Leaving Before Completing: How Course Withdrawal Predicts College Student Success

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Course withdrawal is common among college students, but scant empirical research has explored the effects of course withdrawal on student outcomes (e.g., persistence, degree attainment). Using statewide administrative data from Texas (N=605,362), we estimate the relationship between course withdrawal and student outcomes, finding that course withdrawal rates usually affect time to degree and degree attainment. We also find that time to degree increases as the withdrawal rate increases; the more students withdraw from courses, the fewer excess credits they accumulate. We also discover nuance in degree attainment, as data suggests a 4% withdrawal rate (about one or two courses withdrawn) may start erosion of a student's degree progress, as evidenced by this study's data. Moreover, further course withdrawals diminished a student's probability of earning a degree. We conclude by discussing implications for practice, policy, and future research.
Keywords: course withdrawal, degree attainment, time to degree, excess credits

Although decades of research investigated why students leave higher education before earning a degree (Bean, 2005; Goldrick-Rab et al., 2016; Johnson et al., 2014; Kuh et al., 2008; Tight, 2020; Tinto, 1975, 1994, 2006), little is known about the effects of course withdrawal on student outcomes. Course withdrawal, or a student withdrawing from a course before completing it, contributed to lower persistence and higher dropout rates in secondary school settings (Finn, 1989). However, most research exploring student persistence in higher education focused on the impacts of financial aid (Goldrick-Rab et al., 2016), student engagement (Kuh et al., 2008), or campus climate (Johnson et al., 2014) as reasons for college students dropping out. Given the sizable gap in the literature, it should be critical for researchers to examine how course withdrawal influences college student outcomes.

The research community already knows that 44% of first-time degree-seeking college starters did not earn any credential within six years of matriculation (author's calculations, Beginning Postsecondary Students (BPS): 12/17), suggesting that many college students take on educational debt and do not have a postsecondary credential to show for it. The research community also knows that college degree attainment has become more important than ever before for individual success and may help individuals overcome existing socioeconomic and educational inequalities (Carnevale et al., 2011; Haveman & Smeeding, 2006). Yet, the COVID-19 pandemic widened existing inequalities in higher education (Ice et al., 2021; U.S. Bureau of Labor Statistics, 2021), as thousands of college students withdrew from their coursework through the pandemic and did not earn a credential. Understanding the consequences of course withdrawal can inform higher education stakeholders to develop policies and practices for improving college student outcomes, especially as it relates to college students accumulating excess credits and threatening their financial aid eligibility by surpassing their federally mandated maximum timeframe to degree and amassing educational debt from paying for college courses that a student withdrew from which did not contribute to their degree progress.

As a result, this study makes a novel contribution to the literature by rigorously investigating how course withdrawal impacts several college student outcomes using one of the largest longitudinal postsecondary datasets in the United States. Subsequently, this study addresses a simple but impactful research question: What is the relationship between course withdrawal rate and college student outcomes (degree attainment, time to degree, and total excess credits)?

By answering this question, stakeholders, including college students, will better understand how course withdrawal affects student outcomes and how to carefully plan course enrollment plans that support persistence and degree attainment. Moreover, institutional policymakers and leaders can use this study's findings to

justify targeted interventions to identify course withdrawal patterns and discuss course planning and academic support with their students. If these interventions can be implemented, course withdrawal rates may decrease, thus increasing the odds of a college student earning a degree while also taking fewer courses and compiling less educational debt, a welcome development in postsecondary education for all stakeholders involved.

Literature Review

Simply put, college students must successfully finish their courses to earn grades and credits toward their degree. Course withdrawal is a form of non-course completion, meaning that when a college student withdraws from a course, that student has expended effort toward completing and paid for the course without earning a grade or credit toward their degree. As a result, the student paid tuition and fees for courses that do not count towards their degree. Institutions also withheld enrollment seats from other students who need and would fully pay for the courses (Adelman, 2005; Akos & James, 2020; McKinney et al., 2019; Nicholls & Gaede, 2014). Additionally, course withdrawal may lengthen completion time or increase total excess credits, endangering a student's financial aid eligibility (Nicholls & Gaede, 2014). It is critical to understand not only why college students withdraw from courses but also how course withdrawal impacts these students' outcomes.

To begin, college students often share more than one reason for dropping a course, suggesting they experience multiple circumstances contributing to course withdrawal (Bicak, 2024; Wheland et al., 2012). For example, students might withdraw due to personal or family issues during the semester (Michalski, 2014; Swager et al., 1995; Wheland et al., 2012) and then decide to discontinue their education. Thus, course withdrawal behaviors could indicate underlying factors leading to dropping out of college altogether. Also, because non-academic factors play more dominant roles in course withdrawal decisions among community college students than among university students (Conklin, 1997; Michalski, 2014), researchers suggest it is important to investigate these populations separately (Bicak, 2024).

There is limited research on the effects of course withdrawal on college students' long-term outcomes, such as degree completion, time to degree, or excess credit accumulation. Only two studies address the relationship between course withdrawal and student success. In both studies, excessive course withdrawals, which Adelman (1999, 2005, 2006) defined as withdrawing from 20% or more of courses attempted, were negatively linked to student outcomes. First, in the sole longitudinal study of course withdrawal, McKinney et al. (2019) used six years of data to examine the relationship between course withdrawal rates and student outcomes (i.e., earning a certificate or an associate degree and/or transferring to a four-year institution) in an

urban community college district in Texas. McKinney et al. (2019) found that students in a Texas community college district who withdrew from 20% or more of courses attempted experienced 44 % lower odds of community college credential completion or transfer to a four-year institution than those with lower course withdrawal rates. Thus, the researchers suggested that excessive course withdrawal behaviors may be related to lower student retention and achievement of student degree outcomes.

Akos and James (2020) also examined the relationship between course withdrawal and university student retention, finding that excessive course withdrawals correlate with reduced retention rates among university students from the first to the second year. Moreover, Akos and James (2020) found that students with higher incoming high school grade-point averages were much less likely to withdraw from a course than peers with lower grade-point averages, suggesting high school preparedness may be a predictor of course withdrawal patterns in higher education.

Additionally, there is limited research on the association between course withdrawal and time to degree and total excess credits. Nicholls and Gaede (2014) investigated the relationship between course withdrawals and time to degree among 1,979 engineering degree holders from the University of Alabama in Huntsville. Here, the researchers' primary finding was that students who withdrew from at least one course were much less likely to graduate than peers and that even one-course withdrawal was significantly associated with a longer time to graduation. However, Nicholls and Gaede (2014) did not control any other potential variables that can affect student degree completion, such as students' academic backgrounds.

