Undergraduates in the Professional Fields: Exploring the Impact of Institutional Characteristics on Time Spent Preparing for Class

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Authors' Note

Paper presented at the annual meeting of the American Educational Research Association in San Francisco, CA, April 28, 2013. Please direct correspondence concerning this article to Amy Ribera at 1900 East Tenth Street, Suite 419, Bloomington, IN 47406-7512. Email: akribera@indiana.edu

Abstract

Using data from over 137,000 full-time seniors enrolled at 543 four-year colleges and universities in 2011, this study explores the relationship between the amount of time students spent preparing for class each week and both institutional context and field of study, with a particular focus on five professional fields (business, education, engineering, nursing, and allied health) relative to arts & sciences. Controlling for student and institutional characteristics, results indicate both systematic differences in study time related to field of study and a positive relationship between selectivity, Carnegie type, and study time. Moderating effects were found between discipline and institutional selectivity, Carnegie type, and control. Findings promise to inform national and disciplinary discussions about academic rigor, student effort, and learning outcomes.

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Colleges and universities are often scrutinized by internal and external stakeholders for alleged diminishing quality and academic rigor (e.g., Hersh & Merrow, 2005; Rojstaczer & Healy, 2012). As an indicator of this decline, the national media has recently focused on the amount of time undergraduates spend studying (de Vise, 2012; Ellis, 2012). The notion that study time corresponds to learning in college has both intuitive appeal and empirical support, dating to Ralph Tyler's pioneering assessment work in the 1930s (Merwin, 1969). More recently, Arum and Roksa (2011) found that the amount of time devoted to studying was positively related to gains on a test of college students' analytical reasoning and problem solving. According to the 2012 National Survey of Student Engagement (NSSE) (2012), first-year students who reported most of their grades to be A or A- averaged about four more hours per week on class preparation that did those with grades of C+ or lower. Those earning Bs were almost exactly in the middle. A similar pattern held for seniors, but the groups with high and low grades were separated by only 2.3 hours in study time.

Recent evidence suggests that college students are indeed studying less than they once did. In an analysis of survey results spanning four decades, Babcock and Marks (2011) concluded that after adjusting for differences between surveys, the average full-time college student studied about ten more hours per week in 1961 than in 2003. Interestingly, technological change does not appear to account for these changes, because most of the decline occurred between 1961 and 1981, well before the advent and widespread adoption of technologies that have revolutionized certain aspects of academic work (e.g., personal computers and Internet-based research tools) (McCormick, 2011). Results from NSSE indicate that contrary to the conventional wisdom that students should plan to study two hours for each hour of class, the actual ratio is closer to parity (NSSE, 2012).

Although these studies open the discussion about declining student effort and academic standards, they do not take full account of the growing complexity of American higher education. In other words, the decrease in study time may be partly due to the expansion of higher education since World War II (Altbach, 2011). The 'massification' of higher education has led to more diverse institutions, academic programs, and students (Lucas, 1994). College and universities are enrolling more students from socially diverse backgrounds with regard to race/ethnicity, gender, age, and socioeconomic status (McCormick, 2011). Many of these students have competing demands on their time, such as work and family obligations, which may leave them with less discretionary time to devote to schoolwork (Plant, Anders Ericsson, Hill, & Asberg, 2005). More college students are working for pay than in previous decades, and the average number of hours worked by full-time students has also increased (McCormick, 2011).

An important part of the study-time puzzle involves students' major field of study. Recent decades have seen dramatic changes in the mix of college majors, characterized by a shift of students away from the traditional arts and sciences to what Brint, Riddle, Turk-Bicakci, and Levy (2005) call the "practical arts". Recent NSSE findings have documented substantial variability by college major in the average amount of time full-time seniors spend preparing for class, with students majoring in professional fields represented at both extremes: in 2011, full-time engineering majors averaged about 19 hours per week on class preparation, while business majors on average spent only 14 hours per week preparing for class (NSSE, 2011). Examined another way, about two-thirds of engineering majors reported spending more than 20 hours per week preparing for class, compared with only one-fifth of business majors (NSSE, 2011). In their analysis of declines in study time over four decades, Babcock and Marks (2011) investigated the role of compositional changes in the student body. While demographic changes accounted for a very small portion of the change, adding major and number of hours worked substantially increased the share of the decline in study time that is attributable to compositional

changes (to about 18 percent). In their analysis of gains in analytical reasoning and problem-solving skills during the first two years of college, Arum and Roska (2011) found that smallest gains were among students in professional fields such as business, education and social work. Finally, in Brint, Cantwell, and Saxena's (2012) analysis of study time, they found the lowest study times by humanities and social science majors and the highest study times for science and engineering majors. However, their analysis did not include professional fields other than engineering.

In light of the growth of the practical arts and Arum and Roksa's findings of diminished learning gains among students majoring in certain professional fields, it is important to better understand how one element of learning—study time—varies among professional fields and the arts and sciences, and how much these differences may reflect differences among both students and institutions. (In this paper, "professional" refers broadly to undergraduate majors with a direct occupational connection, without regard to formal certification or control of entry into a profession.)

Interestingly, students with greater non-academic obligations (e.g., working, caring for dependents, commuting) tend to gravitate towards certain majors. According to NSSE (2011), business majors reported spending an average of 27 hours per week on non-academic obligations, contrasted with about 16 hours per week for engineering majors. What is less clear from these aggregate findings is the influence of the institutional context on students' time spent preparing for class. Previous studies have shown selectivity, control, and Carnegie classification are related to students' academic and social behaviors (McCormick, Pike, Kuh, & Chen, 2009; Porter, 2006; Titus, 2004; Toutkoushian & Smart, 2001). Colleges and universities also differ in the mix of majors available. In view of the fact that some of the most popular and fastest growing college majors today are in the professional fields (Crosby, O., & Moncarz, R., 2006; NCES, 2011), it is important to examine how institutional context may moderate the relationship between major and study time.

Purpose and Research Questions

This study seeks to identify factors that contribute to how students allocate their time to inform the conversation about quality, rigor, and student effort. Controlling for student background characteristics, nondiscretionary time (that is, time devoted to work, family obligations, and commuting to campus), and college grades, this study investigates the amount of time that full-time college seniors spend preparing for class in five professional fields of study (business, education, engineering, allied health, and nursing) and in the arts and sciences majors. We also investigate the direct and moderating effect of institutional characteristics (e.g., selectivity, control, Carnegie classification) on time spent preparing for class. This study seeks to answer the following research questions:

1. What are the effects of majoring in one of these professional fields, as opposed to the arts and sciences, on time spent studying among full-time senior students?
2. What are the effects of institutional characteristics (e.g., selectivity, control, Carnegie classification) on time spent studying among full-time senior students?
3. Do institutional characteristics (e.g., selectivity, control, Carnegie classification) moderate the relationship between discipline and time spent studying among full-time senior students?

