
Tracking and Explaining Credit-Hour Completion

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Abstract: This study highlights factors associated with changes in earned hours for two cohorts of incoming freshmen during their first year. The objectives of this study are twofold: (a) to derive model(s) regressing the cumulative hours earned and differential hours earned on student demographic, socioeconomic, and academic characteristics; and (b) to provide succinct conclusions that will increase students' satisfactory academic progress (SAP) based on the results. The study sample of 1,598 cases is made up of students from two cohorts of first-time, four-year degree-seeking students who started in the Fall semesters of 2010 and 2011, respectively. There were two measures of the dependent variable: Cumulative hours earned and the difference in earned hours between the Fall and Spring semesters. Multiple linear regression was used to explain the outcome variables using a student's demographic, socioeconomic, and academic characteristics. The study found that there have been changes at Cameron University related to the freshman first year experience, while there were no significant differences detected between the 2010 and 2011 cohorts. In addition, demographic variables generally did not significantly explain earned hours or changes in earned hours. The significant predictors were generally tied to a student academic standing or factors for which the institution can exercise some control.

Keywords: Predictive modeling, earned hours, credit hours, retention

Introduction

The value of college education is realized when a student graduates. Graduation represents the fulfillment of the requirements set out by an institution's governing body. One of the key elements to graduation is successfully earning and accumulating enough credit hours. Students are required to have earned at least 128 hours in order to graduate with a bachelor's degree at Cameron University. Starting in the 2013-14 academic year, the threshold will go down to 124 hours because of an approved policy change.

Although there are students who graduate with exactly the minimum number of hours required, many do not. There are anecdotal and commonly accepted explanations as to why students may end up with more hours than the minimum required: changing major and minor fields of study (especially later in one's academic career), having transfer courses not subject to course substitution, and not taking courses that meet more than one requirement. In addition, if there are a disproportionate number of students taking remedial classes, it follows that many of them will graduate with earned hours beyond the minimum.

Background

Having more attempted hours than earned hours is problematic to a university as it affects the institution's graduation rate – a key measure of organizational effectiveness. It is also costly to students in terms of time and money. Financial aid policies are increasingly being tied to satisfactory academic progress standards (US Department of Education, 2013). In 2004, the Council of State Governments in Florida reported that an estimated 20% of students in that state

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take more classes than they need in order to fulfill graduation requirements. Overall, this represented approximately 720,000 extra credit hours costing the state \$62 million (The Council of State Governments, 2004).

There are various ways of studying the differential outcomes in hours attempted and hours earned¹. First, one can simply subtract earned hours from attempted hours and come up with “wasted hours” (Marsh, Vandehey, & Diekhoff, 2008).

Second, dividing the number of earned hours by the minimum number of hours required for graduation, in this case 124 hours, gives the *rate of progress*. However, the rate of progress indicator becomes less intuitive when many students graduate with hours beyond the minimum. This measure is somewhat similar to the percentage displayed by *DegreeWorks* – a commercial degree audit system.

Third, one can compute a *ratio of degree completion efficacy* by dividing cumulative hours earned by cumulative attempted hours. The ideal completion ratio should be equal or close to 1.0. This measure is helpful to the extent that there is a general expectation that a student’s completion rate should increase each subsequent semester.

A limited amount of published research exists which uses the credit hour as the outcome variable. This may partly be the result of the fact that many of the studies are internal institutional reports. Most publicly available documents utilizing this variable are in the form of frequency counts that are useful as descriptive statistics with limited explanatory power². Boughan (1999) contended that the credit hour has many potential uses because of its general utility. This type of investigation yields positive outcomes for students in that they favorably consider the idea of shortening degree completion time as something that shows their academic success (Hargrove & Ding, 2004).

Research shows that the vast majority of discontinuance occurs within the first two years of collegiate experience (Levitz, Noel, & Richter, 1999; Marsh, Vandehey, & Diekhoff, 2008; Tinto, 1987). This has led to a proliferation of first-year-experience (FYE) programs to counter this adverse trend. However, these first year experiences programs generally target retention with little emphasis on academic success (Graunke & Woosley, 2005; Marsh, Vandehey, & Diekhoff, 2008). This study focuses on the first year of collegiate experience.

