



Where Do All the Pre-Majors go? A Self-Study of Student Stumbling Points in the Pre-Construction Curriculum

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Abstract

Enrollment figures for the construction program at Texas State University indicate an imbalance in the ratio between pre-majors and matriculated majors. The pre-major program is designed to take three semesters but contains two-thirds of the majors in the construction program. This paper reports on the work in progress self-study to determine the stumbling points for students in this pre-major program. Institutional research data will be used to identify courses in the pre-construction curriculum with the highest rates of students receiving unsatisfactory grades (D, F, or W) for credit in order to identify any courses creating an unintended gate to matriculation. In addition to the examination of course grades, student enrollment and retention data will be examined to determine if there is any disparate effect of the pre-major program on a particular group. The self-study is ongoing and will eventually include surveys on student belonging in major and motivations, these initial results show that there are some non-major courses in the pre-major program with high DFW rates that could be causing student to take longer to matriculate or drop out of the major. Further, an examination of retention rates showed that, although there is some variation over the years, typically females and minority students are retained at lower rates than their male and white counterparts. This self-study is presented in order to highlight any issues unique to construction majors that could be common across construction programs.

Introduction and Context

The construction engineering technology/construction science and management program at Texas State University features a pre-major program wherein students must complete their math, science, and several introductory level construction & engineering technology courses in order to apply to matriculate to the construction major. This pre-construction program is intended to take three semesters, owing to a chain of three courses linked by pre-requisites, although the required courses only contain 30 hours of semester credits. All courses within this pre-major program must be completed with a C or higher and the overall GPA amongst these 30 hours must be a 2.5 in order to matriculate. As three of the eight semesters of the program represent 38% of a student's time in the degree, the expected proportion of pre-construction students to all construction students is approximately 40% of the population. Figure 1 presents the program's enrollment trends over the last nine years, which shows the unexpectedly high proportion of pre-majors to matriculated majors.

The pre-construction program was introduced when the degree was modified from an Industrial Technology major to an Engineering Technology/Construction Management major, it was initially implemented as a series of pre-requisites to take upper level courses. When the pre-construction program was modified to be a pre-major program in the Fall 2014 Catalog (so that

students enrolling in the major were initially enrolled as pre-majors), the proportion of students in pre-construction quickly swelled to 80% of the construction student population, as shown in Figure 1. An investigation at that time found that many students assumed that matriculation was automatic (note: it is not). As the registration system was only set up to check for the prerequisite courses, students were able to register for upper division

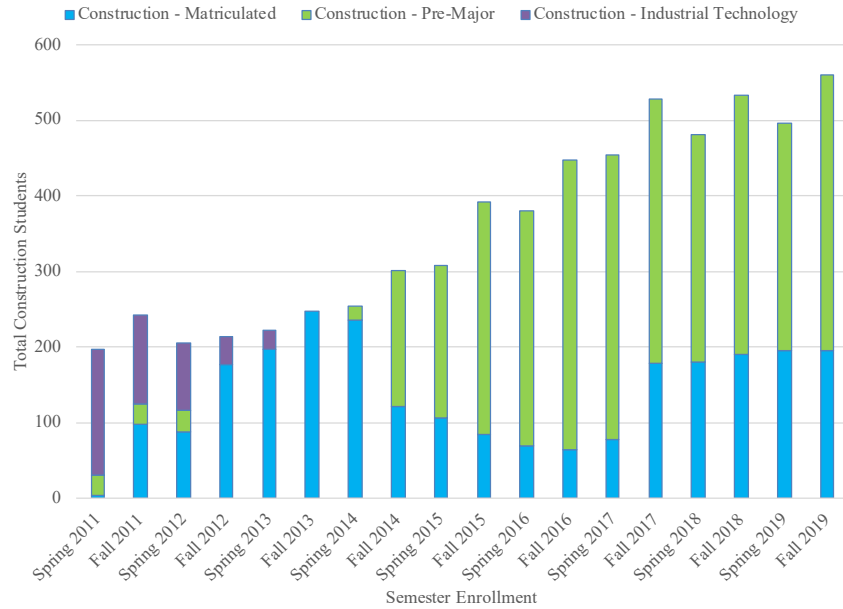


Figure 1: Construction Major Enrollment Trends

courses while still enrolled as pre-construction majors. To address this reason for over-representation in the pre-construction program, a change was made in Fall 2017 that the upper division course prerequisites were to be a matriculated major, which is a program restriction, in order to register for upper division courses. This change addressed the students who had simply never applied to matriculate, but had completed the requirements, as they now were forced to matriculate to continue their studies. Since Fall 2017, the percentage of pre-construction majors has been steady in the 60-65% range of the total construction student population. This percentage is still much higher than what was anticipated based upon academic requirements.