Findings from this study will help advance our understanding of institutional quality and academic rigor as well as the intersection of professional fields of study and institutional characteristics with study time.

Methods

Sample

The sample for this study was drawn from the 2011 administration of the National Survey of Student Engagement (NSSE). It includes 137,258 full-time seniors enrolled at 543 four-year institutions who had complete data on the variables described below. Table 1 shows approximately 63% of the sample were female and 24% were of non-traditional age (i.e., 24 years or older). About 5% of students were allied health majors, 5% nursing majors, 8% engineering majors, 10% education majors, 19%

business majors, and 53% arts and science majors. The racial-ethnic makeup of the sample was as follows: 75% classified themselves as White, 7% as African-American/Black, 8% as Asian, 8% as Latino or Hispanic, with the rest selecting another racial-ethnic group or multiracial.

Table 1
Student-level descriptive statistics (n=137,258)

Variable	Mean	SD	Minimum	Maximum
Time spent preparing for class	15.54	8.81	0	33
Female	0.63	0.48	0	1
Non-traditional age	0.24	0.43	0	1
Race/ethnicity				
Asian/Asian-American	0.08	0.28	0	1
Black/African American	0.07	0.25	0	1
Latino/Hispanic	0.08	0.27	0	1
Other race/ethnicity	0.02	0.15	0	1
White	0.75	0.44	0	1
Self-reported college grades				
Mostly A's	0.49	0.50	0	1
Mostly B's	0.46	0.50	0	1
Mostly C's or lower	0.05	0.22	0	1
Nondiscretionary time	22.03	17.80	0	132
Major field				
Arts and sciences	0.53	0.50	0	1
Allied health	0.05	0.21	0	1
Nursing	0.05	0.21	0	1
Business	0.19	0.40	0	1
Education	0.10	0.30	0	1
Engineering	0.08	0.28	0	1

With regard to the institutions represented, Table 2 displays about 16% of institutions were classified as research universities, 5% doctoral universities, 28% master's large institutions, 17% smaller master's institutions, 17% baccalaureate arts and sciences institutions, and 16% baccalaureate diverse institutions. About half (49%) of the institutions were classified as competitive in admissions, with the remainder distributed among noncompetitive (16%), very competitive (22%), and highly/most competitive (13%). About three out of five institutions in the sample were private institutions. As expected, there was considerable variation among institutions with respect to the concentration of students in the various major-field groups.

Table 2
Institution-level descriptive statistics (n=543)

Variable	Mean	SD	Minimum	Maximum
Selectivity				
Noncompetitive	0.16	0.36	0	1
Competitive	0.49	0.50	0	1
Very competitive	0.22	0.41	0	1
Highly or most competitive	0.13	0.34	0	1
Carnegie type				
Research universities	0.16	0.37	0	1
Doctoral universities	0.05	0.23	0	1
Master's large	0.28	0.45	0	1
Master's medium and small	0.17	0.38	0	1
Baccalaureate arts and science	0.17	0.38	0	1
Baccalaureate diverse	0.16	0.37	0	1
Private control	0.57	0.50	0	1
Proportion of major field				
Arts and sciences	53.55	19.41	4.55	100.00
Allied health	3.87	5.47	0.00	47.37
Nursing	5.97	9.18	0.00	54.90
Business	18.78	11.63	0.00	75.78
Education	12.28	10.89	0.00	60.00
Engineering	5.57	12.62	0.00	90.72

Variables

The dependent variable was student-reported time spent preparing for class. The survey asked students to indicate how many hours in a typical seven-day week they spend "preparing for class (e.g., studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)." The response options were 0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, and more than 30 hours per week. We recoded each response to the interval's midpoint, with a value of 33 assigned for the last option. The average time spent preparing for class for senior students in our sample was 15.5 hours with a standard deviation of 8.8 hours.

Student-level control variables included non-traditional age (i.e., 24 years or older), gender (with males as the reference group), race/ethnicity (with White as the reference group), self-reported grades, a measure of nondiscretionary time commitment, and student's academic major. Students were asked

to report what most of their grades had been at their current institution. Grade categories were collapsed into mostly A's, mostly B's and C's or below (reference group). Nondiscretionary time was derived from four items on the survey asking how many hours in a typical seven-day week are spent working for pay on or off campus, caring for dependents, and commuting to class. Response categories were the same as for class preparation and recoded in the same way, then summed.

Students were classified into one of six broad disciplinary categories based on their reported major: (1) allied health, (2) business, (3) education, (4) engineering, (5) nursing, and (6) arts and sciences. Five of the disciplines were from the professional fields (allied health, business, education, engineering, and nursing) with students majoring in the arts and sciences serving as the reference group. Appendix A outlines the specific majors that are represented by each broad category. As shown in Table 3, the average time spent preparing for classed varied by major category. Mean study time ranged from 13.5 hours per week in business to about 19 hours per week in engineering. Majors in the arts & sciences averaged 15.6 hours per week of study time.

Table 3
Average time spent preparing for class among full-time seniors by major field

	# of students	Mean	SD	Minimum	Maximum
Arts and sciences	72,512	15.63	8.75	0	33
Allied health	6,387	15.46	8.62	0	33
Nursing	6,360	18.10	9.41	0	33
Business	26,619	13.46	8.10	0	33
Education	13,889	15.15	8.59	0	33
Engineering	11,491	18.95	9.32	0	33

The institution-level variables included institutional control (public or private), selectivity, Basic Carnegie classification, and the proportion of seniors in each major. Four selectivity tiers were created based on Barron's ratings of institutional selectivity: noncompetitive or less competitive, competitive including competitive+ (reference group), very competitive including very competitive+, and highly or most competitive. Carnegie classification was collapsed into six groupings: research universities, doctoral universities, master's large institutions (reference group), master's medium and small

institutions, baccalaureate arts and sciences institutions, and baccalaureate diverse institutions. Average time spent preparing for class by institutional characteristic is given in Table 4. Students at highly or most competitive institutions study on average 17.5 hours per week while students at noncompetitive and competitive institutions average 14.9 hours per week. With regard to Carnegie type, seniors at baccalaureate arts and sciences institutions averaged 17.2 hours per week of study time, compared with 14.7-15.6 hours per week at the other types.