The study institution, Cameron University, has two-year, four-year, and a limited number of graduate programs. The university has an open admissions system that allows for the recruitment of students who otherwise would have had a low chance of attending college. Smittle (1995) stated that having an open admission attracts a diverse student body with varying levels of academic preparation. Thus, it places a greater responsibility on the institution to identify at-risk students and provide reasonable assistance early in their college career (Maxwell, 1994; Smittle, 1995). This often results in remediation programs for students less prepared for college.

¹ This paper highlights three methods with the tacit acknowledgement that there may be other ways of studying the difference between hours earned and hours attempted.

² Explanatory power = when the variation in the outcome variable (earned hours or difference in earned hours) is clarified by its covariation with an independent variable (predictor variable).

This study highlights factors associated with changes in attempted over earned hours for two cohorts of incoming freshmen during their first year at a university in the South Central United States. The objectives of this study were twofold:

1. To derive model(s) regressing the cumulative hours earned and differential hours earned on student demographic, socioeconomic, and academic characteristics; and
2. To provide succinct conclusions that will increase students' satisfactory academic progress based on the results.

Data and Methodology

The Office of Institutional Research, Assessment, and Accountability at Cameron University derived the data from multiple administrative sources. The study sample of 1,598 cases is made up of the remaining students from two cohorts of first-time, four-year degree-seeking students at Cameron University who started in the Fall semesters of 2010 and 2011, respectively. The analytical sample included only those students who persisted to the following Spring semester: 783 from 2010 Fall to 2011 Spring, and 815 from 2011 Fall to 2012 Spring.

There are two measures of the dependent variable: *Cumulative hours* earned and the *difference in earned hours* between the Fall and Spring semesters. In this study, multiple linear regression was used to explain these outcome variables using a student's demographic, socioeconomic, and academic characteristics:

$$Y = X\beta_k$$

Where,

Y is either the cumulative earned hours after the first Spring semester or the gained earned hours between the Fall and Spring semesters.

X represents the set of independent variables as listed the Table 1.

β_k are the unstandardized parameter estimates for each independent variable including the constant.

Table 1. *Descriptive Statistics for Analytical Variables*³

		(N=1,598)	\bar{X}	σ	
Dependent Variables					
End of First Spring Cumulative Earned Hours			16.83	12.12	
Fall-to-Spring Gained Earned Hours			7.39	5.62	
Independent Variables⁴					
Demographic Characteristics	Year	- 2010 Cohort	0.49		
		- 2011 Cohort	0.51		
	Age		21.02	5.77	
	Sex	- Female	0.61		
		- Male	0.39		
	Race	- Non-Hispanic White	0.43		
		- Non-Hispanic Black	0.17		
		- Hispanic/Latino	0.11		
		- Multiple Race Identification	0.13		
		- Other Race/Unknown Race	0.16		
	Years since high school graduation		2.36	5.36	
Socioeconomic/Background Factors	Military Status	- No	0.92		
		- Yes	0.08		
	Aid/Grants	- No	0.38		
		- Yes	0.62		
	Concurrent	- No	0.87		
		- Yes	0.13		
	ACT Composite	- 26+ (80 th percentile)	0.08		
		- 21—25 (50—80 th percentiles)	0.23		
		- <20 (Below 50 th percentile)	0.50		
		- Unknown/NA	0.19		
		Hours Prior to First Fall		1.23	3.91
	High School GPA	- 3.00+	0.37		
		- 2.00—2.99	0.22		
		- 0.00—1.99	0.02		
		- Unknown/NA	0.39		
	High School - Other Location		0.65		
	- Lawton/Fort Sill High School		0.35		

³ The mean for categorical variables (those with more than one level) represents the proportion in each category of the variable. There are no standard deviation computations for categorical variables.

⁴ Many of the continuous or scale variables are categorized in order to utilize sample characteristics so that cases with missing values for some of the variables are not left out of the multivariate analyses. The cutoff points are meant to be based on standard practice or to be somewhat intuitive. For example, the Composite ACT score is categorized by establishing cutoff points using reported percentiles (80th percentile and above, 50th to 80th percentiles, and less than 50th percentile) (ACT, 2013).