Background

The two needs identified in the self-study (retention and academic support) lead to the theoretical underpinning of this proposed study, Tinto's theory of student engagement and retention [1975, 1993]. The theory identifies the pre-academic individual's identity, educational and social experiences, and family influence as both "predictors of and reflections... in that collegiate environment" (Tinto, 1975, p. 96). Tinto argues that the more integrated the individual is in the institution, both academically and socially, the greater the commitment they will have to complete their studies. Figure 2 is a graphic of Tinto's Model of Engagement with the points in red graphics of where we will focus our research.

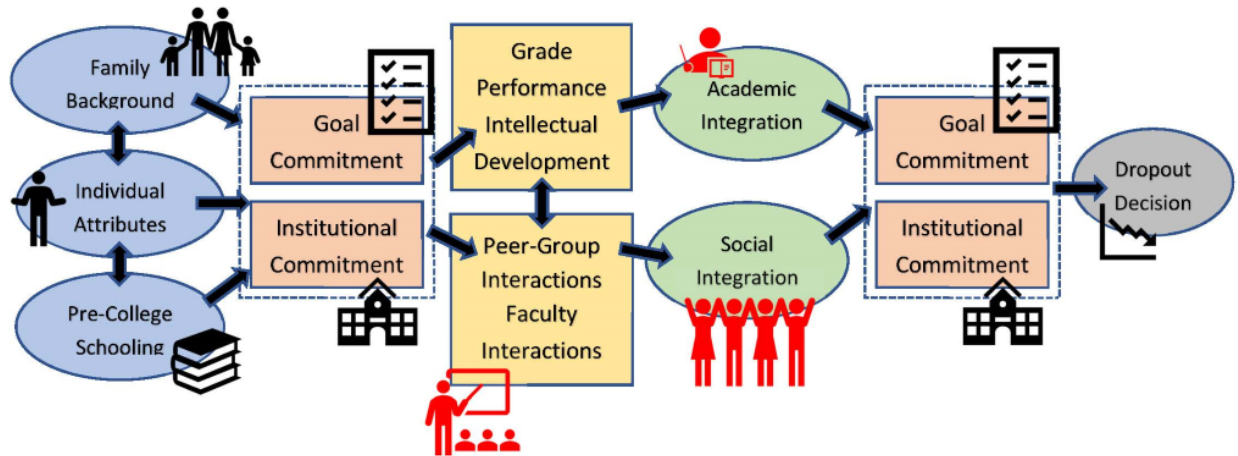


Figure 2: Tinto's (1975) Model of Engagement

Per Tinto's model, a student can be academically integrated, but if they are not socially integrated, they may change institutions. We propose to measure these interventions through belonging to their major, which is a proxy for the student's commitment to their goals and institutional retention.