Table 4
Average time spent preparing for class among full-time seniors by institutional selectivity, Carnegie type, and control

	# of institutions	Mean	SD	Minimum	Maximum
Selectivity					
Noncompetitive	85	14.89	1.60	11.44	19.81
Competitive	268	14.87	1.69	8.75	21.75
Very competitive	119	15.88	1.71	12.33	20.61
Highly competitive	71	17.54	2.35	12.56	24.24
Carnegie type					
Research university	86	15.56	1.29	11.72	19.71
Doctoral university	29	14.86	1.01	11.83	16.44
Master's large	154	14.74	1.55	8.75	18.62
Master's medium and small	92	15.25	1.85	9.71	21.75
Baccalaureate arts and science	94	17.20	2.38	10.31	24.24
Baccalaureate diverse	88	15.09	2.13	11.23	21.82
Control					
Private	307	15.67	2.35	8.75	24.24
Public	236	15.15	1.37	11.54	21.25

Analyses

Given the nested structure of the data (students within institutions), we used the hierarchical linear modeling approach of Raudenbush and Bryk (2002). Analyses were conducted in three phases using HLM7 (Raudenbush, Bryk, & Congdon, 2010). First, a fully unconditional model was estimated with no predictors at either level. The purpose of this model was to decompose the variance in time spent preparing for class into variance due to differences between institutions and variance due to differences among students.

Next, the unconditional model was expanded to include the student-level variables. In this model, individual students' time spent preparing for class was considered a function of their major plus the student-level controls (gender, age, race-ethnicity, self-reported grades, and nondiscretionary time). Given that we were mainly interested in whether the relationship between academic major and time spent preparing for class significantly varies across institutions, the slopes of the majors were specified as random in the level-2 model (i.e., they were allowed to vary across institutions), while the slopes of the other student-level variables were fixed across institutions. In this model, student's major was centered on their institutional mean in order to examine cross-level interactions while all other control variables were centered on their grand mean (Enders & Tofighi, 2007; Hofmann & Gavin, 1998).

The final stage of analysis utilized the full set of student- and institution-level variables to examine their impact on time spent preparing for class. In this analysis, the student-level model remained the same; however, the intercept and the slope for each academic major category were predicted by the institution-level variables (selectivity, Carnegie type, institutional control, and proportions of students in each major). Student-level variables were centered as the previous analysis and institution-level variables were centered on their grand mean. The final model was as follows:

Level-1 Model

Time spent preparing for class$_{ij}$ = β_{0j} + β_{1j}*(*non-traditional age*$_{ij}$) + β_{2j}*(Mostly *A's*$_{ij}$) + β_{3j}*(Mostly *B's*$_{ij}$) + β_{4j}*(*Female*$_{ij}$) + β_{5j}*(*Hispanic*$_{ij}$) + β_{6j}*(*Black*$_{ij}$) + β_{7j}*(*Asian*$_{ij}$) + β_{8j}*(Other race-ethnicity$_{ij}$) + β_{9j}*(non-discretionary time $_{ij}$) + β_{10j}*(Allied *health major*$_{j}$) + β_{11j}*(*Nursing major*$_{ij}$) + β_{12j}*(*Business major*$_{ij}$) + β_{13j}*(*Education major*$_{ij}$) + β_{14j}*(*Engineering major*$_{ij}$) + r_{ij}

Level-2 Model

β_{0j} = γ_{00} + γ_{01}*(*Non-competitive*$_{j}$) + γ_{02}*(Very competitive$_{j}$) + γ_{03}*(Highly/Most competitive$_{j}$) + γ_{04}*(*Research university*$_{j}$) + γ_{05}*(*Doctoral university*$_{j}$) + γ_{06}*(*Master's medium/small institution*$_{j}$) + γ_{07}*(*Baccalaureate arts and science institution*$_{j}$) + γ_{08}*(*Baccalaureate diverse institution*$_{j}$) + γ_{09}*(*Private institution*$_{j}$) + γ_{010}*(Proportion of allied health major $_{j}$) + γ_{011}*(Proportion of nursing major $_{j}$) + γ_{012}*(Proportion of business major $_{j}$) + γ_{013}*(Proportion of business major$_{j}$) + γ_{014}*(Proportion of engineering major$_{j}$) + u_{0j}

$\beta_{1j} = \gamma_{10}$

:

$\beta_{9j} = \gamma_{90}$

$\beta_{Sj,\ where\ S=10,\ldots,14} = \gamma_{S0} + \gamma_{S1}*(Non\text{-}competitive_j) + \gamma_{S2}*(\text{Very competitive}_j) + \gamma_{S3}*(\text{Highly/Most competitive}_j) + \gamma_{S4}*(Research\ university_j) + \gamma_{S5}*(Doctoral\ university_j) + \gamma_{S6}*(Master's\ medium/small\ institution_j) + \gamma_{S7}*(Baccalaureate\ arts\ and\ science\ institution_j) + \gamma_{S8}*(Baccalaureate\ diverse\ institution_j) + \gamma_{S9}*(Private\ institution_j) + \gamma_{S10}*(\text{Proportion of allied health major }_j) + \gamma_{S11}*(\text{Proportion of nursing major }_j) + \gamma_{S12}*(\text{Proportion of business major }_j) + \gamma_{S13}*(\text{Proportion of business major}_j) + \gamma_{S14}*(\text{Proportion of engineering major}_j) + u_{Sj}$

Results

The first phase of the analysis allowed us to partition the variability in students' time spent preparing for the class into variability due to differences among students and variability due to differences between institutions (Table 5). Results indicate that 4.0% of the variability in time spent preparing for class is due to between-institution differences. The unconditional model also demonstrated that the predicted grand mean time spent preparing for class is about 15.5 hours. That is, full-time seniors in our sample, across all institutions, tend to spend about 15.5 hours on average preparing for class. Additionally, students' average time spent preparing for class was found to significantly vary across institutions.