Institutional /Academic Factors	Tuition Code - In-state	0.92	
	- Out-of-state	0.08	
	Declared Major - No	0.23	
	- Yes	0.77	
	Part-time - No	0.90	
	- Yes	0.10	
	Immediate educational goal - Bachelor's	0.71	
	- Associates' creditable toward BS	0.17	
	- Associates' not wholly creditable toward BS	0.12	
	Original type of admission - Baccalaureate seeking	0.57	
	- Associates' seeking	0.29	
	- Other	0.14	
	Campus Resident First Fall - No	0.80	
	- Yes	0.20	
	Month enrolled - March	0.16	
	- April	0.11	
	- May	0.14	
	- June	0.15	
	- July	0.17	
	- August/September/October	0.27	
	First Fall GPA	2.29	1.29
	In UNIV1001 First Fall - No	0.76	
	- Yes	0.24	
	Remedial Math - No	0.48	
	- Yes	0.52	
	Remedial English - No	0.62	
	- Yes	0.38	
Remedial Reading - No	0.83		
-Yes	0.17		
Cumulative Spring attempted hours	25.22	4.39	

Note: Where, \bar{X} is the arithmetic mean and σ is the standard deviation.

Students included in the analysis had an average of 16.83 ($\sigma=12.12$) earned hours and gained an average of 7.39 ($\sigma=5.62$) hours between their first Fall and Spring semesters. The average cumulative attempted hours for the two semesters was 25.22 ($\sigma=4.39$) hours. The 2011 cohort makes up 51% of the sample. Sixty-one percent of the sample is female. The average age is 21.06 ($\sigma=5.77$) years, which parallels with 2.36 ($\sigma=5.36$), the average number of post-high school years before enrollment. It is apparent that many of the students are not immediately opting for university education once they finish high school. Over one third of the students (35%) graduated from high schools in the Lawton/Fort Sill area. Thirteen percent were concurrently enrolled when they were still in high school. The average number of hours attempted prior to the

Summer before starting at Cameron University were 1.23 ($\sigma=3.91$) credit hours. Half of the sample has an ACT Composite score below 20 even though 37% reported a high school GPA at or above 3.00.

Non-Hispanic White students constituted 43% of the sample. Only 8% of the sample had some military connection—either as active duty or as a dependent family member. Sixty-two percent received financial aid or grants. The vast majority of the students (92%) paid their tuition as in-state residents. Only 10% of the students were enrolled as part-time (less than 12-credit hours). Twenty percent of the students resided on campus during their first Fall semester.

The majority of students (71%) reported that their immediate educational goal was a bachelor's degree and 57% were originally admitted as baccalaureate degree seeking. Seventy-seven percent had declared a major area of study. Nearly 30% of the retained students enrolled in classes during the months of August, September, and October. Twenty-four percent were enrolled in UNIV 1001 Introduction to University Life. Of all the remedial classes, math had the most enrolled (52%). The average first Fall semester GPA was 2.29 ($\sigma=1.29$). This variable was not categorized, as was that for high school GPA, since there were no students with an "unknown" Fall GPA value.

Results

Preliminary regression models were run including as many predictor variables as were available in the student management system. After checking for collinearity issues and efficacy of the models, the final two models are presented in Table 2. The inclusion of separate ACT scores for English, Math, Reading, and Science did not improve the predictive efficacy of the model. Final models contain only the categorized Composite ACT score.

Although entering blocks of variables in developing the models did improve the r-squared value at each stage, the overall objective of the study was to identify any significant predictors rather than detecting the relative importance of demographic, socioeconomic, or academic/institutional factors. It was evident that there was no need to run separate cohort models since the combined models showed no significant difference by cohort.

The adjusted r-squared values for the two models are provided in order to counter the argument that this study contains "kitchen sink" regression analyses that use a long list of independent variables in an attempt to find any that would explain the dependent variables. The independent variables used in the models were included given the current state of knowledge in higher education research when examining student outcomes. The levels of the categorical variables were properly constituted through a deliberate effort. The methodology influenced the results rather than vice versa.