Given this scant research, there are many reasons to build upon prior work (Akos & James, 2020; McKinney et al., 2019; Nicholls & Gaede, 2014). The scope of the research might be expanded, as previous studies drew data from a limited number of four-year campuses (Akos & James, 2020), one community college district (McKinney et al., 2019), core business courses at one four-year university (Boldt et al., 2017), and engineering students at one four-year institution (Nicholls & Gaede, 2014). This is especially important because meaningful differences may exist across sectors and samples. Only McKinney et al. (2019) conducted a six-year follow-up examination of the relationship between course withdrawal rates and student outcomes (earning a certificate or- an associate degree or transferring to a four-year institution) from a Texas urban community college district. Matching McKinney et al.'s (2019) six-year period, this study leverages statewide longitudinal data from the Texas Education Research Center to examine the relationships between credit withdrawal rate and student degree outcomes.

This study extends the scope of existing research by examining the relationship between course withdrawals and total excess credits, which were not explored in previous studies. This study offers additional knowledge about student outcomes beyond those examined in previous studies, such as community college credential completion (McKinney et al., 2019) or time to degree (Nicholls & Gaede, 2014). While Nicholls and Gaede (2014) compared average times to degree between students who withdrew from at least one course and those who did not, this study examines the relationship between course withdrawals and time to degree while controlling for additional covariates in regression models. This approach strengthens the literature and informs many educational stakeholders about college student course withdrawal and its relation to student outcomes.

Conceptual Framework

To inform the construction of key variables of interest and the inclusion of predictors in regression models, the research team relied on prior research on academic momentum and college student success. We employed the concept of *academic momentum* to contextualize factors that shape both student course withdrawal decisions and student success (Adelman, 1999, 2005, 2006; Attewell et al., 2012; Wang, 2017). Because the study focused on the role course withdrawal plays in shaping student degree outcomes, we also drew on the literature on understanding predictors of student outcomes and theories of *college persistence* (Bean & Metzner, 1985; Tinto, 1975, 1994, 2006). Those two theoretical concepts allowed the research team to identify variables relevant to this study's purposes: *academic momentum* and theories of *college persistence* helped us build regression models to estimate the relationship between course withdrawal rate and student degree outcomes while including other important statistical controls.

ACADEMIC MOMENTUM

Scholars in higher education borrowed the term *momentum* from the field of physics, in which it is defined as the product of mass and velocity, to describe factors that facilitate or impede progress in students' postsecondary trajectories (Adelman 1999, 2005, 2006; Attewell et al., 2012; Wang, 2017). The conceptual framework of *academic momentum* informed the identification of the variables the research team used in statistical models. As Wang (2017) has explained, individual and institutional factors either "collectively build" or "cause friction that reduces" momentum toward an educational outcome; in this process, students' various academic experiences can affect the "magnitude and direction of momentum," throughout the educational journey (p. 262). Students' academic histories, as captured through transcript data, show where a student has stalled or gained forward momentum (Adelman 1999, 2005, 2006; Belfield et al., 2016).

Course withdrawals may cause friction with student academic momentum by stalling student progress. While previous studies focused mainly on positive experiences that enhance students' academic progress, there is limited research on impediments to their momentum. However, a few studies have focused on course-taking behaviors that may have negative consequences on student success, including course withdrawal, incompletion, and repetition (Adelman, 1999; 2005; 2006; Akos & James, 2020; McKinney et al., 2019). As one critical factor, course withdrawal may lead to backward momentum, increasing time to degree or discouraging students' aspirations of earning a college credential altogether. In addition, taking developmental education courses has been found to reduce student's academic momentum toward desired outcomes (Bahr, 2008; Hagedorn et al., 2008; Leinbach & Jenkins, 2008; Lin et al., 2020; Schudde & Keisler, 2019). Furthermore, research suggests that summer enrollment and whether students enroll in 15 credits in the first year improve student academic momentum and lead to better outcomes (e.g., Attewell et al., 2012; Attewell & Douglas, 2014; Attewell & Monaghan, 2016). Gaining or reducing academic momentum could ultimately shape student course withdrawal decisions and degree outcomes. Controlling the variables from *academic momentum* theory allowed the research team to establish clear linkages between student course withdrawal and student success.