Table 5
Estimation of base model of time spent preparing for class

Fixed Effects	Coefficient	S.E.	t-ratio
Institutional mean time spent preparing for class	15.5	0.08	182***
Random Effects	Variance	D.F.	Chi-square
Between Institutions	3.125	542	4711***
Within Institutions	75.379		
Intra-class correlation	0.040		

***p<.001

The second phase of the analysis allowed us to answer our first research question: What are the effects of academic major on time spent preparing for class? Results from the student-level model (Table 6) indicated that the addition of the student-level variables explained 6% of the variance in

Table 6
Estimation of time spent preparing for class as a function of student-characteristics

Fixed Effects	Coefficient	S.E.	t-ratio
Mean Time Spent Preparing for Class	15.42	0.089	173.72***
Non-traditional age	1.66	0.083	20.04***
Mostly A's	3.02	0.123	24.57***
Mostly B's	1.19	0.113	10.54***
Female	1.16	0.059	19.62***
Hispanic	0.06	0.099	0.66
African-American/Black	-0.15	0.108	-1.44
Asian	1.28	0.097	13.21***
Other race-ethnicity	0.56	0.162	3.45***
Non-discretionary time	0.01	0.002	2.60**
Allied Health	0.06	0.153	0.37
Nursing	2.83	0.221	12.82***
Business	-1.68	0.091	-18.43***
Education	-0.62	0.114	-5.44***
Engineering	3.64	0.180	20.21***

Random Effects	Variance	D.F.[1]	Chi-square
Between Institutions	3.75	138	1276***
Allied Health slope	1.99	138	215***
Nursing slope	8.43	138	577***
Business slope	1.34	138	286***
Education slope	1.81	138	226***
Engineering slope	3.28	138	281***
Within Institutions	71.05		

**p<.01; ***p<.001
[1]Chi-square statistics are based on 138 of 543 institutions that had sufficient data for computation (i.e., institutions that had students in all of the academic major categories).

students' time spent preparing for class. While this is not a large proportion of explained variance, this result is not surprising given that other studies (Brint et al, 2012) have also demonstrated that student background and academic discipline explain relatively little variation in students' study time. Results from this model demonstrated that nursing majors spend nearly three more hours per week preparing for class than arts and sciences majors, and engineering majors spend 3.6 more hours per week preparing for class than otherwise similar arts and science majors. Education majors spend nearly a half an hour fewer hours per week preparing for class than arts and sciences majors while business majors spend about 1.5 fewer hours preparing for class than arts and science majors. No differences were

found between arts and sciences majors and allied health majors. Additionally, the slope effects for the academic major categories were found to vary significantly across institutions, indicating that the "gap" in study time between professional majors and arts and sciences majors varies across institutions.

The third phase of the analysis (the full model) allowed us to answer our remaining research questions. Significant parameter estimates from the full model are presented in Table 7. (Full results are presented in the Appendix.) The addition of the institution-level variables explained 54.5% of the variability between institutions in the average time spent preparing for class.

Examining the impact of institutional characteristics on average time spent studying, results indicate that the mean time spent preparing for class was greater at very competitive and highly or most competitive institutions than at competitive institutions, differing on average by two-thirds of an hour and one and a half hours per week, respectively. In addition, the average time spent preparing for class was more than one and a half hours higher at baccalaureate arts and sciences institutions and about half an hour higher at master's medium/small institutions and baccalaureate diverse institutions compared to master's large institutions; no differences in average study time were found between the other types and master's large institutions, nor between public and private institutions. Average study time was lower at institutions with larger proportions of business and education major and higher at institutions with larger proportions of engineering majors.

In order to examine the third research question, whether institutional characteristics moderate the effect of discipline on study time, we allowed institutional characteristics to predict differences in study time between each group of professional majors and arts and sciences. Compared to otherwise similar arts and sciences majors, those studying nursing averaged nearly three more hours per week preparing for class. However, this gap narrowed considerably at highly selective institutions—reflecting increased study time by arts & sciences majors at those institutions and slight decrease for nursing

Table 7
Significant Fixed Effects from the Full Model of Time Spent Preparing for Class

Fixed Effects	Coefficient	S.E.	t-ratio
Intercept (Mean Time Spent Preparing for Class)	15.43	0.065	236.72***
Student-level Model for Time Spent Preparing for Class			
Non-traditional age	1.70	0.082	20.80***
Mostly A's	3.05	0.122	25.02***
Mostly B's	1.21	0.112	10.77***
Female	1.18	0.059	19.83***
Asian	1.26	0.098	12.89***
Other race-ethnicity	0.55	0.163	3.36***
Non-discretionary time	0.01	0.002	3.31***
Model for Institutional Mean Time Spent Preparing for Class			
Very Competitive	0.67	0.166	4.03***
Highly or Most competitive	1.60	0.280	5.72***
Master's Medium and Small	0.40	0.204	1.97*
Baccalaureate Arts and Sciences	1.62	0.288	5.64***
Baccalaureate Diverse	0.59	0.228	2.60*
Average: Business	-0.05	0.008	-6.80***
Average: Education	-0.02	0.008	-2.15*
Average: Engineering	0.03	0.008	3.27**
Model for Allied Health Slope			
Intercept (Mean Allied Health Slope)	0.03	0.240	0.14
Doctoral Universities	1.22	0.608	2.01*
Average: Allied Health	0.07	0.027	2.45*
Model for Nursing Slope			
Intercept (Mean Nursing Slope)	2.78	0.332	8.39***
Highly or Most competitive	-2.53	0.989	-2.56*
Research Universities	-1.80	0.703	-2.56*
Model for Business Slope			
Intercept (Mean Business Slope)	-1.83	0.101	-18.10***
Baccalaureate Arts and Sciences	-0.72	0.353	-2.05*
Baccalaureate Diverse	-0.93	0.358	-2.60*
Private	-0.45	0.226	-1.99*
Model for Education Slope			
Intercept (Mean Education Slope)	-0.71	0.133	-5.37***
Private	-0.69	0.286	-2.42*
Average: Engineering	-0.04	0.018	-2.07*
Model for Engineering Slope			
Intercept (Mean Engineering Slope)	3.27	0.332	9.85***
Baccalaureate Arts and Sciences	-2.29	1.095	-2.09*
Private	-0.93	0.442	-2.12*
Average: Engineering	-0.03	0.014	-2.02*

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

majors (Figure 1). The gap in study time between nursing and arts and science majors was also reduced at research universities compared with master's large institutions. Those studying engineering averaged 3.6 more hours per week preparing for class than arts and science majors, but this gap narrowed considerably at baccalaureate arts and science institutions compared with master's large institutions (Figure 2), and narrowed by nearly an hour at private institutions. Business majors and education majors, by contrast, studied less than their arts and science major counterparts. Business students averaged nearly two hours less study time per week and education majors averaged nearly an hour less than similar arts and sciences majors. For business majors, this gap increased at both types of baccalaureate institutions compared with master's large institutions (Figure 3) and also at private institutions. For education majors, the gap in study time increased at private institutions (Figure 4) and at institutions with higher proportions of engineering students. Using master's large universities as a baseline, study time was comparable between allied health and arts and science majors at other Carnegie types, with one exception. At doctoral universities, allied health majors studied just over an hour more than arts & science majors (Figure 5).