It can be observed that the adjusted r-squared values in both models (0.77 and 0.53, respectively) are more or less similar to the r-square values (0.77 and 0.54, respectively) indicating that the regression equations do not have limited generalizability. The supporting F-tests indicate that both models are significantly explaining the variance in the dependent variables. However, it does appear that the predictor variables account for more variance in explaining earned hours (model 1) compared with explaining the variance in the difference in gained earned hours (model 2).

Table 2. Multiple Regression Models of First Year Earned Hours and Fall-to-Spring Gained Earned Hours

Predictor Variable	Levels/Categories	Model 1: Earned Hours	Model 2: Gained Earned Hours
Constant		-14.53***	-8.97***
Year	†2010 Cohort		
	2011 Cohort	0.39	0.36
Age		0.03	-0.04
Sex	† Female		
	Male	0.38	0.18
Race	† Non-Hispanic White		
	Non-Hispanic Black	-0.61	-0.35
	Hispanic or Latino	-0.12	0.09
	Multiple races	-0.19	0.07
	Other/unknown	-0.83*	-0.41
Years Since High School Graduation		0.02	0.06
Military status	† Non-military		
	Military	1.76***	1.16***
Aid or Grants?	† No		
	Yes	-0.98***	-0.58**
Concurrently Enrolled	† No		
	Yes	0.02	0.30
ACT Composite Score	† Unknown/NA		
	26+ (80%+)	4.07***	1.57***
	21-25 (50-80%)	1.70**	1.10**
	<20 (<50%)	0.57	0.65
Hours Prior to First Fall		1.04***	0.04
High School GPA	† Unknown/NA		
	3.00+	0.19	0.70***
	2.00-2.99	-0.99**	-0.47
	0.00-1.99	-0.68	-0.36
High School Location	† Other HS location		
	Lawton/Fort Sill location	1.01***	0.19
Tuition Code	† In-state (OK)		
	Out-of-state	2.56***	2.22***
Declared Status	† Undeclared		
	Major declared	0.08	-0.09
Part-Time/Full-Time Designation	† Full-Time		
	Part-Time	3.48***	2.80***

Immediate Educational Goal	† Bachelor's		
	Associate creditable toward BS	0.61	0.46
	Associate not wholly creditable toward BS	-0.35	-0.29
Original Type of Admission	† Regular baccalaureate seeking		
	Regular associate seeking	-1.01	-0.57
	Other	-0.16	-0.09
Campus Resident First Fall	† No		
	Yes	0.88**	0.34
Month Enrolled First Time	† Aug/Sep/Oct		
	March	2.94***	1.57***
	April	1.98***	0.91**
	May	1.67***	1.10***
	June	1.18**	1.12***
	July	0.69	0.51
First Fall GPA		3.25***	1.42***
In UNIV1001 First Fall	† No		
	Yes	-0.54	-0.26
Remedial Math	† No		
	Yes	-3.06***	-0.80***
Remedial English	† No		
	Yes	-2.76***	-0.75***
Remedial Reading	† No		
	Yes	-1.93***	-0.65**
Fall-Spring Total Attempted Hours		0.89***	0.51***

Model 1: $R^2 = 0.77$; $R^2_{adjusted} = 0.77$; $F_{(38,1559)} = 138.39^{***}$ || Model 2: $R^2 = 0.54$; $R^2_{adjusted} = 0.53$; $F_{(38,1559)} = 48.54^{***}$

†—Reference category; *— $0.05 \leq p < 0.10$; **— $0.01 \leq p < 0.05$; ***— $p < 0.01$

Demographic Characteristics. Results from the multivariate analyses show that those of other or unknown race earn on average 0.83 credit hours less than non-Hispanic White students. This significant relationship goes away when explaining changes in hours earned between the Fall and Spring semesters. Race, like the other demographic variables of cohort, age, sex, and years since high school graduation does not significantly predict both outcome variables.

Socioeconomic Background. Those with some military affiliation earn 1.76 more credit hours compared to those without any military affiliation. They also gain 1.16 credit hours more compared to students without any military affiliation between the Fall and Spring semesters. These results indicate there are characteristics associated with military affiliation that lead to

acquiring more earned hours that translate to gaining significantly more hours between the first two semesters of enrollment at Cameron University.

