



# **Understanding Community College Transfers' Early Academic Momentum and Its Association with Degree Attainment at a Texas Research University**

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### Understanding Community College Transfers' Early Academic Momentum and Its Association with Degree Attainment at a Texas Research University

As Texas continually engages in a global economy dependent on skilled and knowledgeable workers, the demand for an educated workforce that can compete at the highest levels to help the state remain competitive and prosperous keeps growing (THECB, 2015). The *60x30TX* new strategic plan predicts that by 2030, Texas will need approximately 60% of its 25- to 34-year-old workforce to have postsecondary credentials, including certificates and associate's, bachelor's, or master's degrees. Although an increase of all types of postsecondary credentials is encouraged, production of baccalaureate degrees in science, technology, engineering, and mathematics (STEM) plays a particularly critical role in retaining a robust economy in Texas.

To strengthen such production, an important strategy is to leverage an untapped talent pool in STEM fields: community college transfer students (Hagedorn & Purnamasari, 2012). Community colleges have great potential to affect the growth and diversification of the STEM enrollment and workforce, as they have a long history of serving under-represented students, such as students of color, low-income students, first-generation, and adult learners (Cohen, Brawer & Kisker, 2013). Particularly in Texas, community colleges play a pivotal role in the overall success of the state's higher education system. Almost 52% of all students in Texas public higher education enrolled in community college fall 2014 (Texas Association of Community Colleges, 2015) and in 2013-14, 70% of 4-year degree completers had previously enrolled in a community college, the highest rate in the entire nation (National Student Clearinghouse, 2015).

Although it is significant to promote community colleges as pathways to STEM

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baccalaureate degree attainment, community college transfers have much lower persistence and graduation rates when compared with their peers who started at the same 4-year university. For example, for Texas community college students who completed 60 semester credit hours prior to their transfer in fall 2008, the average degree completion rate by summer 2012 was 68.5%, whereas it was 84.2% for non-transfer students (THECB, 2014a). Among students who graduated with a bachelor's degree, community college transfers required seven years, two years longer than their non-transfer counterparts (THECB, 2014a). Lower graduation rates and greater time to degree lead to individual financial loss, as well as cost inefficiency for Texas community college transfers. Therefore, it is essential to conduct empirical research to identify who these students are, what STEM-related pathways they choose, what courses they take, and most importantly, what factors may hinder or support their persistence and timely degree completion in 4-year universities.

A critical perspective explaining degree (non)completion is *academic momentum* (Adelman, 1999, 2006). It was used to indicate that undergraduates who progress to graduation at a certain speed are more likely to complete their degrees than those whose progress is slow and/or interrupted. A student's initial academic course load and progress set a trajectory that strongly influences subsequent degree completion. In other words, a student with an early loss of momentum will have a much lower chance of graduation. Based on Adelman's research (1999, 2006), Wang (2015) examined early academic momentum, particularly in STEM majors, and defined it as "academic behaviors and efforts students exhibit in early STEM course work that propel them forward toward persistence and success in STEM fields of study" (p. 377). Wang examined this framework from three perspectives: number of STEM credits attempted in the first term in college, quality points students received for their STEM courses, and whether students

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enrolled in STEM courses during the first summer. This updated notion of momentum is more dedicated to understanding STEM degree completion; however, it does not fully consider the unique experiences of community college transfer students. Therefore, in this study, I re-examined the concept of early academic momentum particularly for community college transfer students and included variables pertaining to transfers' academic experiences before and after transfer.

### **Purpose and Research Questions**

In the current study, I explored important variables that contribute to transfer students' early academic momentum and examined differences between students enrolled in STEM fields of study and those who did not. I also investigated the extent to which early academic momentum is associated with students' likelihood of graduation with a bachelor's degree. The following research questions were addressed in this study:

- 1) What are the socio-demographic characteristics, early academic momentum, and other academic experiences of the community college transfer students enrolled in UDFW Fall 2006?
- 2) What are the differences between STEM and non-STEM majors regarding their socio-demographic characteristics, early academic momentum, and other academic experiences?
- 3) To what extent do socio-demographic characteristics, early academic momentum, and other academic experiences are associated with STEM and non-STEM majors' degree attainment, respectively?

