

EFFECTS OF ONLINE COURSE LOAD ON DEGREE COMPLETION, TRANSFER, AND DROPOUT AMONG COMMUNITY COLLEGE STUDENTS OF THE STATE UNIVERSITY OF NEW YORK

Peter Shea, University at Albany, State University of New York, Temi Bidjerano, Furman University, United States of America

Abstract

Past research suggests that some students are at risk of lower levels of academic performance when studying online compared to students who take coursework only in the classroom. Community college students appear to be among those that struggle in online settings. In this paper, we hypothesize that online course load may influence outcomes for such students, especially those at risk for lower levels of degree attainment. To examine this, we conducted a state-wide study using data from the 30 community colleges (n = 45,557) of the State University of New York, to understand online course-load effects on degree completion, transfer, and dropout. We conclude that when controlling for covariates known to impact degree completion, community college students who successfully complete online courses nearly double their chances (odds ratio = 1.72) of earning a degree or transferring to a 4-year college. However, racial minorities had reduced outcomes and additional research is warranted.

Post-secondary completion is a significant predictor of a host of individual and societal benefits. Online education has increased access to post-secondary credentials for millions of people. (Allen & Siemen, 2016). Community colleges enrol a higher proportion of online students than other institution types (NCES, 2017). However, concerns exist about outcomes for community college students who take online coursework, especially the effect of higher online course loads. The next section briefly summarizes relevant literature reflecting those concerns.

Review of Related Research

While results are not unanimous (e.g. Wladis, Conway, & Hachey, 2016), several large-scale studies clearly identify community college students to be at risk of significantly worse outcomes online than in face-to-face settings. One consistent finding is that online course load has a negative influence on academic performance. For example, in large, state-wide studies in both Virginia and Washington students who took a higher proportion of credits online were less likely to obtain a degree or transfer to a four-year institution than students who took lower proportions of online credits (Jaggars, Edgecombe, & Stacey, 2013). Further, among the institutions studied in the PAR framework (James, Swan, & Daston, 2016) odds

ratio analysis indicated that students mixing online and face-to-face courses or taking only face-to-face courses had up to 1.6 times greater odds of being retained than fully online students. Shea and Bidjerano (2017) found similar results for students in New York State. The odds of degree completion were about 1.5 times greater for SUNY students with a combination of online and traditional courses compared to students with classroom courses only. However, the odds of degree attainment were about 2 to 3 times lower for fully online students relative to students with a mix of online and classroom courses. Taking online courses results appears to result in diminishing returns regarding the attainment of a college degree indicating a curvilinear relationship (Shea & Bidjerano, 2018). We know that taking some courses online assists students toward the beneficial goal of degree attainment, however, prior research has indicated that taking online courses exclusively results in lower levels of retention across major studies in which this outcome is assessed. However, prior research has not included methodology that might account for the curvilinear relationship indicative of diminishing returns for increased online course loads. Specifically, previous research has not looked at the effects of course completion rates in online and classroom settings.

Purpose and Research Questions

This current study seeks to re-investigate the "tipping point" at which the proportion of online course enrolment leads to impaired degree completion using different analytic approaches. Specifically, this paper investigates the research questions below.

- RQ1: Using survival analysis methods, is there a threshold for online course enrolment intensity that jeopardizes one's prospects for successful completion of a college degree and increase risk of dropout when controlling for course completion rates?
- RQ2: Does the intensity of online coursework modify the effect of traditional predictors of degree completion such as remedial education, GPA, minority status etc. when controlling for course completion rates?

The purpose of the study was to examine the effect of intensity of online coursework at a community college level on the probability of experiencing one of three outcomes: degree completion, transfer to a 4-year institution, and dropout. We have reasons to believe that the relation between online education and indicators of college success is far more complex to be adequately captured by conventional linear statistical models (Shea & Bidjerano, 2018; Jaggars & Xu, 2010; Xu & Jaggars, 2011; 2013). Previously we concluded that participation in online coursework has a non-linear effect on the odds of degree, transfer, and dropout at any time of a student career. We asked also what specific factors explain the intricate relationships between online coursework and prospects for attaining any of the three outcomes. To extend our prior investigation, in this study we use competing-risk discrete time-event history analysis, also known as survival analysis. This method offers several advantages over traditional regression analysis. A unique feature of survival analysis is in its capacity to model both the likelihood of an outcome and the timing of the outcome (Singer & Willett, 2003) by accounting for cases for which the outcome is missing or unknown (also called censoring) thus allowing precise estimates of not only when an outcome comes about but also of how it