With regard to the student-level variables, nontraditional age students spend about 1.7 more hours per week preparing for class and women spend over an hour more per week preparing for class than men, net of the other variables in the model. Student who report grades of mostly A's and mostly B's spend significantly more time preparing for class student students who report grades of C's or lower. In fact, those who report grades of mostly A's study about three hours more than otherwise-similar students who report grades of C's or lower. Asian students spend more time than otherwise-similar White students preparing for class.

Figure 1
Adjusted Mean Study Time for Nursing and Arts and Science Majors by Institutional Selectivity

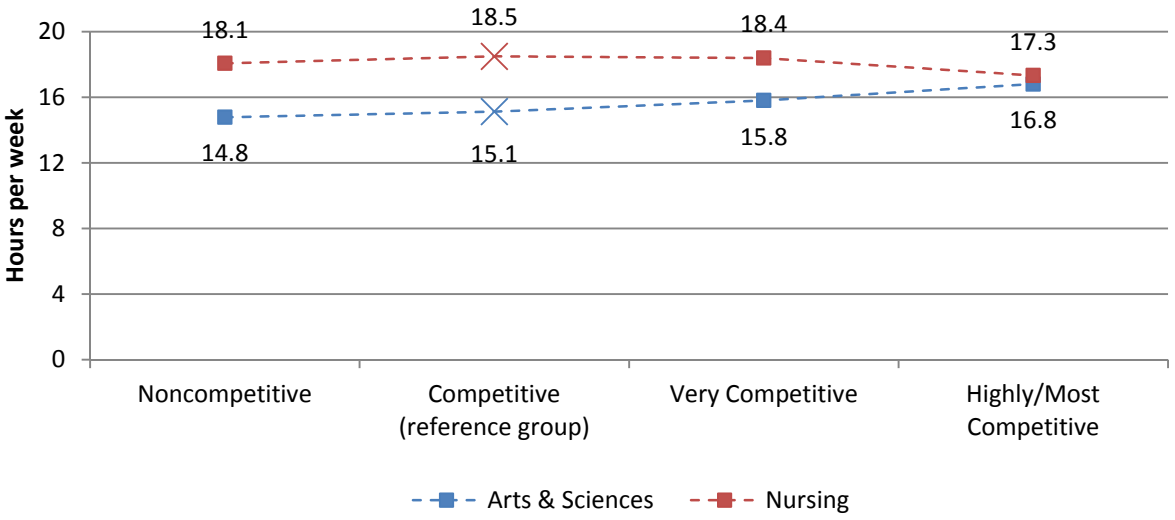


Figure 2
Adjusted Mean Study Time for Engineering and Arts and Science Majors by Carnegie Type

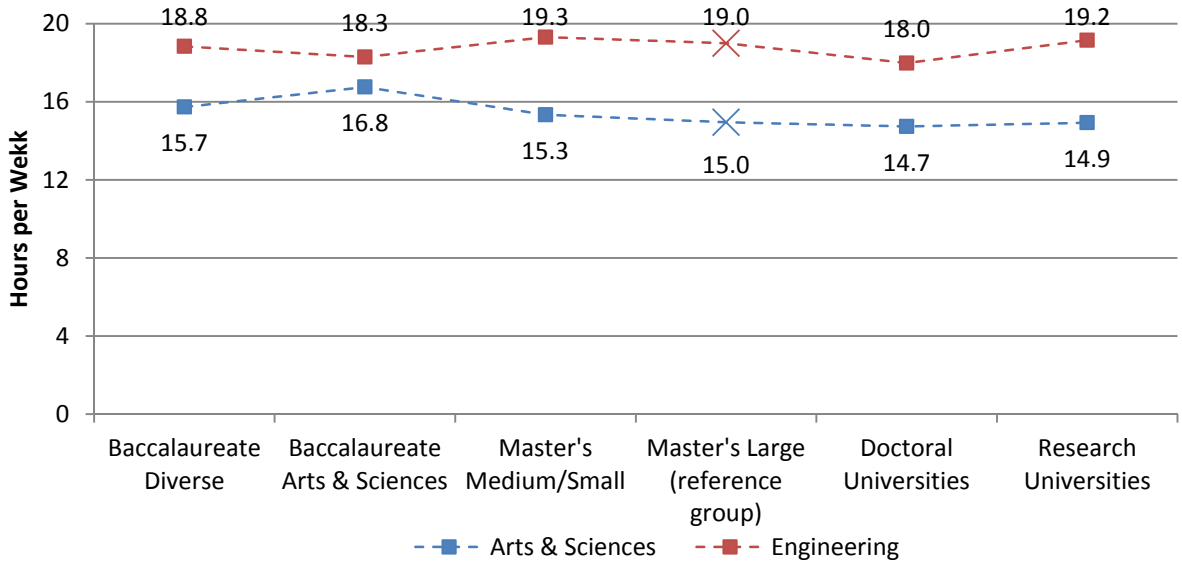


Figure 3
Adjusted Mean Study Time for Business and Arts and Science Majors by Carnegie Type