In the study of student retention, multiple research found that creating of a sense of belonging is essential for student retention (Latona and Browne 2001; Pearson 2012, p.191. and O'Keeffe 2013). Belonging is a universal human need (Baumeister and Leary, 1995), wherein people tend to look around them and compare their various identities (identity as major, identity as gender, identity as family role, etc.) to those in their group (Walton & Cohen, 2007). Greater overlap leads to greater belonging within the group. Those who do not see themselves as fully part of the group tend to be more sensitive to their differences than those who do not (Hogg, Terry, & White, 1995). Murphy, et al (2007) explain that women in male-dominated fields are more likely to experience prejudice and discrimination (Inzlicht & Ben-Zeev, 2000 and Inzlicht, et al 2005, Adams et al, 2006) against them and that these experiences can decrease belonging. The Department of Engineering Technology student population is only 11% female and, as such, these students are certainly an outgroup in male-dominated fields. Marra et. al 2012 looked at engineering students and found that the lack of belonging was a strong indicator in student's decision to leave the field, even when controlled for gender, indicating the importance of student belonging is not dependent on gender. Women are not the only students at risk of feeling part of the outgroup, indeed the challenges for students of color are multifaceted: overcoming stereotypes held by majority peers and thus feeling very isolated, often being first generation and feeling tremendous pressure to succeed, and even just trying to navigate expected roles and expectations within group work can be daunting (Hunn 2014). A low sense of belonging amongst minority students as a group has been found to be a strong link to dropping out of the program (Just 1999, Swail et al 2003, Zea et al 1997). Belonging uncertainty is when someone questions whether they belong to a group [aka their social ties], and this questioning can be triggered by any number of different events (Walton & Cohen, 2007). The events don't have to be overtly discriminatory, stressful, or targeted. Those individuals who have some underlying uncertainty about their belonging in the group will be more sensitive to these triggers (Walton & Cohen, 2007). Mendoza-Denton et al. (2006) indicate that social support can mitigate these chilling effects. Further, Mendoza-Denton et al. (2006) cited mentoring and cross-group

friendships (so forming friendships with those in the other group – between genders or between ethnicities/races, e.g.) as forms of social support that they found to have such a mitigating effect. Therefore, the proposed student tutoring and resource center is also planned to provide some social events to encourage student friendships, such as these important cross-group friendships in addition to the natural mentoring that can develop through tutoring.

Belonging has been tied to self-efficacy and engagement, which also are tied to positive career outcomes (aka persistence in their field) (Walker & Greene, 2009). Student engagement is tied to positive social support, and therefore this proposal strives to provide these supports. When students are more engaged in their studies that they positively identify with it (Schaufeli et al, 2001) and are more likely to find resources that help them to succeed (Xanthopoulou et al, 2009). Thus, students who are engaged will be more likely to overcome slights based upon their out-group status and instead persevere to reach their goals because they will seek out and find the supports they need, but those students who are not engaged are still at risk.

Within the varied studies on belonging, three forms of student belonging have been explored as sources of student persistence: belonging to the institution, belonging to the major, and belonging to the classroom (Baumeister and Leary, 1995; Freeman et al, 2007; Strayhorn, 2012; Zumbunn et al, 2014; and Wilson et al, 2015). While the differing types of belonging have some differing triggers, there are several items that emerge as the most common: positive interactions with faculty and positive interactions with fellow students. Multiple researchers (Chickering & Gamson, 1987; Glennen, Farren, & Vowell, 1996; and Heisserer and Parette 2002) found that students, at minimum, need one solid connection at the university to build a sense of belonging and improve their retention odds. Komarrju et al (2010, p.332) states the same, but that specifically the connection should be to a faculty member. Positive faculty interactions include the faculty sending outside of class communications, learning student names, and generally showing an interest in the students (Jaasma and Koper, 1999; Myers, 2004; Martin, Myers and Mottet, 1999; Wolf-Wendel, Ward and Kinzie, 2009; Freeman et al, 2007; Rocca, 2010; and Komarrju et al, 2010). The students' interactions with other students are especially powerful when they include discussion of class materials outside of the classroom (Hurtado and Carter, 1997, and Hurtado et al, 2007). These two main threads of positive interactions with faculty and with other students are drivers behind a key component of the proposed research intervention plan: creating a major-specific support center that offers tutoring from in major peers as well as faculty coffee hours to foster positive interactions such as mentoring and informal advising. In O'Keeffe's study of college retention, they found that, "the creation of a caring, supportive and welcoming environment within the university is critical in creating a sense of belonging" (O'Keeffe, 2013 p. 1). This finding is an important informant for creating the culture of the peer-tutoring and resource center: to purposefully strive to be welcoming and caring.