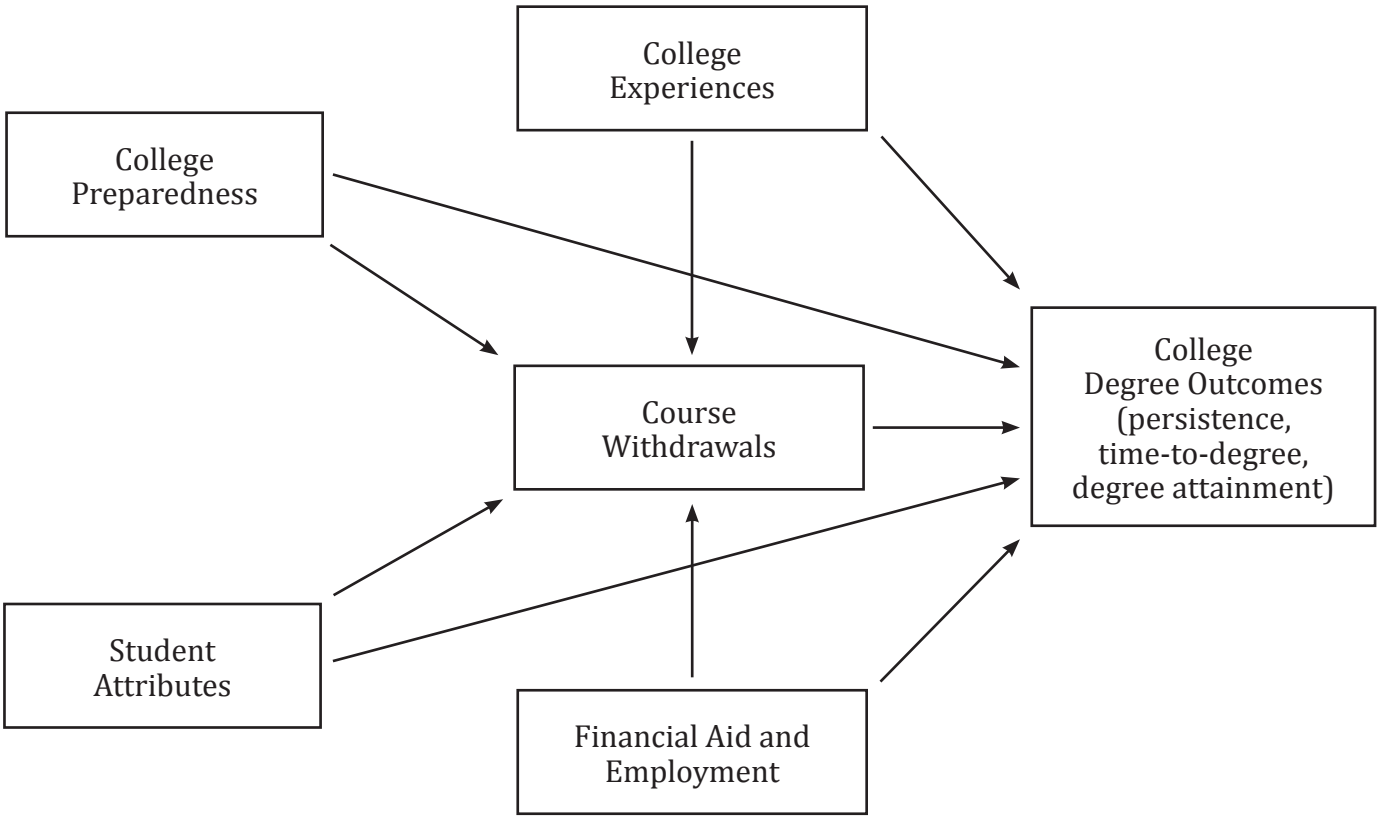
THEORIES OF STUDENT PERSISTENCE

Theories of *student persistence*, including Tinto's (1975) integration theory and Bean and Metzner's (1985) non-traditional student attrition model, highlight the importance of examining the longitudinal process of student persistence toward completion. Theories of student persistence guided this study's research design. Therefore, we conducted longitudinal data analyses to examine student degree outcomes. Tinto's student integration model focuses on the predictors of persistence, such as individual attributes and prior academic achievement (Tinto, 1975, 1994, 2006). However, some scholars have criticized Tinto's theory for focusing on traditional and White students in four-year colleges, excluding varied minoritized populations and non-residential campuses (Wiseley, 2009). Unlike Tinto's student integration model, the Bean-Metzner (1985) non-traditional student attrition model emphasizes external factors that may shape the trajectories of non-traditional students, including financial situations and hours working for pay (Wiseley, 2009). Taking variables from student persistence theories, such as student attributes and financial situations, into account in regression models allowed the research team to control for the link between student background characteristics, student experiences, and student degree outcomes.

Ultimately, Figure 1 below illustrates how concepts from *academic momentum* and *student persistence* shape college student degree outcomes, with our integration of course withdrawals providing additional insight:

Figure 1

Conceptualizing the Relationship between Course Withdrawals and College Degree Outcomes Through the Concept of Academic Momentum and Theories of College Persistence



Methods

Using the student-level statewide longitudinal datasets from the Texas Education Research Center (ERC), we describe the credit withdrawal rate as the total number of credits from courses withdrawn divided by the total number of credits attempted (Bicak, 2024). We use withdrawal rate and credit withdrawal rate (e.g., the rate of credit withdrawal) interchangeably throughout the paper. Finally, we applied logit and ordinary least squares (OLS) models to examine the direct relationship between credit withdrawal rate and student outcomes, paying respect to degree attainment, time to degree, and total excess credits.

DATA

For this study, we used data from the Texas Education Research Center (ERC), a repository for population-level longitudinal statewide administrative datasets. We

drew primarily from data provided by THECB (Texas Higher Education Coordinating Board), including enrollment data, student schedule (course transcript) data, graduation data, and financial aid data. We restricted the analytical sample to only public higher education in Texas because the ERC does not have course-taking data, which we could use to identify course withdrawals. This study focuses on first-time degree-seeking students at public two-year colleges.[1] (i.e., both technical and community colleges) and undergraduate enrollees at public universities in four fall cohorts (fall 2011-fall 2014). Overall, this study included three different analytic samples[2] (N=605,362): the community college-only sample (N=304,491), the transfer sample (N=79,763), and the university sample (N=221,108).

VARIABLE CONSTRUCTION

We calculated the rate of credit withdrawal (total withdrawn credits divided by total attempted credits) for each student. For the rate of credit withdrawal, we divided total withdrawn credits by total attempted credits from all courses that have reported grades (i.e., A, B, C, D, F, W (Withdrawn), credit/passed, or no credit/did not pass) (THECB, 2021a, pp. S.12). Throughout this report of the analysis, we use percentages for the credit withdrawal rate (e.g., 11% instead of 0.11).

Additionally, we used credit withdrawal rate as the main variable of interest when examining the association between withdrawal rate and student outcomes. Credit withdrawal rate may better represent student course-taking behaviors more accurately than a single measure of whether students ever withdrew from a course (Adelman, 1999). For example, in the case of two students who withdrew from a total of two courses (six credits), one of whom dropped out of the college after attempting 12 credits in the first semester and the other who graduated with a bachelor's degree after completing 120 credits. The first student withdrew from two courses (worth six credits) out of four courses attempted (12 credits). The second student also withdrew from two courses (six credits) out of 40 courses (120 credits). While the withdrawal rate is 50% (6/12) for the first student, the withdrawal rate is only 5% (6/120) for the second student.

[1] We use community college and public two-year college interchangeably. This study includes technical and vocational colleges under the umbrella of either of those phrases.

[2] We dropped students who took fewer than ten credits, as Adelman (1999) recommended.

To generate additional variables that we use in regression models, we relied on THECB files. We captured student background characteristics, including race/ethnicity, gender, age, residency status, student intent, and initial major. As the academic momentum literature suggests (Attewell et al., 2012; Attewell & Douglas, 2014), we constructed a variable for whether students took a course during a summer session of their first year. To control student college readiness, we identified whether students ever took a developmental education course during college (Jackson & Kurlaender, 2014). Also, to capture students' first-year academic momentum, we constructed the average semester credit loads in their first year's long semesters (fall and spring). Finally, we generated the final cumulative GPA in the final semester enrolled.

Using the THECB Financial Aid Database System (FADS), which provided measures of federal and state financial aid (e.g., recipients of Pell Grants or Texas Public Educational Grants), we captured whether students *ever* received a Pell Grant within six years of initial college enrollment. This variable (ever Pell Grant status) is a time-invariant variable, which means it does not change across time (Williams, 2015). By using wage data from Texas Workforce Commission (TWC) datasets, we created a variable for employment status (paid work) in the first year.

