student to be able to see an engineering model, especially a student model from their school. An even better strategy is to have the CC student come to visit the university and to meet with successful transfer engineering students who came from their CC.

The last question that we analyzed was when the student knew they would go to a 4-year college or university. The results for this question varied quite widely between the three cohorts: 8% of the 2007 cohort, 60.7% of the 2010 cohort, and 42.3% of the 2012 cohort knew “from the beginning” that they would enroll in a 4-year college. The 2007 result is different from the 2010 and 2012 results at the $p=.000$ level. In the 2007 cohort, 52% decided on a 4-year school while at the CC. This result is statistically different from the 22% of the 2010 cohort at $p = .007$ and from the 36% of the 2012 cohort by $p = .146$. The difference between the 36% of the 2012 group and the 21% of the 2010 group is significant at the $p=.034$ level. If the trend of more students deciding on a 4-year school while at the CC continues, there is even a greater urgency for representatives from 4-year colleges and universities to visit with CC students to interest them in engineering, to give them advice about choosing a major, and to give them tools to have a smooth transfer. It is good to note again that 20% of the 2012 students said that not knowing their major was a factor for their first college choice, usually a CC.

IV. Conclusions

Since we had just done this study twice, with a very small sample of 25 in 2007 and then a sample of 61 in 2010 (the populations of transfer students in the program), we did not know how representative or reliable our data was. Also, we wondered if there were changes in the transfer student characteristics that had changed with time. With a much larger class in the Fall of 2012 (179 students with 133 transfer students), we had the opportunity of including well over 100 students in the 2012 survey. While the trends that we had found in the first two surveys have held quite true, there were a few statistically significant fluctuations, trends, or changes as have been noted in the analysis section. We urge others dealing with transfer students to survey their populations to see the patterns of their transfer students and then to make the appropriate changes in programming or handling of the students to make improvements.

A special thanks goes to Carlos Flores, graduate assistant, who helped with organizing the data.

References

1. "Obama: 'We don't have enough engineers'", http://www.computerworld.com/s/article/9717624/Obama_We_don_t_have_enough_engineers , Downloaded 12/31/2012.
2. "Obama jobs council calls for more engineers," http://www.cleveland.com/business/index.ssf/2011/08/obama_jobs_council_calls_for_more_engineers Downloaded 12/31/2012.
3. Tinto, V. (2012). *Completing College: Rethinking Institutional Action*, The University of Chicago Press: Chicago and London.
4. Anderson-Rowland, M.R., "Evaluating an Academic Scholarship Program for Engineering and Computer Science Transfer Students," (2006). 36th ASEE/IEEE Frontiers in Education Conference, San Diego, 6 pages.
5. Johnson, D. O. and Chen, Y. C. (2004) *Guaranteed 4.0*, JCYC Studio, Dallas, Texas.
6. Anderson-Rowland, M.R., Banks, D.L., Zerby, D.L., and Chain, E.L., "The METS Center: A Place Where Community College Transition Students Encourage Each Other in Obtaining an Engineering Degree," (2005) Proceedings of the 2005 WEPAN/NAMEPA Joint Conference, Las Vegas, Nevada, 11 pages.
7. Anderson-Rowland, M.R., "Community College Transfer Engineering Students: Does Gender Make a Difference?" *Proceedings of the 2008 American Society for Engineering Education Annual Conference & Exposition*, Pittsburgh, PA, June 2008, 13 pages, www.asee.org
8. Anderson-Rowland, M. R. (2012). "Understanding the Path of Engineering and CS Upper Division Transfer Students to a Large University," *2012 American Society for Engineering Education Proceedings*, San Antonio, TX, 13 pages.
9. Anderson-Rowland, M. R. and Rodriguez, A. A. (2010) "Motivated Engineering Transfers – STEM Talent Expansion Program (METSTEP)," *Proceedings of the 2010 American Society for Engineering Education Annual Conference & Exposition*, Louisville, KY, 12 pages, CD-ROM and www.asee.org
10. Anderson-Rowland, M. R., Rodriguez, A. A., Bailey, J. H., Grierson, A. E., Pangasa, R., Vangilder, C., McBride, R. B., and Hall, R. A. (2011) "STEP Grant Challenges and Results: Motivated Engineering Transfer Students From Non-Metropolitan Community College," *2011 American Society for Engineering and Education Proceedings*, Vancouver, British Columbia, Canada, 13 pages. www.asee.org