Where supplemental instruction (SI) programs provide peer-led activities to enhance a course's learning, Ora (2012) notes that "SI targets high-risk courses, rather than 'at-risk' students" (p. 1). SI Leaders are trained in learning theories and are then tasked with assisting students with course content and study skills, however, Ora questions why the SI program's results show increased GPA for the semester students receive SI assistance, but that semesters to follow do not show this improvement. Further, students typically volunteer to receive SI assistance, Ora argues that these students already exhibit the motivation for success and is not surprised on their

persistence to graduation. It is the other “at risk” students that do not volunteer for SI that our proposed tutoring center is aimed. Per Emblom-Callahan (2019), it is the under-prepared students that need additional lessons in “time management and study skills that help students beyond the scope of one course” (p. 6).

Results

This study is planned to look at what student success challenges our pre-construction majors are encountering that are preventing timely matriculation and to implement proven strategies to address these problems. As part of our self-study, we have examined the DFW rates, or rates of which students earn a D, F, or withdraw from a course, for the courses in the pre-construction curriculum. As shown in Figure 3, pre-calculus mathematics and engineering chemistry, by far, are the two courses that have the highest DFW rates within this grouping. The university’s student success initiatives fund Supplemental Instruction for these courses and free tutors in the SLAC, which is located within the university library. Supplemental Instruction (SI) is a peer tutoring model in which the SI leaders are students who previously did well in the course they are tutoring. These SI leaders attend lectures alongside the students they are tutoring and then hold additional lectures for small groups of the students enrolled in the course. Despite these student success efforts, the DFW rates are still quite high for these courses and it is hypothesized that these two courses are at least partially responsible for students getting stuck in the pre-construction sequence.

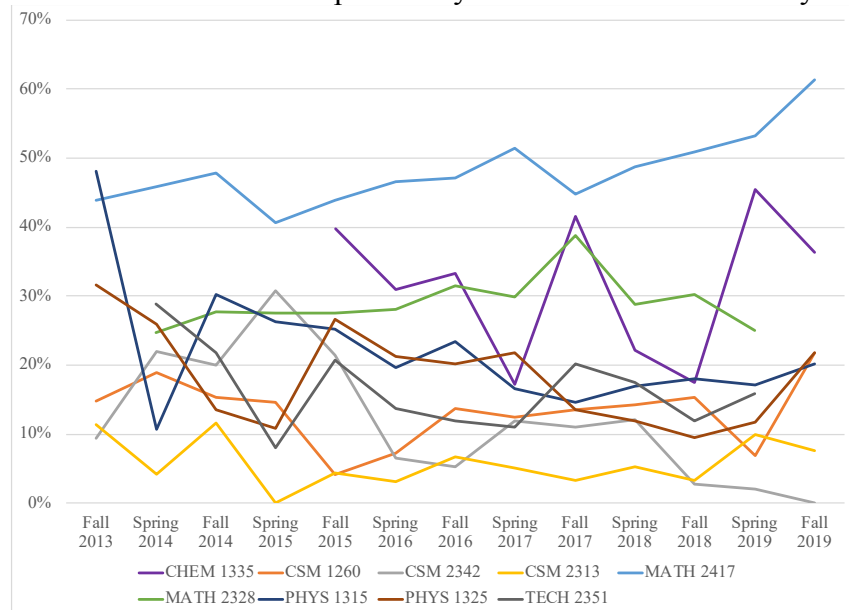


Figure 3: DFW Rates of Pre-Construction Curriculum

In addition to student performance in the pre-construction curriculum, the research team examined trends in retention. Figure 4 presents the one-year retention rates by cohort for first-time students (ie freshmen returning for their sophomore year) for both the construction majors and the university average for those same periods. Note that the university value includes students who have changed majors, but are still enrolled at the university, whereas the construction number only includes students remaining in the same major.

Figure 5 presents one-year retention data for transfer students for both the construction major and for the university. Again, the university percentage includes students who have changed majors and are still enrolled at the university whereas the construction value includes only students who are still enrolled as construction students. That the construction transfer student retention rate is as high as the university's rate indicates a relatively high rate of transfer student retention. These two representations of retention data show that there is a greater gap in construction student retention amongst first-time students than amongst transfer students. Further investigation would be needed to discover if most transfer students arrive with their math and chemistry courses already completed, however the research team's anecdotal experience with transfer students is that their prior coursework varies widely. The research team therefore hypothesizes that the difference in retention between first-time students and transfer students is that these student groups vary in their sense of major belonging and/or motivation.