We also used degree attainment, time to degree, and total excess credits as outcome variables. To create measures capturing degree attainment and time to degree, we used graduation files from THECB datasets, including student certificates, associate degrees, and bachelor's degree attainment by month and year. We used an associate degree or certificate as a degree attainment outcome for the community college-only sample and bachelor's degree attainment for the transfer and university samples. When running analyses for time to degree and total excess credits as outcomes, we restricted the analytic samples to relevant degree holders (associate degree holders for the community college sample or bachelor's degree holders for the transfer and the university samples). We also intentionally excluded certificate completers from time to degree and excess credits analyses because the credit requirements and length of time for completion of a certificate vary more than for associate or bachelor's degrees. For example, while the communication certificate program requires 32 credits at Austin Community College (ACC), students only need to take 17 credits for the accounting certificate (ACC, 2021). Developing universal methods to calculate time to degree and excess credits is thus less feasible for certificate completers, as evidenced in this study.

We measured the exact time to degree in months by subtracting initial enrollment time from graduation time (within six years, given the follow-up period). An associate's degree, on average, requires 60 semester credit hours, and a bachelor's degree requires 120 semester credit hours (SCH)[3] We considered total excess credits of more than 60 for associate degree holders and more than 120 SCHs for bachelor's degree holders that students earned.[4] throughout the duration of the study at Texas public postsecondary institutions (Zeidenberg, 2015).

ANALYTIC METHODS

In this study, we employed ordinary least squares (OLS) regression models and logistic regression models to show the relationships between withdrawal rate and college student outcomes. We ran logistic regression models for binary outcomes (degree attainment) and OLS regression models for continuous outcomes (time to degree and total excess credits). The main independent variable of interest was the credit withdrawal rate. We ran models to predict associate degree or certificate attainment within six years of initial enrollment for the community college-only sample. For the transfer and the university samples, we ran one model to examine bachelor's degree attainment within six years of initial enrollment as an outcome. For all three models, we used logistic regression models to determine whether students earned a degree within six years of initial enrollment. The unit of analysis is at the student level, and we predicted student degree attainment outcome according to the following logit model:

$$\text{Log}\,(P/(1\text{-P})) = B_0 + B_1 W_{ijk} + B_2 W^2_{ijk} + B_3 S_{ijk} + \alpha_j + coh_k + \varepsilon_{ijk} \quad (2)$$

The outcome variable of interest, P, represents the probability of earning a degree within six years for student (i) at higher education institution (j) in cohort (k). As a main variable of interest, W_{ijk} indicates a continuous measure of withdrawal rate for student (i) at college (j) in cohort (k). To capture non-linear relationships between withdrawal and degree outcomes, we added the quadratic term of withdrawal rate

[3] When students did not earn enough credits for their degree (60 or 120 credits), we assumed excess credits were 0 instead of a negative value, following the example of previous studies (Fink et al., 2018; Schudde et al., 2022).

[4] Some researchers (Fink et al., 2018) used total credits attempted instead of total credits earned when calculating excess credits. However, in this study, we used total excess credits earned in this study. As withdrawn credits (independent variable) are a part of attempted credits (dependent variable), this violates the independence assumption when those two measures of credits are in regression models

(W^2_{ijk}) to the models. S_{ijk} represents a vector of student *i*'s time-invariant characteristics (such as race/ethnicity). α_j represents a vector of institutional fixed effects. coh_k represents a vector of cohort fixed effects. ε_{ijk} is the error term.

Employing ordinary least squares (OLS) regression, we predicted student time to the degree and total excess credits according to the following model:

$$Y\_ijk = B_0 + B_1 W_{ijk} + B_2 W^2_{ijk} + B_3 S_{ijk} + \alpha_j + coh_k + \varepsilon_{ijk} \quad (3)$$

Y represents the student's continuous outcomes of interest, specifically time to degree (measured by months) and total excess credits. Like equation 2, W_{ijk} represents a continuous variable of course withdrawal rate for student (*i*) at college (*j*) in cohort (*k*). Like the degree attainment model, we added the quadratic term of credit withdrawal rate (W_{ijk}) to the models. S_{ijk} represents a vector of student i's time-invariant characteristics, such as gender. α_j represents a vector of institutional fixed effects. coh_k represents a vector of cohort fixed effects. ε_{ijk} is the error term. B_1 and B_2 are the coefficient(s) we were interested in for both equation 2 and equation 3.

DESCRIPTIVE STATISTICS OF SAMPLE

Table 1 below displays variable counts, means, and percentages for the three analytic samples and the combined sample:

Table 1

Descriptive Statistics

	All (Combined Samples)		Community College Only Sample		Transfer Sample		University Sample	
	N	% (or mean)	N	% (or mean)	N	% (or mean)	N	% (or mean)
Race/Ethnicity								
Hispanic	240,628	39.7%	136,130	44.7%	31,180	39.1%	73,318	33.2%
White	217,112	35.9%	93,945	30.9%	33,042	41.4%	90,125	40.8%
Black	84,685	14.0%	48,426	15.9%	7,770	9.7%	28,489	12.9%
Asian	31,966	5.3%	9,451	3.1%	5,129	6.4%	17,386	7.9%
Native	3,309	0.5%	1,813	0.6%	427	0.5%	1,069	0.5%
Mixed	18,905	3.1%	8,722	2.9%	1,702	2.1%	8,481	3.8%
Unknown	8,757	1.4%	6,004	2.0%	513	0.6%	2,240	1.0%