### **Method**

#### **Research Site, Data Source, and Sample**

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The data used in the study were drawn from longitudinal, student transcript data collected from transfer students enrolled in a 4-year public research university in the Dallas-Fort Worth metroplex (pseudonym, UDFW). UDFW has been nationally recognized for its large number of transfer students. It recently was ranked by *U.S. News & World Report* as one of the top universities in the nation in new transfer student enrollment.

The dataset tracks a cohort of community college students who enrolled in UDFW in fall 2006 over a decade (from fall 2006 to summer 2016). Community college transfer students in this study are defined by the type of institutions the students attended prior to their enrollment in UDFW. That is, students who attended a community college immediately before enrolling in UDFW are referred as community college transfer students. In total, the sample has 2,112 community college transfer students.

### **Variables and Measures**

Transfer students' degree attainment is the dependent variable of the study and is dichotomously coded: 1 when a student obtained a bachelor's degree by the summer of 2016, and 0 otherwise.

Transfer students' sociodemographic variables include gender, age, race/ethnicity, Pell grant eligibility, first-generation status, and financial aid. As the focus of the study is transfer students, early academic momentum is defined by variables most relevant to transfer students' experiences from two perspectives: prior to transfer, and after transfer. The concept of academic momentum highlights transfer students' preparation for learning at UDFW, as well as the "quality" and "quantity" of their academic experiences at UDFW. Specifically, transfer students' academic momentum is measured in the following areas: 1) if the student received an associate's degree, 2) number of transfer semester credit hours (SCH) accepted by UDFW, 3) math

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preparedness, 4) English preparedness, 5) number of SCHs completed in the first semester, and 6) first-semester GPA.

Other academic variables are also included in analysis, including students' enrollment status (i.e., full-time versus part-time), academic standing, classification (freshman, sophomore, junior, or senior) and time to degree.

### **Analytical Procedure**

I conducted descriptive analyses to provide an overview of the community college transfer student profile in both STEM and non-STEM programs in the first semester.

Additionally, for STEM and non-STEM students, I conducted a logistic regression analysis respectively to investigate to what extent transfer students' socio-demographic background characteristics and early academic momentum are associated with their likelihood of obtaining a degree within 10 years after transfer.

### **Limitations**

Prior to the discussion of the results, it is important to consider the limitations of the study. First, I used only one cohort of transfer students enrolled in a 4-year, public research university in fall 2006. The results of the study may not be generalized to community college students who transferred more recently, and those who study in other types of 4-year institutions. In the next steps of my research, I plan to include transfer students who enrolled in UDFW in the following semesters and examine the trends of the transfers. Second, I only focused on degree completion in 10 years and used this as the only outcome variable. If degree completion over different periods of time (i.e., 2-year graduation, 4-year graduation) are calculated and used as dependent variables, the results of the regression analyses may suggest different relationships between the independent variables and students' degree attainment. Degree attainment is

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important, but graduation within a reasonable timeframe is even more critical for students, as well as for higher education institutions. Thus, in my future study, I will include 2- and 4-year graduation as dependent variables in my analysis and investigate how students' background characteristics and early academic momentum are associated with their degree attainment within different time frames. Third, the current study does not differentiate degree completion by disciplines. Factors impacting STEM degree attainment may be different from the ones influencing non-STEM degree completion. Thus, I will focus on STEM degree attainment particularly and explore how early academic momentum contributes to students' degree completion. Thus, the findings can provide more insights into transfer students' STEM success. Finally, transfer students who are treated as non-recipients of bachelor's degrees in this study may be still enrolled in UDFW or have transferred to and graduated from a different institution. However, due to the limitation of the data, these students are grouped together with those who dropped without obtaining a degree by summer 2016.

### **Results**

#### **Descriptive Statistics**

**Socio-demographics.** Among the transfer students in the study, more than half (56.4%) were female, 40% were White, and the average age was 24.6 years (see Table 1). Almost 60% of the transfers were first-generation students, and nearly two thirds (64.4%) were eligible for the Pell grant. The average amount of financial aid that the transfers received was \$2,278.05 during their first semester. Almost all of the transfers lived off campus; only 6.2% resided in university apartments or residence halls.