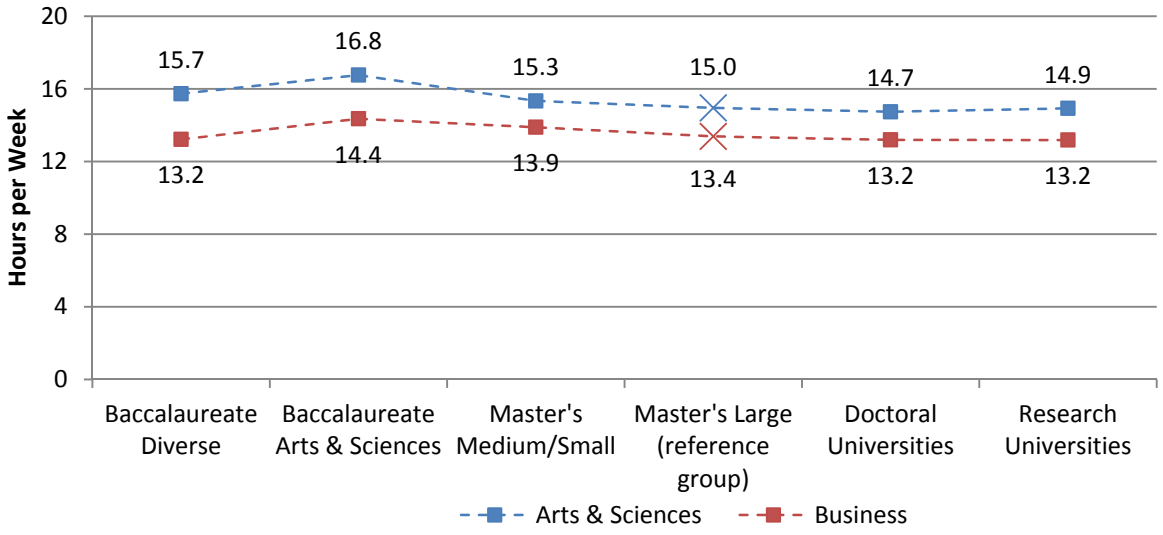


Figure 4
Adjusted Mean Study Time for Education and Arts and Science Majors by Control

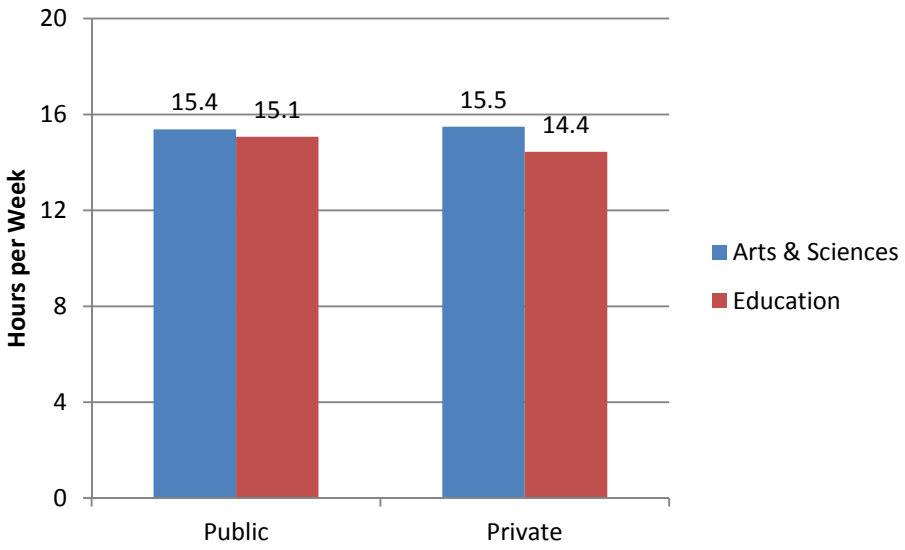


Figure 5
Adjusted Mean Study Time for Allied Health and Arts and Science Majors by Carnegie Type

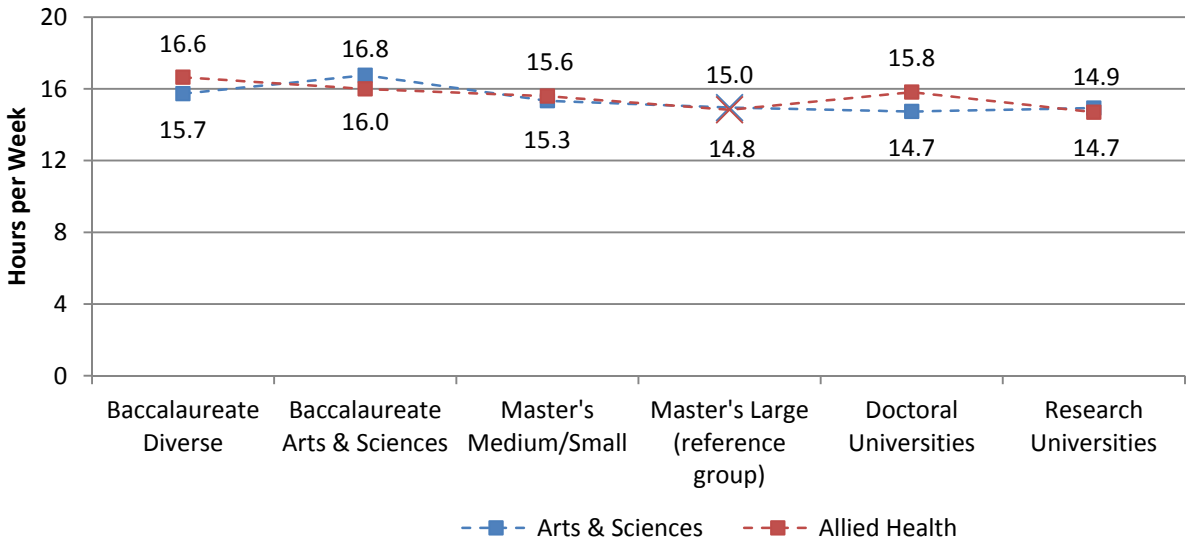
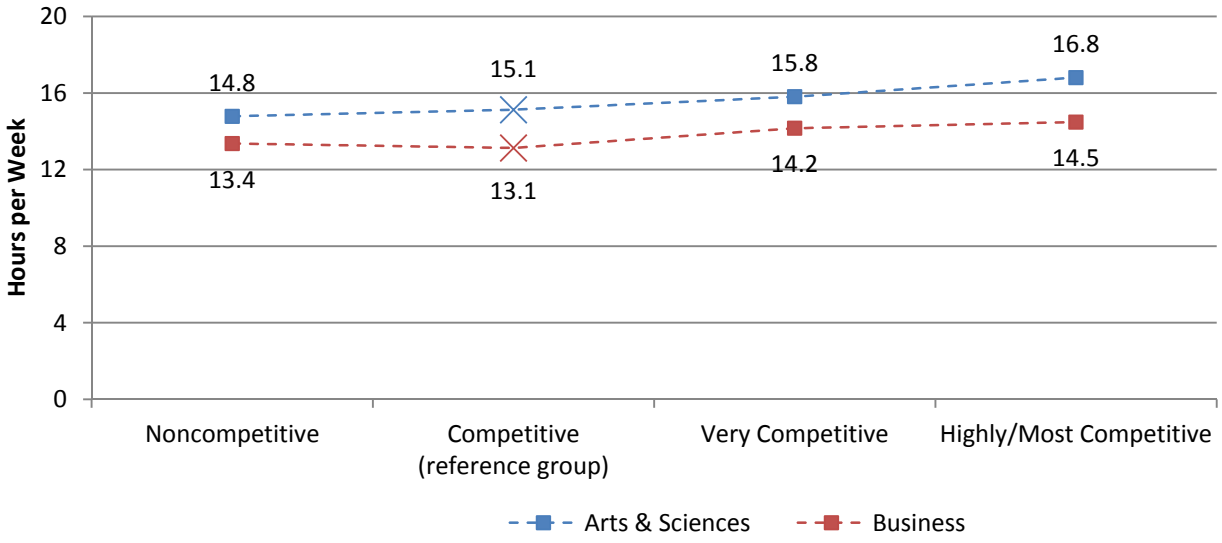