Table 1 (Continued)								
	All (Combined Samples)		Community College-only Sample		Transfer Sample		University Sample	
	N	% (or mean)	N	% (or mean)	N	% (or mean)	N	% (or mean)
Women	321,947	53.2%	159,351	52.3%	44,321	55.6%	118,275	53.5%
Pell grant recipients	340,475	56.2%	186,536	61.3%	47,651	59.7%	106,288	48.1%
Residency Status								
Non-resident	33,936	5.6%	17,345	5.7%	2,527	3.2%	14,064	6.4%
Texas Resident	571,426	94.4%	287,146	94.3%	77,236	96.8%	207,044	93.6%
Student Initial Intent[a]								
Associate degree	203,616	33.6%	169,260	55.6%	34,356	43.1%		
Certificate	22,549	3.7%	21,054	6.9%	1,495	1.9%		
Transfer/bachelor's degree	107,204	17.7%	73,711	24.2%	33,493	42.0%		
Improve skills/enrichment	18,444	3.0%	16,279	5.3%	2,165	2.7%		
No response	32,441	5.4%	24,187	7.9%	8,254	10.3%		
Student Meta Majors								
Industrial, Manufacturing, and Construction	21,500	3.6%	15,263	5.0%	1,178	1.5%	5,059	2.3%
Natural Sciences	42,784	7.1%	9,568	3.1%	3,567	4.5%	29,649	13.4%
Business	61,427	10.1%	27,592	9.1%	8,394	10.5%	25,441	11.5%
Social and Behavioral sciences	26,742	4.4%	8,664	2.8%	2,635	3.3%	15,443	7.0%
Communication Sciences	11,101	1.8%	3,401	1.1%	928	1.2%	6,772	3.1%
Literature, Linguistic and Fine Arts	26,969	4.5%	10,157	3.3%	2,747	3.4%	14,065	6.4%
Math and Computer Sciences	18,529	3.1%	8,758	2.9%	2,449	3.1%	7,322	3.3%
Education, Social Services and Policy	41,768	6.9%	26,245	8.6%	6,834	8.6%	8,689	3.9%
Engineering and Related Fields	39,496	6.5%	11,736	3.9%	2,862	3.6%	24,898	11.3%
Humanities and Liberal Arts	199,650	33.0%	130,207	42.8%	37,849	47.5%	31,594	14.3%
Service Oriented	18,176	3.0%	8,009	2.6%	1,463	1.8%	8,704	3.9%
Health	63,612	10.5%	37,661	12.4%	6,030	7.6%	19,921	9.0%
Undecided/Undeclared	33,608	5.6%	7,230	2.4%	2,827	3.5%	23,551	10.7%

Table 1 (Continued)								
	All (Combined Samples)		Community College-only Sample		Transfer Sample		University Sample	
	N	% (or mean)	N	% (or mean)	N	% (or mean)	N	% (or mean)
Time to degree	213,523	42.7	40,821	37.3	43,901	50.6	128,801	41.7
Excess credits	213,523	11.5	40,821	18.9	43,901	12.8	128,801	8.7

While the table presents means for the continuous variables, such as age at college entry, the percentage is presented for categorical variables, such as race/ethnicity. While Hispanic students constitute the largest group in the community-college-only sample (44.7%), the largest group in the transfer and university samples is that of White students (around 41%). Black students represent higher proportions of the community college-only sample and university sample (12.9%) than of the transfer sample, at 15.9%, 12.9%, and 9.7%, respectively. A significant proportion of students in all samples were in-state students (more than 94%). More than half (55.6%) of community college students intended to earn an associate degree. Among community college transfer students, 43.1% intended to earn an associate degree, and 42% intended to earn a bachelor's degree. Humanities and liberal arts majors were the most common majors among community college-only students and transfer students, at 42.8% and 47.5% of students in each sample, respectively. The share of liberal arts or humanities majors was significantly lower among the university sample (only 14.3%), though it was still the most common major. Cumulative GPAs were higher among transfer students than students in the university and community college-only samples.

Results

We present the findings from regression analyses, which examine the relationship between credit withdrawal rates and student degree outcomes (degree attainment, time to degree, and excess credits). Table 2 displays logistic regression models examining the relationship between credit withdrawal rate (proportion of total credits withdrawn out of all attempted credits) and student degree attainment within six years of initial enrollment.

Table 2

Logistic Regression Results Examining Relationships Between Credit Withdrawal Rate and Student Degree Attainment within Six-Years

	Community College	Transfer	University
Withdrawal Rate	1.019***	0.938***	1.070***
	(0.002)	(0.004)	(0.004)
Withdrawal Rate (Quadratic)	0.998***	0.996***	0.990***
	(0.000)	(0.000)	(0.000)
Student Variables	X	X	X
Cohort Fixed Effects	X	X	X
Institution Fixed Effects	X	X	X
Observations	304,490	79,761	221,101

Notes: The table presents odds ratios with standard errors in parentheses from logistic regression models performed, where each column represents a separate sample (the community college-only, the community college transfer and university samples). Certificate or/and associate degree were used in the community college-only sample while bachelor's degree was used in the transfer and university samples. All models include student variables (race, gender, age at the college entry, student intention, residency status in initial enrollment, student meta majors, ever Pell grant status, worked for pay in the first year, summer enrollment in the first year, average semester credits in the first year, ever earned developmental education credits, and total cumulative GPA). All models include cohort fixed effects and institution fixed effects. One observation from the community college-only sample, 2 observations from the transfer sample and 7 observations from the university sample were dropped due to multicollinearity when using institutional fixed effects.
*** p<0.001, ** p<0.01, * p<0.05

All three models in Table 2 included both the withdrawal rate and the quadratic term of withdrawal rate. Including the quadratic term in the regression models allowed the regression lines to better fit the data, allowing a more precise estimation of the relationship between withdrawal rate and student outcomes, which was also important given the large sample size. It also allowed the research team to examine whether lower rates of credit withdrawal might have differential correlations with student outcomes than higher rates of credit withdrawal.

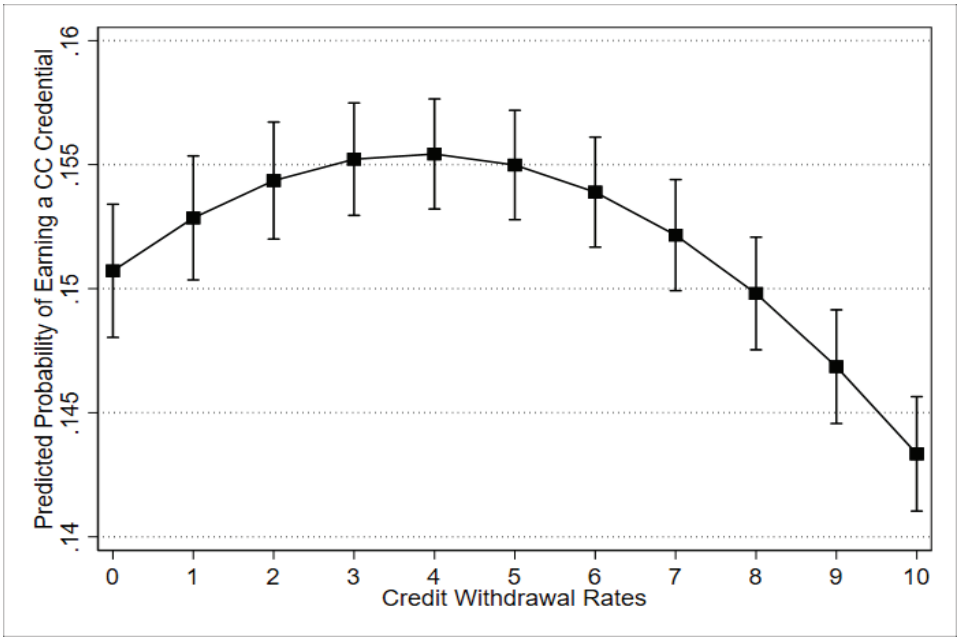
Odds ratios are reported in all logistic regression models. A greater than 1 odds ratio indicates a positive relationship between an independent variable and an outcome variable, while a lower than 1 odds ratio indicates a negative relationship. If odds ratios from those two withdrawal rate variables (the withdrawal rate and the quadratic term of withdrawal rate) have opposite directions (one greater than 1 and