**Academic Experiences Prior to UDFW.** The majority of the transfer students (84.6%) did not obtain an associate's degree prior to enrolling in UDFW. On average, approximately 18

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courses, or 54 transfer semester credit hours (SCH), were accepted by UDFW.

**Academic Experiences at UDFW.** Almost two thirds of the transfers (63.2%) enrolled in UDFW full time, and the majority (80.6%) were in good standing. The highest proportion (43.9%) of the transfers were classified as juniors, followed by sophomores (26.3%), and seniors (17.4%).

In terms of their academic studies, more than a quarter of the transfer students (25.5%) enrolled in the College of Business, followed by the College of Liberal Arts (18.6%), and the College of Nursing (13.8%).

Transfer students' math and English preparedness were measured by whether they had successfully completed, by the end of the first semester, at least one of the foundation math and English courses, respectively. In total, 69.3% and 84.7% of the transfers were prepared in math and English, respectively.

During the first semester at UDFW, on average, the transfer students took 3.7 courses, and successfully completed three of them. The average ratio of course completion for all transfers was 0.81. In other words, the transfer students, on average, completed approximately 81% of the courses that they attempted in the first semester at UDFW. The ratio of SCH completion followed a similar pattern.

Since being enrolled in fall 2006, only 56.4% of the transfer students graduated with a degree within 10 years (by Summer 2016). The other students were still enrolled, dropped out, or transferred to another institution. Among the students who graduated within 10 years after they transferred to UDFW, on average, they spent 3.2 years to obtain a bachelor's degree. Slightly over one-fifth (20.9%) of the transfers chose to pursue a STEM major in the first semester. However, only 11.6% of the students graduated with a STEM degree in 10 years.

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Table 1

*Descriptive Analysis of the Transfer Students*

Variables	STEM	Non-STEM	Total
<b>Socio-Demographics</b>			
Female (%)	41.6	60.3	56.4
Age (Mean)	23.9	24.7	24.6
<b>Race/Ethnicity (%)</b>			
African American	13.0	15.7	15.2
Asian	15.0	7.3	8.8
Hispanic	13.0	17.5	16.6
White	54.1	54.5	54.4
Other	35.4	27.2	31.3
Pell Eligibility (%)	65.4	64.2	64.4
First Generation (%)	60.8	58.8	59.2
Financial Aid (Mean)	2302.5	2271.6	2278.1
Off-campus Housing (%)	92.5	94.2	93.8
<b>Prior to UDFW</b>			
Associate Degree (%)	10.9	16.6	15.4
<b>Course-taking (Mean)</b>			
No. of Transfer Courses Accepted	17.2	18.5	18.2
No. of Transfer SCH Accepted	52.0	53.6	53.3
<b>UDFW</b>			
Full-Time Students (%)	64.5	62.8	63.2
Good Academic Standing (%)	74.5	82.2	80.6
<b>Classification (%)</b>			
Freshmen	13.8	12.1	12.5
Sophomore	27.4	26.0	26.3
Junior	40.5	44.8	43.9
Senior	18.3	17.1	17.4
Math Preparedness (%)	78.3	66.9	69.3
English Preparedness (%)	84.4	84.7	84.7

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Course-taking (Mean)			
No. of UTA Courses Attempted	3.8	3.6	3.7
No. of UTA Courses Completed	3.0	3.0	3.0
No. of SCH Attempted	10.9	10.8	10.8
No. of UTA SCH Completed	8.1	8.9	8.7
Average Ratio of UTA Course Completed	76.0	82.2	80.9
Average Ratio of SCH Completed	74.2	82.1	80.5
First-Semester GPA (Mean)	2.13	2.44	2.38
Time to Degree (Mean)	3.5	3.1	3.2

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### Comparison between STEM and non-STEM Majors

The descriptive analysis results show that differences exist between transfer students enrolled in STEM and non-STEM majors at UDFW. For instance, slightly over 40% of STEM majors were female, while female students in non-STEM majors made up 60%. Asian students were over-represented in STEM majors. More specifically, the proportion of Asian students in STEM was twice as many as in non-STEM majors (15.0% compared to 7.3%). While only 10.9% of the transfers pursuing STEM obtained an associate's degree, 16.6% of non-STEM students were associate's degree recipients. While a comparable percentage of STEM and non-STEM majors were prepared for English, a much higher proportion of STEM majors (78.3%) were prepared for math, compared to non-STEM majors (66.9%).