Figure 6
Adjusted Mean Study Time for Business and Arts and Science Majors by Institutional Selectivity



Discussion

Similar to other studies on academic effort, we found the amount of time students spend preparing for class is related to characteristics of students, their major fields, and institutions. Although our findings show significant relationships with study time and individual characteristics, field of study, and institutional context, the model explained only a small portion of the variance. The model did not capture variation in faculty teaching practices or expectations of learning within the aggregated major-field groups, both of which may play an important role in how students spend their time in- and outside of the class (Astin, 1993; Kuh, Nelson Laird, & Umbach, 2004; Umbach & Wawrzynski, 2005). The model also does not capture the varying assessment methods or grading strategies that exist between majors nor does it capture students' selection into their major. Some professional majors, such as nursing, require students to pass an entrance exam before admittance while others, such as engineering, require extensive prerequisite preparation in science and mathematics courses both of which may influence students' propensity to allocate time to their academic work. Future research may focus on the impact of faculty uses of technology in the classroom, pedagogical choices, and assessment methods on study time as well as students' motivation to pursue a certain major. Future studies may also wish to investigate more fine-grained differences between specific majors within the groups treated in this study (e.g., between specialties within business or engineering).

Despite these limitations, we found evidence of institutional differences in how much students study as well as the field of study they majored in. The difference in study time between arts and science majors and students in the various professional fields were moderated by certain institutional characteristics. In examining cross-level interaction effects, the most notable differences between arts and sciences and the host of professional majors were related to Carnegie type, though the specific nature of this effect varied among the professional major groups. Net of other factors, allied health students at doctoral universities studied over an hour more per week than their counterparts at

master's large universities (Figure 5). While business students at baccalaureate arts and sciences colleges studied about an hour more than their peers at master's large universities (14.4 and 13.4 hours, respectively), they studied almost two hours less than arts and sciences majors at baccalaureate arts and sciences institutions contributing to a widening gap between business and arts and science majors at baccalaureate arts and science colleges relative to the gap at master's large institutions (Figure 3).

The gap in study time between engineering majors and arts and science majors was reduced at baccalaureate arts and sciences colleges compared with master's large institutions (see Figure 2). While engineering majors studied about the same amount of time across Carnegie type (between 18 and 19 hours), arts and science students almost two more hours at baccalaureate arts and science institutions (about 17 hours) than at the other Carnegie types (about 15 hours). A similar pattern was found for nursing majors across selectivity tiers (see Figure 1). While nursing majors studied about the same across selectivity tiers, about 18 hours (with about an hour dip at most selective institutions), average study time for arts and science majors tended to steadily across selectivity tiers culminating in arts and sciences and nursing majors spending about the same amount of time preparing for class at highly and most selective institutions.

To explain the differences in study time in the same field at different types of institutions, a future study could examine the variation in admission standards for these fields. For example, admission in an allied health field at a large doctoral university may be more competitive, thus requiring more study time, compared to a similar program at a smaller regional campus.

According to Smart (2010), examining distinctive academic environments within institutions may lead to a better understanding of students' learning behaviors and engagement patterns than the impact of "remote and distal nature of institutional-level measures" (p. 469) like selectivity and Carnegie classification. He also encourages researchers to employ a theoretical approach to organizing academic majors so to "discern those environments' potential influences on student learning" (Smart, Feldman, &

Ethington, 2000, p. 240). This approach may be useful to better understanding the difference in class preparation among students studying the professional fields.

Conclusion

Despite the importance of study time to student learning and recent findings documenting declines in how much college students study, surprisingly little is known about what drives study time. This research shows that students allocate their time differently based on a number of factors including field of study, type of institution attended, and individual background characteristics. Consequently, the focus on aggregate average study time masks important individual and structural sources of variation, most importantly field of study. Although field of study shows a clear relationship to study time, features of the institution moderate these effects in interesting ways.

Many scholars would agree that the quality of time and effort students invest in their academic activities is necessary for student learning and development (Astin, 1993; Arum & Roksa, 2011; Michaels & Miethe, 1989; Pace, 1982). While this study uncovered both disciplinary and institutional differences in the *amount* of time students spend preparing for class, the next step is to better understand how that time is being spent, and specifically whether it is being spent on *educationally effective and productive* activities. This has particular relevance for undergraduate professional education, given Arum and Roksa's (2011) findings of a learning advantage for arts and science majors. For example, although engineering students may spend more time preparing for class than arts and science majors, are they less likely to engage in collaborative or peer-mediated learning associated with positive social and cognitive gains (Cabrera et al., 2002; Cruce, Wolniak, Seifert, & Pascarella, 2006; O'Neil, 2012; Umbach & Wawrzynski, 2005)? Further research needs to inquire into the features of undergraduate professional education and how they can serve to diffuse learning objectives where the arts and sciences seem to currently confer differential educational benefits.

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Appendix A

NSSE Academic Major Categories by Broad Disciplinary Fields

Allied Health	**Arts and Sciences**
Allied health/other medical	Anthropology
Dentistry	Art, fine and applied
Medicine	Astronomy
Pharmacy	Atmospheric science (including meteorology)
Therapy (occupational, physical, speech)	Biochemistry or biophysics
Veterinarian	Biology (general)
	Botany
Business	Chemistry
Accounting	Communications
Business administration (general)	Computer science
Finance	Earth science (including geology)
International business	Economics
Marketing	English (language and literature)
Management	Environmental science
Other business	Ethnic studies
	Gender studies
Education	Geography
Business education	History
Elementary/middle school education	Language and literature (except English)
Music or art education	Marine (life) science
Physical education or recreation	Mathematics
Secondary education	Microbiology or bacteriology
Special education	Music
Other education	Other arts & humanities
	Other biological science
Engineering	Other physical science
Aero-/astronautical engineering	Other social science
Civil engineering	Philosophy
Chemical engineering	Physics
Electrical or electronic engineering	Political science
Industrial engineering	Psychology
Materials engineering	Social work
Mechanical engineering	Sociology
General/other engineering	Speech
	Statistics
Nursing	Theater or drama
Nursing	Theology or religion
	Zoology