one lower than 1), this indicates a non-linear relationship between withdrawal rate and degree attainment. For example, degree attainment increases as withdrawal rates increase up to a turning point. After this turning point, degree attainment decreases as withdrawal rates increase. However, if both withdrawal rate and the quadratic term of withdrawal rate have the same direction (i.e., both odds ratios are greater than 1), this indicates a linear relationship between withdrawal rate and degree attainment.

Table 2 indicates a non-linear relationship between withdrawal rate and degree attainment for the community college-only and the university samples and a linear relationship for the transfer sample. A non-linear relationship emerged between credit withdrawal rate and degree attainment in the community college-only sample (see Table 2, withdrawal rate: OR= 1.019, SE= 0.002, p< 0.001; squared term of withdrawal rate: OR= 0.998, SE= 0.000, p< 0.001). A withdrawal rate of up to 3.8 percent was associated with an increase in the predicted probability of completing a community college credential (an associate degree or certificate). After a withdrawal rate of 3.8 percent, the predicted probability of community college credential attainments decreases (see Figure 2).

Figure 2

Predicted Probability of Completing a Community College Credential over Credit Withdrawal Rates for the Community College-only Sample



Similar patterns emerged for the university sample (see Figure 3). The predicted probability of earning a bachelor's degree increased up to a 3.3 percent of withdrawal

rate, but after this turning point, the predicted probability decreased (see Table 2, withdrawal rate: OR= 1.070, SE= 0.004, p< 0.001; squared term of withdrawal rate: OR= 0.990, SE= 0.000, p< 0.001). For the transfer sample, the relationship was straightforward. There was always a negative relationship between withdrawal rate and earning a bachelor's degree as both odds ratios were lower than 1 (see Table 2, withdrawal rate: OR= 0.938, SE= 0.004, p< 0.001; squared term of withdrawal rate: OR= 0.996, SE= 0.000, p< 0.001). As the withdrawal rate increased, the predicted probability of degree attainment decreased.

Figure 3

Predicted Probability of Earning Bachelor's Degree over Credit Withdrawal Rates for the University Sample

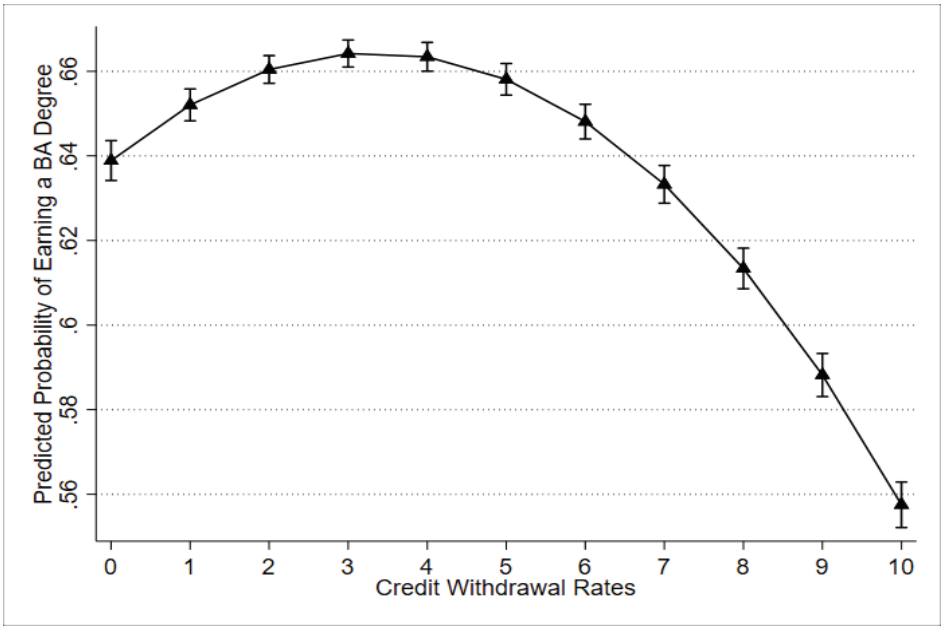


Table 3 below displays OLS regression models examining the relationship between withdrawal rate and time to degree among students who earned a degree:

Table 3

OLS Regression Results Examining Relationships Between Credit Withdrawal Rate and Time to Degree

	Community College	Transfer	University
Withdrawal Rate	0.634***	0.576***	0.532***
	(0.024)	(0.027)	(0.014)
Withdrawal Rate (Quadratic)	-0.006***	-0.005***	0.001
	(0.001)	(0.002)	(0.001)
Student Variables	X	X	X
Cohort Fixed Effects	X	X	X
Institution Fixed Effects	X	X	X
Observations	40,821	43,901	128,801
R-squared	0.317	0.214	0.292

Notes: The table presents coefficients with standard errors in parentheses from OLS regression models performed, where each column represents a separate sample (the community college-only, the community college transfer and university samples). Community college-only sample include students who earned an associate degree within a six-year period while transfer and university samples include those who earned a bachelor's degree within six-year period. All models include student variables (race, gender, age at the college entry, student intention, residency status in initial enrollment, student meta majors, ever Pell grant status, worked for pay in the first year, summer enrollment in the first year, average semester credits in the first year, ever earned developmental education credits, and total cumulative GPA). All models include cohort fixed effects and institution fixed effects.