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comes about. It is a flexible longitudinal method showing how processes may unfold contingent upon characteristics that remain constant and /or may change with time; that is, the method allows the incorporation of predictors of outcomes with fixed values as well as of variables that change values over time. In the context of a competing-risk discrete model, time is conceived as discrete (as opposed to continuous) and the propensity for multiple mutually exclusive outcomes is studied simultaneously. In essence, modelling revolves around estimating (a) the probability of each outcome occurring at a given point in time (known as risk or hazard) provided that the alternative outcomes have not occurred at a previous time and (b) the change in the risk for the outcome as a function of one or more predictors.

Method

Sample

The study uses institutional data on first-time community college students enrolled in a degree program in one of the 30 community colleges part of the SUNY system. The dataset contained archival program and course enrolment records of all students (n = 45,744) who were enrolled in a 2-year degree granting institution from Fall 2012 to Fall 2017. The vast majority of the students in the sample (91.52%) were between 16 and 25 years old with less than 3% being older than 45.

Measures

Time and Outcome Variables. We considered three competing risks: departure from a 2-year institution for academic or other reasons (dropout); attainment of an educational credential; and transfer to a four-year institution. Transfer and degree attainment were combined in one outcome variable due to some methodological considerations. In the context of competing risk survival analysis, an individual is at risk for multiple events at any given time but can experience only one of the series of events. One event cancels the risk for another event. A sizable portion of sample members had completed a degree and immediately transferred to a 4-year institution or earned their 2-year degree during their transfer semester. Had we coded these students as "degree completers" as opposed of "transfers", we would have had underestimated the hazard (probability) of transfer.

The available data encompassed the enrolment histories of the sample members over the course of 21 consecutive semesters including major (spring and fall) and interim (winter and summer) terms. The last four semesters of data were used in a limited way – only as a means of identifying the subset of students who dropped out or departed (described below). The remaining 17 semesters were collapsed. This resulted in nine discrete time intervals each comprised of two consecutive semesters.

In each observation period, a student faces two distinct outcomes: the desirable outcome of graduation from their two-year institution or transfer to a 4-year one or the negative outcome of departure or dropout from a two-year institution. Dropout/departure functions as a competing risk to graduation or transfer and vice versa. The combined outcome degree or

transfer was defined as completion of a degree without evidence of subsequent return or transfer to a four-year baccalaureate program, whichever occurred first.

Independent Variable and Covariates. The majority of students in these community colleges mixed online and classroom study. The focal variable of interest was exposure to online coursework, operationalized as online course load or the proportion of online credits attempted relative to all credits attempted in a given time interval. We controlled for both time-dependent and time-independent covariates. These included a set of conventional predictors of college success such as age, gender, race/ethnicity indicators (Caucasian, Asian, African-American, Hispanic, and other race), international student status, level of academic preparation (whether the student qualified for remedial coursework at time of entry), student determination (whether the student had a goal to complete a degree or transfer to a four-year institution) and type of program (Humanities, STEM or other) at exit. Age was defined as the age in 2012. Except for age, all time-independent variables were categorical.

In the case of time-dependent covariates, the value of the variable changes from one-time period to the next and the hazard of an event at a given time depends on the value of the covariate at that time. Time-varying covariates were selected based on both theoretical and empirical grounds; the set included: number of credits earned as recorded at the end of each time interval, student status (whether the student was full-time in both terms in a time interval), end-of time-interval grade point average (GPA) and financial aid status indicators (whether a student was a federal Pell grant recipient or a New York State grant (TAP) recipient at a time).

Results

The unique risk (probability) associated with an outcome is also the proportion of students who experienced that particular outcome at a given time. As seen, the probability for a degree and/or transfer is low at first then it peaks initially during the fourth time interval. The hazard for dropout remains relatively constant across time. The plots suggest also that events of occur mostly in the spring and summer terms. The corresponding cumulative functions are profiled in Figure 1.