Appendix B

Estimation of time spent preparing for class as a function of student and institutional-characteristics (final model)

Fixed Effects	Coefficient	S.E.	t-ratio
Model for Institutional Mean Time Spent Preparing for Class			
Intercept (Mean Time Spent Preparing for Class)	15.43	0.065	236.72***
Noncompetitive	-0.23	0.193	-1.22
Very Competitive	0.67	0.166	4.03***
Highly or Most competitive	1.60	0.280	5.72***
Research Universities	-0.02	0.198	-0.10
Doctoral Universities	-0.04	0.227	-0.20
Master's Medium and Small	0.40	0.204	1.97*
Baccalaureate Arts and Sciences	1.62	0.288	5.64***
Baccalaureate Diverse	0.59	0.228	2.60*
Private	-0.04	0.163	-0.25
Average: Allied Health	0.00	0.011	0.21
Average: Nursing	0.01	0.009	1.35
Average: Business	-0.05	0.008	-6.80***
Average: Education	-0.02	0.008	-2.15*
Average: Engineering	0.03	0.008	3.27**
Non-traditional age	1.70	0.082	20.80***
Mostly A's	3.05	0.122	25.02***
Mostly B's	1.21	0.112	10.77***
Female	1.18	0.059	19.83***
Hispanic	0.08	0.099	0.79
African-American/Black	-0.15	0.106	-1.40
Asian	1.26	0.098	12.89***
Other race-ethnicity	0.55	0.163	3.36***
Non-discretionary time	0.01	0.002	3.31***
Model for Allied Health Slope			
Intercept (Mean Allied Health Slope)	0.03	0.240	0.14
Noncompetitive	-0.33	0.450	-0.73
Very Competitive	-0.46	0.369	-1.23
Highly or Most competitive	-0.15	0.527	-0.28
Research Universities	-0.16	0.375	-0.42
Doctoral Universities	1.22	0.608	2.01*
Master's Medium and Small	0.37	0.476	0.77
Baccalaureate Arts and Sciences	-0.66	0.789	-0.84
Baccalaureate Diverse	0.97	0.856	1.13
Private	0.83	0.436	1.91
Average: Allied Health	0.07	0.027	2.45*
Average: Nursing	0.02	0.025	0.78
Average: Business	0.03	0.019	1.32
Average: Education	0.02	0.017	1.20
Average: Engineering	0.04	0.022	1.73
Model for Nursing Slope			
Intercept (Mean Nursing Slope)	2.78	0.332	8.39***

Noncompetitive	-0.28	0.604	-0.46
Very Competitive	-0.77	0.553	-1.39
Highly or Most competitive	-2.53	0.989	-2.56*
Research Universities	-1.80	0.703	-2.56*
Doctoral Universities	-0.09	0.672	-0.13
Master's Medium and Small	-0.04	0.650	-0.07
Baccalaureate Arts and Sciences	-0.14	1.159	-0.12
Baccalaureate Diverse	0.37	0.734	0.50
Private	-0.08	0.518	-0.15
Average: Allied Health	0.01	0.039	0.14
Average: Nursing	0.01	0.029	0.21
Average: Business	-0.01	0.030	-0.40
Average: Education	0.05	0.027	1.68
Average: Engineering	-0.01	0.042	-0.15
Model for Business Slope			
Intercept (Mean Business Slope)	-1.83	0.101	-18.10***
Noncompetitive	0.51	0.272	1.87
Very Competitive	0.35	0.213	1.62
Highly or Most competitive	-0.21	0.323	-0.65
Research Universities	-0.19	0.224	-0.87
Doctoral Universities	0.04	0.385	0.09
Master's Medium and Small	0.14	0.334	0.43
Baccalaureate Arts and Sciences	-0.72	0.353	-2.05*
Baccalaureate Diverse	-0.93	0.358	-2.60*
Private	-0.45	0.226	-1.99*
Average: Allied Health	0.00	0.019	-0.15
Average: Nursing	-0.02	0.015	-1.21
Average: Business	0.00	0.013	0.05
Average: Education	0.02	0.013	1.50
Average: Engineering	0.00	0.009	-0.33
Model for Education Slope			
Intercept (Mean Education Slope)	-0.71	0.133	-5.37***
Noncompetitive	-0.12	0.321	-0.38
Very Competitive	-0.02	0.321	-0.06
Highly or Most competitive	-0.08	0.438	-0.18
Research Universities	-0.12	0.328	-0.35
Doctoral Universities	1.05	0.557	1.88
Master's Medium and Small	-0.09	0.361	-0.25
Baccalaureate Arts and Sciences	-0.46	0.531	-0.86
Baccalaureate Diverse	0.04	0.402	0.10
Private	-0.69	0.286	-2.42*
Average: Allied Health	0.00	0.023	0.06
Average: Nursing	0.01	0.016	0.69
Average: Business	-0.01	0.015	-0.81
Average: Education	0.00	0.013	-0.16
Average: Engineering	-0.04	0.018	-2.07*
Model for Engineering Slope			
Intercept (Mean Engineering Slope)	3.27	0.332	9.85***

Noncompetitive	0.39	0.527	0.73
Very Competitive	0.07	0.466	0.16
Highly or Most competitive	-0.56	0.631	-0.89
Research Universities	0.13	0.461	0.28
Doctoral Universities	-0.69	0.714	-0.97
Master's Medium and Small	0.02	0.999	0.02
Baccalaureate Arts and Sciences	-2.29	1.095	-2.09*
Baccalaureate Diverse	-0.80	0.836	-0.96
Private	-0.93	0.442	-2.12*
Average: Allied Health	-0.06	0.048	-1.16
Average: Nursing	0.00	0.038	-0.11
Average: Business	-0.02	0.027	-0.88
Average: Education	-0.01	0.030	-0.28
Average: Engineering	-0.03	0.014	-2.02*

Random Effects	Variance	D.F.[1]	Chi-square
Between Institutions	1.709	124	849***
Allied Health slope	1.314	124	184***
Nursing slope	6.806	124	462***
Business slope	1.133	124	262***
Education slope	1.663	124	217***
Engineering slope	2.778	124	262***
Within Institutions	71.063		

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

[1]Chi-square statistics are based on 138 of 543 institutions that had sufficient data for computation (i.e., institutions that had students in all of the academic major categories).