Students who receive financial aid or grants earn 0.98 credit hours less than those who do not. They also earn 0.58 credit hours less than non-recipients of financial aid or grants do between the two first semesters. Graduates of Lawton/Fort Sill area high schools are likely to earn 1.01 credit hours more than those from other locations do. This significant relationship goes away when it comes to semester-to-semester earned hours. For every credit hour taken prior to the Summer before enrolling at Cameron University, a student earned 1.04 credit hours. Again, this significant relationship vanishes when it comes to semester-to-semester earned hours.

Models 1 and 2 show that the academic performance of students while in high school significantly predicts hours earned in the first year of college. Students with an ACT Composite score of 26 or higher earn more than 4 credit hours and gain 1.57 credit hours between the first two semesters compared to those whose ACT Composite score is unknown or not available. Having a high ACT Composite score of 26 or more contributes the highest earned hours. Even those with ACT Composite score between 21 and 25 earn and gain more credit hours than those whose score are unknown or not available.

A surprising result is that students with a high school GPA between 2.00 and 2.99 earn 0.99 credit hours less than those whose high school GPA is unknown. Those whose high school GPA is above 3.00 gain on average 0.7 credit hours compared to those whose high school GPA is unknown. These counterintuitive results may be the function of the 39% proportion of students whose high school GPA is unknown (see Table 1).

Academic and Institutional Factors. Out-of-state students earn 2.56 credit hours more than in-state students do; they gain significantly more credit hours, 2.22. It may be that the out-of-state designation induces those students to work harder and thus earn more hours. Since out-of-state students pay more in tuition, they may be compelled to complete quickly their studies and hence the finding that they have one of the highest semester-to-semester gained earned hours.

Campus residents receive 0.88 credit hours more than those who did not live on campus during their first Fall semester at Cameron University. Part-time students compared to full-time students earn 3.48 credit hours more and gain 2.8 credit hours from one semester to the next. Part-time students compared to full-time students have the highest gains in credit hours from one semester to the next. They also have the second highest earned credit hours. It is an interesting finding to the extent that it appears that those who choose to be part-time students make steady progress toward degree completion. Full-time students may be attempting more hours than they are capable of earning.

The month when a student enrolled for Fall classes is a significant predictor of both hours earned and semester-to-semester gained hours. For example, students who enrolled in March earned 2.94 credit hours more than those who enrolled in the Fall months of August, September, or October. The same students who enrolled in March gained on average 1.57 credit hours more than those who registered in the Fall. For each credit hour a student attempted, he or she earned 0.89 credit hours and gained 0.51 credit hours between the Fall and Spring semesters.

Students who succeed as reflected by their first Fall GPA also earn and gain more credit hours. For every unit increase in a student's GPA, earned hours increase by 3.25 and gained earned credit hours increase by a factor of 1.42. The analyses show that students who are in remedial classes earn and gain less credit hours compared to those not taking any remedial classes. Students who are in remedial Math courses earn the least hours compared to those enrolled in remedial English or Reading courses. This is an intuitive result since remedial hours do not count toward degree completion.

Conclusion

Although there have been changes at Cameron University when it comes to the first year experience, there were no significant differences detected between the 2010 and 2011 cohorts. In sum, the findings of this study have been:

- Military affiliated students earn and gain more hours than those without any military affiliation.
- Students who receive some sort of financial aid and/or receive grants earn less and gain less credit hours than those who do not.
- High school academic performance as shown by high school GPA and ACT composite score predict satisfactory academic progress in college. Superior academic performance in college also results in more earned and gained hours.
- Local high school graduates earn more credit hours than those who graduated from high school outside the Lawton/Fort Sill area. However, out-of-state students also earn more hours than in-state students do.
- The more hours a student attempts, the more likely he or she is to earn and gain more credit hours.
- Any remediation results in fewer earned or semester-to-semester gained hours.

In addition, it can be of some solace to decision makers to note that demographic variables (age, sex, race, and years since high school graduation) generally do not significantly explain earned hours or changes in earned hours. The significant predictors are generally tied to a student academic standing or factors for which the institution can exercise some control.

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