During the first semester, the average completion ratio of courses for STEM students was lower. More specifically, on average, STEM majors successfully completed about 76% of the courses that they attempted, while non-STEM students completed more than 80% of the courses attempted. The average ratio of SCH completed followed a similar pattern. Among transfer students who graduated with a bachelor's degree by summer 2016, STEM majors on average spent 3.5 years at UDFW, while non-STEM majors stayed at UDFW for slightly over 3 years

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before graduation. When examining the first-semester GPA, non-STEM majors outperformed their counterparts enrolled in STEM programs (2.44 vs. 2.13).

### Logistic Regression Analysis

**STEM Majors.** The first logistic regression model focused on STEM majors and estimated their likelihood of graduating with a bachelor's degree. Being female is significantly associated with students' degree completion. More specifically, the odds of obtaining a degree increase by 7.0% for female students.

Table 2

*Logistic Regression Analysis for Transfer Students in STEM and Non-STEM Majors*

	STEM		Non-STEM	
	<i>B</i>	OR	<i>B</i>	OR
<b>Socio-Demographics</b>				
Female (Male=ref)	0.070 *	1.073	0.388 **	1.475
Race/Ethnicity (White=ref)				
Asian	-0.270	0.763	-0.306	0.737
Black/African American	0.361	1.435	-0.112	0.894
Hispanic	0.425	1.530	0.039	1.039
Other	0.192	1.212	0.016	1.016
Age	-0.028	0.972	-0.008	0.992
Pell Eligibility	0.347	1.416	0.203	1.225
First Generation	-0.198	0.820	-0.189	0.827
<b>Academic Momentum</b>				
Associate's Degree	0.338	1.402	0.090	1.095
No. of Transfer SCHs Accepted	0.003	1.003	0.009 **	1.009
Math Preparedness	0.398	1.489	0.417 **	1.518
English Preparedness	-0.754	0.470	-0.525	0.592
No. of UTA SCHs Completed	0.116 *	1.123	0.064 *	1.066
First-semester GPA	0.569 **	1.767	0.712 ***	2.038

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

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Among all the early academic momentum variables entered in the regression equation, only the number of completed SCH and the first-semester GPA are significantly associated with the outcome variable (see Table 2). That is, when there is a 1-point increase in the number of SCH completed in the first semester, the odds of graduating with a bachelor's degree increase by 12.3%. When students receive a 1-point increase in their first-semester GPA, the odds of obtaining a degree increase by 76.7%. Other variables do not have a significant association with the outcome variable.

**Non-STEM Majors.** Another logistic regression was conducted focusing on non-STEM majors. Among the socio-demographic variables, being female is significantly associated with the likelihood of obtaining a bachelor's degree in 10 years. In other words, the odds of obtaining a degree increase by 38.8% for female students. Although receiving an associate's degree was not found to be significantly associated with obtaining a degree, the number of transfer SCH accepted by UDFW has a positive association with degree attainment. That is, controlling for other independent variables in the model, the odds of receiving a bachelor's degree increase by 0.9% when there is one additional transfer SCH accepted by UDFW. Students who have passed at least one math course (1301 or above) are more likely to graduate with a bachelor's degree. In other words, the odds of obtaining a degree is estimated to increase by 51.8% when the student passed at least one math course in the first semester. The total number of SCHs and GPAs obtained at UDFW during the first semester have a positive relationship with the odds of obtaining a bachelor's degree. More specifically, controlling for other independent variables in the model, the odds of graduating with a degree increase by 6.6% when the student receives one more SCH in the first semester. Similarly, the odds of obtaining a degree increase by 103.8% for every 1-point increase in the first-semester GPA.