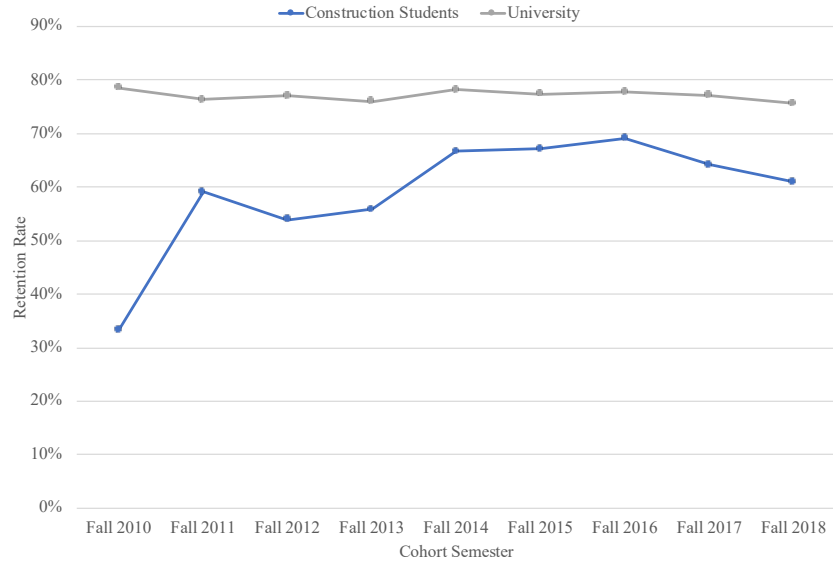


Figure 4: One-year Retention Rates of First-Time Students

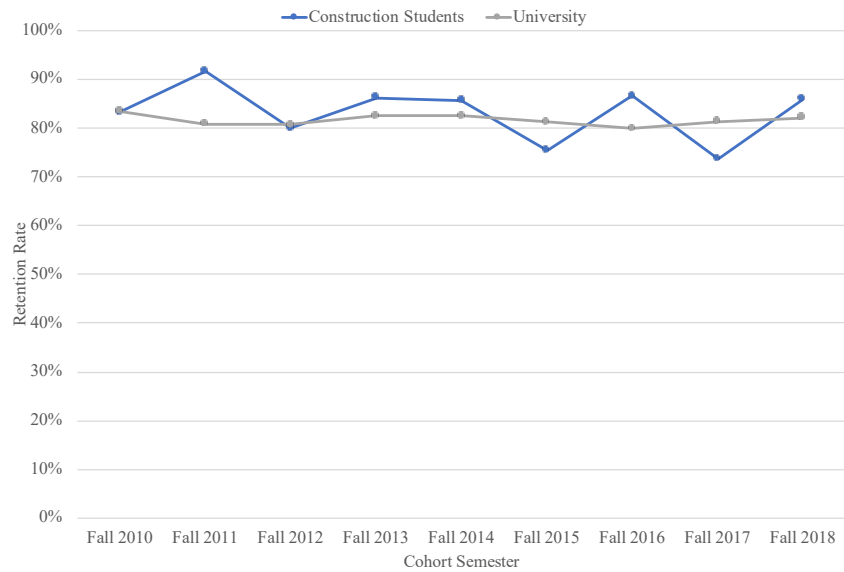


Figure 5: One-year Retention Rates for Transfer Students

Additional investigation of first-time student retention trends investigated influence of gender or ethnicity. Figure 6 presents these retention rates by gender. The small number of female construction majors, especially through 2014 caused the dramatic results to that point. From 2015, there have been sufficient female students to look at trends in retention and see that it has been improving, but more data will be needed to see if this trend holds.