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The cumulative hazard represents event rates or the cumulative proportions of students with an event up to a particular time interval. The cumulative hazard probability of degree/ transfer increases slowly in the first terms when the hazard is low, then it increases steadily. With respect to departure/ dropout, the probability increases more rapidly in the first 2 years of college. In both cases, there is little change in the cumulative hazard probabilities after the third year in college. The median time-to-transfer or degree is 3 years, whereas the median time-to-dropout or departure was found to be 2 years. Overall, by the end of the second year of college, 50% of the sample members had experienced one outcome or another.

The Effect of Semester Online Course Load

The addition of course load with its square term as a predictor resulted in substantial improvement in model fit. Students who opt for more online courses in any given time have a higher conditional probability of degree or transfer but, in this model, benefits wear off at higher levels of online course intensity (see Figure 2).

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Figure 2. Probability of degree/ transfer at Time 4 by online load

Conversely, increasing levels of online load decreases the hazard of dropping out in any given term to a point at which each additional credit is likely to result in increased risk for dropping out (see Figure 3).



Figure 3. Probability of departure/ dropout at Time 4 by online load

The hazard associated with online course load was found to be invariant across time intervals. Contrary to previous research, our initial results suggest that effect of the intensity of online

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coursework is not linear in nature. This curvilinear relationship is lost however when course completion rates are included in the analysis.

Covariate Effects and the Relationship between Online Load and Outcomes

With the last set of models shown in Table 1, we addressed the question of whether the effect of online load changes in the presence of other well-known predictors of college success. Our analysis indicates that effect of online load remained notable after controlling for a host of traditional indicators of degree completion, transfer and dropout. Conventional demographic predictors of college success behaved in predicable fashion when the time-varying predictors of semester GPA and online coursework were not considered (Model 3). Model 4 indicates that an upward shift in semester GPA increases the hazard (likelihood) of positive outcomes as well as decreases the hazard of negative outcome.

Table 1:Results from Multilevel Multinomial Logistic Regression: Time to Degree/ Transfer and
Time to Departure/ Dropout

Predictors	Model 2				Model 3				Model 4				Model 5			
	Deg/Tr Est	OR	Depart Est	OR	Deg/Tr Est	OR	Depart Est	OR	Deg/Tr Est	OR	Depart Est	OR	Deg/Tr Est	OR	Depart Est	OR
On	1.44***	4.20	86***	.42	1.08***	2.95	53***	.59	1 35***	3.85	- 47***	63	.54**	1.72	.00	1.00
On2	-1.65***	.19	1.65***	5.2	-1.25***	.29	1.27***	3.56	-1.35***	26	.71***	2.04	23	.79	.06	1.06
Age					10***	.91	.09***	1.09	-15***	.86	.15***	1.16	15***	.86	.11***	1.12
Age2					.00***	1.00	00***	1.00	.00***	1.00	.00***	1.00	.00***	1.00	.00***	1.00
Female					.07***	1.07	27***	.76	05*	95	08***	92	05	.95	10***	.90
Asian					14**	.87	28***	.75	15	.86	30***	.74	18	.84	31***	.74
Black					27***	.77	.34***	1.40	08	.92	.01	1.01	10*	.91	.01	1.01
Hisp					28***	.76	.17***	1.19	25***	.78	.02	1.02	22***	.80	01	.99
Rc oth					24**	.79	.53***	1.70	24*	.79	.28***	1.33	23*	.79	.26***	1.29
Rc mi					56***	.57	.45***	1.57	60***	55	.35***	1.42	55***	.58	.34***	1.40
Rem					97***	.38	.17***	1.19	81***	.45	12***	.89	84***	.43	24***	.79
Goal					.04	1.04	04	.96	.08	1.08	03	.97	.05	1.05	01	.99
Intern					.76***	2.13	39***	.68	.64***	1.90	.15	1.17	.41**	1.50	.37*	1.44
Sta					.41***	1.51	13***	.87	.48***	1.62	14***	.87	.29***	1.34	.11***	1.12
Pell					13***	.87	.32***	1.38	09	.91	.19***	1.21	05	.95	.17***	1.18
TAP					.14***	1.15	59***	.56	.10***	1.11	41***	.66	04	.96	30***	.74
Hum					.23***	1.25	.24***	1.27	.25***	1.28	.21***	1.23	.33***	1.38	.17***	1.18
STEM					08	.93	.02	1.02	09	.91	03	.97	10	.90	02	.98
GPA									.81***	2.24	89***	.41	.70***	2.02	48***	.62
Cred													.11***	1.11	14***	.87
Var Camp Var Prog	11*** 12***				.12*** .11***				.08*** .08***				.11*** .10***			
LL	-102,004.2				-98,417.27				-85,676.00				-82,269.46			
AIC	204,056.40				196.910.50				171,427.90				164,612.90			
BIC	204,296.20				197,290.20				171797.60				164,982.60			