### **Discussion and Conclusion**

Focusing on community college transfer students, this study investigated early academic momentum, which consists of a group of important variables pertaining to the transfers' academic experiences before and after their enrollment in the UDFW. It also examined how transfer students' background characteristics and early academic momentum differ by their majors (STEM vs. non-STEM), and how they are associated with degree attainment for STEM and non-STEM students, respectively.

Overall, the results of the study suggest that transfer students enrolled in STEM and non-STEM programs share common characteristics but differ in several key background and academic momentum variables. For instance, STEM majors are more likely to be male students, identified as Asian, and more likely to take at least one of the foundation math courses by the end of the first semester. Compared to their non-STEM counterparts, STEM students are less likely to receive an associate degree prior to their transfer and tend to have a lower ratio of course and SCH completion.

For both STEM and non-STEM majors, the number of SCHs that they successfully completed and their GPA in the first semester are associated with their degree attainment. Female students are more likely to graduate with a degree when compared with their male counterparts. Additionally, for non-STEM students, two other early academic momentum variables (the number of transfer SCHs accepted and math preparedness, are also associated with the likelihood of obtaining a degree.

Similar with previous studies (e.g., Adamuti-Trache & Andres, 2008; Buchmann & DiPrete, 2006; Crisp, Nora, & Taggart, 2009; Malcom, 2010; Peng, Wright, & Hill, 1995; Scott & Mallinckrodt, 2005; Wang, 2013), gender is found to be a variable that differentiates STEM

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postsecondary choice and degree attainment. The gap in the proportion of female students in STEM and non-STEM majors suggests again that female students are less likely to be attracted to STEM fields of study. While women students should have the freedom to choose majors that they desire the most, such “freedom” is often constrained by gender stereotypes that think women are less capable of studying math and science (Ceci, Williams, & Barnett, 2009). When considering degree completion, female students are more likely to earn a degree. It is clear that different patterns exist for male and female transfer students regarding their STEM interests and degree completion. This finding implies that male and female transfers may experience different challenges as they progress towards a bachelor’s degree and, thus, educational programs and activities need to be tailored to respond to the specific needs of transfer students in both gender groups.

For students in both STEM and non-STEM majors, the results indicate that community college transfers who obtained more SCHs and received better grades in the first semester are more likely to graduate with a bachelor’s degree. This finding implies that transfer students’ first-year academic experiences are important for their degree attainment. This finding is not surprising, since numerous studies have identified GPA as a strong predictor of students’ academic success (Tyson, et al., 2007; Wang, 2013). Researchers have also indicated that transfer students tend to experience “transfer shock,” and are more likely to experience academic and social challenges during the first year on a new campus. To ensure transfer students’ good performance during their first semester, faculty, advisors, and other educational practitioners need to be aware of the unique challenges that transfer students face, and thus provide educational programs that can best meet their needs.

The study findings also show that, although the differences are small, the STEM majors

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transferred a lower number of courses and SCHs to UDFW compared to their non-STEM peers. Additionally, the number of transfer SCHs accepted was only found to be important for degree attainment for non-STEM students. The study findings may indicate that STEM programs in the 4-year university may require students to take more courses at the 4-year level and that fewer courses taken previously would be recognized by the institution. This may also indicate that the transfer requirement for students pursuing STEM and non-STEM majors are different. To better assist community college students' transition, advisors at both 2- and 4-year institutions need to understand different paths that transfer students take and requirements specific to their discipline that the students choose to pursue.

Although this study is still at a preliminary stage and the concept of the early academic momentum for transfer students needs to be further developed, it makes a unique contribution to the current literature, practice, and policy. The study findings show that academic momentum may be defined differently for students in STEM and non-STEM fields of study, and the extent to which it impacts transfer students' degree attainment might be different. Future studies may examine early academic momentum by including more academic variables and examining differences and similarities across different disciplines. Studies focusing on early academic momentum would provide researchers, educators, and administrators better understandings about how early academic experiences impact students' long-term success, and thus providing early prevention and intervention programs that can best assist transfer students.

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