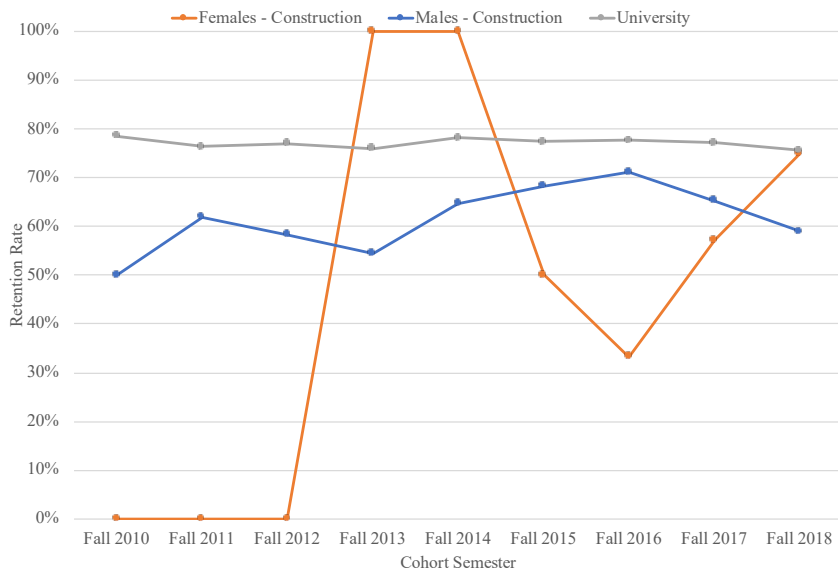


Figure 6: One-year Retention of First-Time Construction Students by Gender

Figure 7 presents one-year retention rates of first-time students by race/ethnicity for the two dominant groups in the major: Hispanic and White, non-Hispanic students. There have been a few years wherein Hispanic students were retained at a higher rate than their White, non-Hispanic counterparts. The greater trend, however, has been that the White, non-Hispanics students are retained at a higher percentage than the Hispanic students.

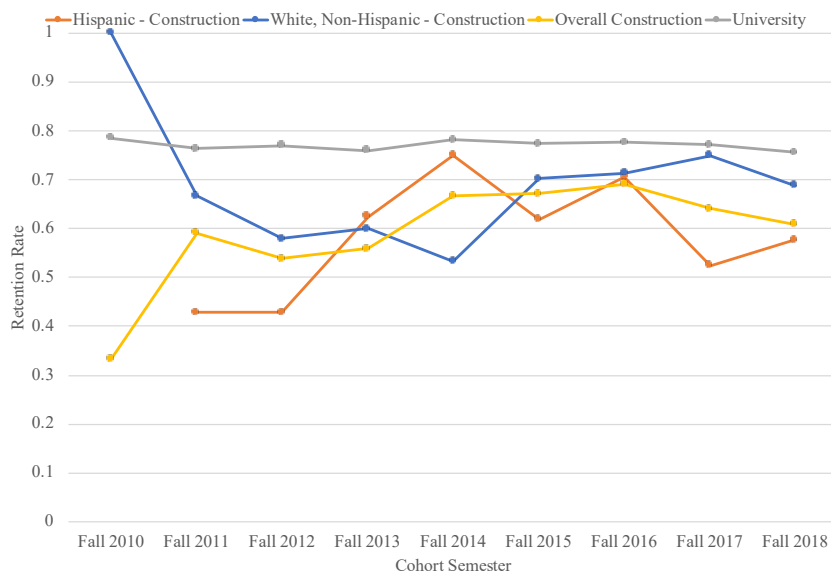


Figure 7: One-year Retention of First-Time Construction Students by Race/Ethnicity

Conclusions and Future Work

This work-in-progress project has shown that there are a few classes in the pre-construction curriculum that are most likely to cause issues with student progression (including Mathematics and Chemistry). Further, the retention of transfer students was not a significant issue, perhaps

because these students have already taken some of the courses with the highest DFW rates, although this theory is unconfirmed. By looking at gender and ethnicity, there are differences in student retention rates. While there is variation, the overall trend has been that females and minorities have been retained at lower rates than males and white students, respectively.

In addition to the examination of institutional data, students will be surveyed at two key points in their pre-major curriculum: in the freshmen introductory course and as they apply for matriculation. The survey will focus on student belonging in the major and their motivation to learn, using validated instruments. Further, the survey will ask students how many semesters they have been in pre-construction and allow for short answer responses as to their perceived challenges with the pre-major program. The combined focus on classroom and social aspects of the pre-major college experience is designed to gain a clear picture of students' stumbling points so that future work can design an intervention using empirical research to ameliorate these issues.

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