Note. ***p <001, **p <05, *p<.01. Coefficients (Est) represent the change in the baseline logit hazard (log odds) for a unit increase in the predictor's value. The odds ratio are also given for ease of interpretation. Time intercepts are omitted. The baseline outcome category is 'no-event'.

In terms of the study's central question, it appears that the curvilinear effect of online course load on dropout/departure can be fully attributed to course completion rates. In terms of degree/transfer, when course completion rates are accounted for, an increasing online load is linearly associated with increased likelihood of degree completion/ transfer (see Model 5). For a one-unit increase in online load, we expect to see about 72% increase in the odds of degree or transfer holding the remaining predictors constant (bOn = .54, OR = 1.72, p = .008).

Holding other predictors at a fixed value, a unit increase in GPA translate into two-fold increase (Bgpa = .70, OR = 2.02, p < .001) and a unit increase in credits earned about an 11% increase (bCred = .11, OR = 1.11, p < .001) in the odds of degree/ transfer. The odds for minority students are up to 29% lower than the odds for Caucasian students.

When it comes to departure or dropout, with credits earned entered as a predictor, the constant effect of online load on prospects of departure/ dropout is virtually zero (bOn = 0.00, p = .567, bOn2 = .06, p = .091). Compared to male students and Caucasian students, female students and Asian students are 10% and 26% less likely to dropout, respectively. As expected, the effect of GPA and credits earned on the odds of departure is negative with a unit increase in both predictors lowering the odds of a negative outcome by 38% (Bgpa = -.48, OR = .62, p < .001) and 23% (bCred = -.14, OR = .87, p < .001), respectively. The coefficient for remedial status at Time 1 is negative (b = -.24, OR = .79, p < .001) suggesting a 21% lower risk for departure/ dropout for remedial students. Albeit counterintuitive, this result is not surprising; if the mission of a community college is to provide a venue for students to compensate for prior academic deficiencies, students in need of remediation should be expected to remain longer in the pipeline.

To qualify findings further, we sought to examine if the effect of online load may potentially depend on demographic and academic factors. Therefore, as a follow-up, we probed all twoway and three-way interactions between online load and time-invariant and time-varying covariates in the context of multilevel logistic regressions. With respect to the outcome departure/ dropout, the effect of online load is contingent upon GPA in any given time period and race (Caucasian vs. other). As indicated in Figure 4, it appears that online course intensity adversely affects the subpopulation of minority students who are academically stronger; these students are significantly more likely to depart/ dropout when the majority of their courses are fully online. Effects of Online Course Load on Degree Completion, Transfer, and Dropout among Community College Students of the State University of New York

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Figure 4. Probability of departure/ dropout as a function of online load, GPA and Race

Discussion

The current study provides new insight through an analysis of prior variables while simultaneously considering course completion rates. It appears that online course completion significantly improves the odds of earning a degree. Unlike previous research (e.g. Shea & Bidjerano, 2018), in the present study, where course completion rates are accounted for, an increasing online load is linearly associated with increased likelihood of degree completion/ transfer. For each additional unit of successful online study, the odds of degree completion/transfer increase by 1.72. Additionally, the constant effect of online load on prospects of departure/ dropout is virtually zero. While this is good news for the average online student, certain subpopulations are at risk relative to the average. Of particular concern are academically stronger minority students; these students are significantly more likely to depart or dropout as their online load increases relative to other subgroups. Further study is warranted to understand the cause and possible interventions to address these issues.

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