*** p<0.001, ** p<0.01, * p<0.05

The results suggest non-linear associations between withdrawal rate and time to degree in both the community college sample (see Table 3, withdrawal rate: *B*= 0.634, SE= 0.024, p< 0.001; squared term of withdrawal rate: *B*= -0.006, SE= 0.001, p< 0.001) and the transfer sample (see Table 3, withdrawal rate: *B*= 0.576, SE= 0.027, p< 0.001; squared term of withdrawal rate: *B*= -0.005, SE= 0.002, p< 0.001). For both community college starter samples, as the student withdrawal rate increased, community college and transfer students needed more time to complete their degrees. However, this pattern ended at the 53% withdrawal rate for the community college-only sample and at the 58% withdrawal rate for the transfer sample, at which point time to degree began to decrease. Practically speaking, however, withdrawal rates of more than 50% were rarely observed in the data. For the university sample, the pattern was more straightforward: as the withdrawal rate increased, the time to a bachelor's degree always increased. Overall, for all three samples, these results support the conclusion that time to degree increases as the withdrawal rate increases.

Table 4 displays OLS regression results examining the relationship between credit withdrawal rate and total excess credits among degree completers.

Table 4

OLS Regression Results Examining Relationship Between Credit Withdrawal Rate and Excess Credits

	Community College	Transfer	University
Withdrawal Rate	0.011	0.045	0.132***
	(0.027)	(0.033)	(0.017)
Withdrawal Rate (Quadratic)	-0.014***	-0.026***	-0.020***
	(0.001)	(0.002)	(0.001)
Student Variables	X	X	X
Cohort Fixed Effects	X	X	X
Institution Fixed Effects	X	X	X
Observations	40,821	43,901	128,801
R-squared	0.142	0.169	0.151

Notes: The table presents coefficients with standard errors in parentheses from OLS regression models, where each column represents a separate sample (the community college-only, the community college transfer and university samples). Community college-only sample include students who earned an associate degree within a six-year period while transfer and university samples include those who earned a bachelor's degree within six-year period. All models include student variables (race, gender, age at the college entry, student intention, residency status in initial enrollment, student meta majors, ever Pell grant status, worked for pay in the first year, summer enrollment in the first year, average semester credits in the first year, ever earned developmental education credits, and total cumulative GPA). All models include cohort fixed effects and institution fixed effects.

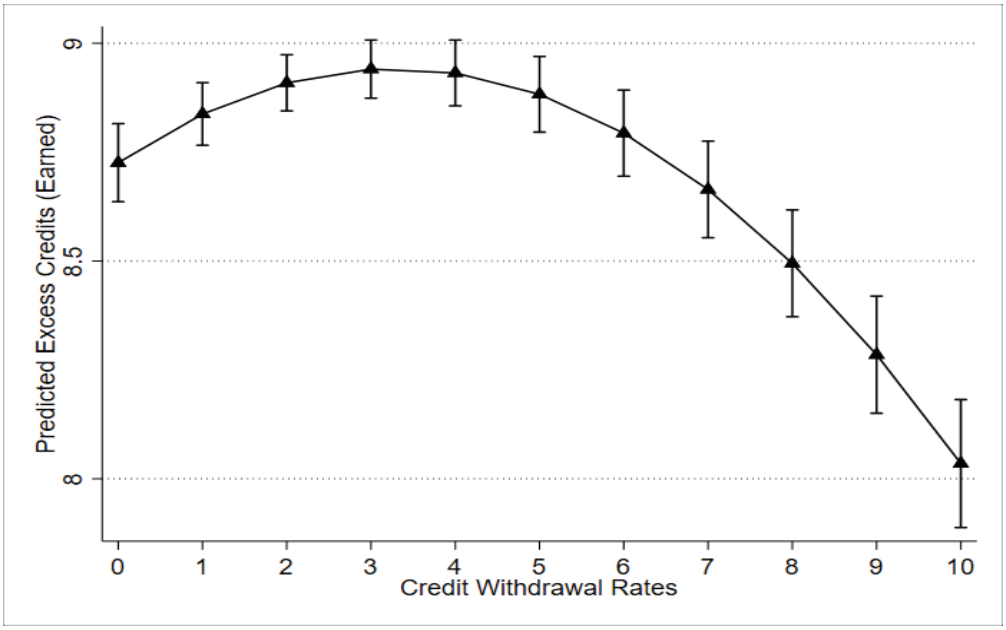
*** p<0.001, ** p<0.01, * p<0.05

For the community college sample and the transfer sample, there was no significant relationship between withdrawal rate and excess credits, although there was a negative significant relationship between the quadratic term of withdrawal rate and excess credits (see Table 4 for the community college-only sample, withdrawal rate: *B*= 0.011, SE= 0.027, p> 0.05; squared term of withdrawal rate: *B*= -0.014, SE= 0.001, p< 0.001; see Table 4 for the transfer sample, withdrawal rate: *B*= 0.045, SE= 0.033, p> 0.05; squared term of withdrawal rate: *B*= -0.026, SE= 0.002, p< 0.001).

The withdrawal rate and its quadratic significantly predict the outcome in the university sample. There was a nonlinear relationship between withdrawal rate and excess credits for the university sample (see Table 4, withdrawal rate: *B*= 0.132, SE= 0.017, p< 0.001; squared term of withdrawal rate: *B*= -0.020, SE= 0.001, p< 0.001). For the university students, the turning point was a 3.3% withdrawal rate (see Figure 4). Specifically, an increase in withdrawal rate of up to 3.3% was associated with an increase in excess credits for university students. After the 3.3% withdrawal rate, the more students withdrew from courses, the fewer excess credits they accumulated.

Figure 4

Predicted Excess Credits (Earned) over Withdrawal Rates for the University Students Who Earned a Bachelor's Degree



Limitations and Future Research

This study aimed to examine the relationship between course withdrawal and long-term student outcomes to inform policy and practices. Due to the nature of the study's research design, this study illustrated correlational relationships after controlling all the available variables in the ERC datasets. Although we included a comprehensive set of available measures in regression models, the state administrative data did not include measures related to student integration into campus life, such as hours of study and involvement in student social activities, which are linked to student

persistence and degree completion (Bean & Metzner, 1985; Bean, 2005; Tinto, 1975, 1994). Future researchers might go beyond the correlational relationships explained in this study to examine additional causal effects of course withdrawal behaviors on student success.

This study covers pre-pandemic cohorts of students from fall 2011 to fall 2014 by tracking students' course withdrawal rates and degree outcomes over six years. Future research should focus on examining the same relationship with post-pandemic data. Such studies are essential to confirm the main findings of this study or revise the cutoff points. For example, acceptable course withdrawal rates could be higher, such as 8%, for new cohorts of college students. If the cutoff changes with new cohorts, this can guide how we adjust our support practices for students. These potential changes reflect evolving educational environments and practices. The new studies can consider the impact of changing educational contexts to ensure the continued relevance and accuracy of our conclusions.

Furthermore, the Texas student population might not be generalizable to the full population of college students across the nation. Future research on course withdrawal behaviors should be conducted with nationally representative samples. For example, the Beginning Postsecondary Students Longitudinal Study (BPS:12/17) could be a good source for its transcript data of a nationally representative sample of first-time degree-seeking students over a period of six academic years (National Center for Education Statistics, 2020). Finally, given our focus on only public institutions, further investigations should include private institutions.

Future studies should also address the relationship between course withdrawals and other student behaviors, such as dropping out and stopping out. For example, how does withdrawing from a course in each semester, or the number of course withdrawals, predict a student's stop-out behaviors in a subsequent semester in the near or far future? To pursue such questions, both institution-specific and cross-institutional or national data should be analyzed in relation to each other. Furthermore, researchers should examine how the number of credits taken in a semester affects students' long-term outcomes using course withdrawals as mediating factors.

Discussion and Implications

Given the data and results of this study, credit withdrawal rates impact degree attainment for college students. These findings have nuance within sub-samples. However, the results vary across different sub-samples. For community college-only and university students, a withdrawal rate of up to 4% was associated with a

higher probability of earning a degree. Beyond this point, further course withdrawals diminished a student's probability of earning a degree in these groups. In other words, while withdrawing from one or two courses may be manageable, excessive withdrawals significantly hinder a student's likelihood of graduation. In contrast, for transfer students, any course withdrawal predicted a lower likelihood of bachelor's degree attainment. The findings of this study suggest that the more transfer students withdraw from courses, the less likely they are to earn a bachelor's degree.

Among students who completed a degree, time to degree increased as the withdrawal rate increased in all three analytic samples. This suggests that community college students may be potentially wasting time, effort, and tuition dollars toward courses they do not complete, adding to the time required to earn a degree. In short, course withdrawal was correlated with an increase in time to a degree, which was hinted at by prior research (Nicholls & Gaede, 2014). However, course withdrawal was also negatively related to excess credits earned, a finding that has not been demonstrated in the literature before now. This finding might be interpreted as illustrating the potential benefits of course withdrawal. These findings show that when students accumulated withdrawn credits during college, they did not end up earning more excess credits after college completion. As spending time and financial resources on acquiring excess credits prolongs time to degree attainment, examining relationships between withdrawn courses, attempted excess credits, earned excess credits, and degree requirements is warranted.

IMPLICATIONS FOR THEORY

Analysis of the relationship between course withdrawal and degree outcome stands to contribute to the literature and theory on *academic momentum* (Adelman 1999, 2005, 2006; Attewell et al., 2012; Wang, 2017). Results from our regression models suggest that credit withdrawal rates exceeding 4% may serve as a "red flag" that negatively predicts degree attainment. A 4% withdrawal rate, or about one or two courses withdrawn, may start erosion of a student's degree progress, as evidenced by the data in this study. While earlier researchers adopted a rate of 20% or more as the benchmark for excessive course withdrawal behaviors, we argue that a lower threshold is useful, given that any withdrawal rate after 4-5% diminishes the probability of degree attainment. Additionally, each increment in withdrawal rate is positively associated with time to degree. By illustrating the relationship between the continuous measure of credit withdrawal rates and student outcomes, we revealed that the link between student withdrawal rate and degree attainment and time to degree seems to start from a much lower threshold than prior studies adopted (e.g., Adelman, 1999, 2005, 2006; Akos & James, 2020; McKinney et al., 2019).

IMPLICATIONS FOR PRACTICE

Leveraging a 4-5% (one or two course withdrawals) threshold as a marker of excessive withdrawal at institutions (i.e., at which point students with an indicator flag might receive outreach for additional advising) could offer a preventative approach for better support to students that may otherwise face negative consequences of excessive course withdrawal. Faculty and advisors can discuss possible consequences of course withdrawals with students, such as the withdrawal of two or more courses (about 4-5% withdrawal rate), which might reduce their chances of earning degrees and that each course withdrawal can increase the time to graduation. Ensuring students understand this information could help them make more informed decisions about taking and withdrawing from courses.

Given the link between course withdrawal rate and degree outcomes, practitioners may also benefit from using course withdrawal metrics like those in this study to inform practice and support student success. Also, institutional research (IR) offices can use this study's methodology to develop measures for early detection of negative course withdrawal behaviors. IR offices can identify students with numerous course withdrawals for additional outreach and targeted advising by academic advisors. Then, responding to early identification measures, student service practitioners can take preventive action to stem excessive course withdrawals. This response can also carry over to faculty communication, as faculty members could be informed that they have students in their current course who have reached the four percent threshold and may require additional academic and/or social support.

IMPLICATIONS FOR RESEARCH

Although recent research expanded knowledge about course withdrawal patterns, previous studies drew data from a limited number of four-year campuses (Akos & James, 2020), one community college district (McKinney et al., 2019), core business courses at one four-year university (Boldt et al., 2017), and engineering students at one four-year institution (Nicholls & Gaede, 2014). This study conducted separate analyses for community college students, transfer students, and public university students in the state of Texas, but further research is needed beyond Texas to inform stakeholders.

Also, beyond quantitative work, educational researchers should explore whether college students are aware of the consequences of course withdrawal and their decision-making related to course withdrawals. This study suggests that a course withdrawal rate of 4% tends to predict negative student outcomes, and if students were aware of that number, perhaps their course planning and thought process would

change as it relates to working toward degree attainment. Moreover, qualitative researchers could engage with campus stakeholders to explore their notions and knowledge of course withdrawal to better fill out the literature and provide diverse, different perspectives on what has been a quantitative subject to date.

Conclusion

Ultimately, in this study, we analyzed student degree outcomes not in previous research, such as time to degree or excess credits, bolstering prior work in this space (Akos & James, 2020; Boldt et al., 2017; McKinney et al., 2019; Nicholls & Gaede, 2014). Given the breadth of the analytic samples, we also provided replicable methods and generalizable findings that could inform other studies. Here, understanding the consequences of course withdrawal is central to developing and implementing interventions that improve student degree outcomes. We know many college students *leave without completing* their courses and degrees every year. We hope this study informs policies and practices to help improve rates of *completion* of their courses before they *leave* their institutions with a degree in hand.

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