Impact of Course Length on Student Learning

Adrian M. Austin and Leland Gustafson[1]

ABSTRACT

Using a database of over 45,000 observations from Fall, Spring, and Summer semesters, we investigate the link between course length and student learning. We find that, after controlling for student demographics and other characteristics, intensive courses do result in higher grades than traditional 16 week semester length courses and that this benefit peaks at about 4 weeks. By looking at future performance we are also able to show that the higher grades reflect a real increase in knowledge and are **not** the result of a "lowering of the bar" during summer. We discuss some of the policy implications of our findings.

Introduction

Condensed or time shortened semesters are becoming more common as more non-traditional students seek higher education. Many universities now offer full semester courses over two or three weekends. Also, inter semester courses of one to three weeks are also becoming popular as university administrators seek to find ways to increase student enrollments. While there is much anecdotal evidence that grades during summer semesters tend to be higher than during the fall semester, we must ask if condensed semester courses actually provide students with the same learning experience as a traditional 16-week semester?

At the University of West Georgia, the source of our data, we find that semester GPAs are on average about 1/3 of a grade higher in the summer, a significant difference. This naturally leads us to inquire whether these higher grades result from better/different students or from the structure of summer courses. We are also led to the related question of whether the higher grades are simply inflationary and do not reflect any greater learning.

The literature is mixed on these questions but most studies suggest that students do perform equally well or better in the condensed format (see Scott and Conrad, 1992, and Daniel, 2000). Many studies, however, are limited by a number of factors. Sample sizes tend to be small, and there is often a lack of other achievement and demographic factors that may also influence student performance. Another critical problem is the focus on the grade earned in an intensive course as a measure of learning[2]. As noted above, those grades may be inflationary which would lead to biased conclusions.

This study attempts to shed some light on these questions by using several demographic variables and measures of ability to account for differences between students. We are able to examine different types of course structures by breaking down the summer semesters into several types of sessions of varying lengths. To measure student learning during summer sessions, independently from their grade, we look at future performance in related courses. We use both OLS and Ordered Probit regression models that control for achievement and demographic factors and use a large dataset of more than 45,000 student performance outcomes from spring 2001 through summer 2004.

Overall we find that there is a significant improvement from taking shorter courses that cannot be explained by student characteristics. This benefit seems to peak with courses that last 4 weeks. More importantly we also find that the improved grades are not inflationary as grades earned during summer

---

[1] Adrian Austin, Assistant Professor of Economics, University of West Georgia, Carrollton, Georgia 30118 aaustin@westga.edu; Leland Gustafson, Professor of Economics, University of West Georgia, Carrollton, Georgia 30118, lvg@westga.edu. The authors would like to thank Brett Katzman, and the anonymous referees for very helpful comments and suggestions.

[2] Seamon (2004) addresses this issue in particular. Unfortunately the sample that he uses is too small to make very strong statements about retained knowledge.

sessions have the same explanatory power for future performance as those earned during a traditional 16 week semester.

Literature Review

Brackenbury (1987) reviews final exam grades in educational psychology classes taught by the same instructor over 3, 8, and 16 week lengths. No significant differences are found in average exam grades. Caskey (1994) compares students taking algebra and accounting classes in both the condensed and traditional semester format. She finds no significant difference in course grades or overall class average. Age, ability and other possible confounding factors are not controlled for in the study. Messina (1996) using descriptive analysis finds that end of course grades for students who take weekend courses at a community college are similar to those taken during a traditional semester. Spurling (2001) looks at the percent of students passing English, mathematics, and English–as-a-Second-Language in both a condensed summer and traditional semester format. He finds that students in the condensed format have significantly higher pass rates than students in the traditional format but does not control for student differences in ability, age, etc.

Rayburn and Rayburn (1999) control for gender, past achievement (GPA, ACT), and major (business, non-business) while evaluating the effect of condensed semester format (8-week) on student performance in management accounting classes. Student performance is measured both by scores on short multiple choice questions and on exam problems. Using ANOVA they find that class length is not a significant factor in multiple choice question scores but is significant in explaining higher exam problem scores in the traditional semester length.

Ewer, et al. (2002) look at student performance in two introductory accounting courses taught by the same professor in two semester formats (16-week and 4-week). They control for student ability by categorizing students by high and low ACT scores and GPA before taking the courses. They use three measures of student performance; mean scores on course tests, the final exam and course GPA. A t-test for differences in means is used to test for significance. Their results show that students with high ACT scores or with high GPA's do perform significantly higher in the condensed semester format. They find no significant difference in performance between the condensed and traditional semester format for students with lower ACT scores or lower GPA's.

Boddy (1985), using regression analysis with paired classes taught by the same instructor, shows that class performance (exam scores) in a 5 and 8 week compressed semester format is significantly higher than the traditional 16 week semester format for Computer Science classes. However, there is no significant difference in performance for History or School Law classes. He also finds that course load, major area of study, amount of paid employment, and length of time since previous study of a subject are not significantly related to achievement in the condensed or traditional semester length.

Students may perform better in the condensed format because there is less time between learning and testing to forget the material. However, are students able to retain material learned in the condensed format and use it in future classes as well as those who learn material in a traditional format. Seamons (2004) puts it quite succinctly, "Whether the formats differ in effectiveness at the conclusion of the course may be of little importance if the difference is short lived and disappears after a period of time." Van Scyoc and Gleason (1993) compared courses in microeconomics taken in a traditional 16-week semester with a 3-week semester format. They find better performance on achievement test in the compressed format at the end of the course and find no difference in retention when measured several months after the course is over. Geltner and Logan (2000) finds that students perform better (GPA, success rate) in 6-week than 16-week classes and retain the material equally well in both formats. Success rates are measured as the percent of students getting a 'C' or better. Retention is measured by the difference in GPA earned by students in the second of two sequential courses where the first course in the sequence is taken in either the condensed or traditional semester format. They control for student achievement by separating students into two groups, those that earned above and below a 3.0 GPA in the traditional spring semester and then compare their GPA's in condensed summer classes. Petrowsky (1996) evaluates student performance in traditional 15 week versus 2 week summer macroeconomic courses. He finds that on exams that measure basic recall student scores where higher in the compressed format. However, on the final exam that required more comprehension and analysis, students in the traditional semester format perform better.

Daniel (2000) contains a literature review for articles on time shortened courses across disciplines and finds that these courses yield comparable and often superior learning outcomes in comparison with traditional semester or quarter length courses (p. 303).

Impact of Course Length on Grades

We utilize a very large database in our study which allows us to compare over 45,000 student records over many different classes. We are also able to look at several different session lengths.

Description of the Data

Our data comes from students at the University of West Georgia, a regional state university, for Spring 2001 through Summer 2004. For these students, we have a set of demographic data including age, race, gender, high school GPA, SAT scores, ACT scores, last date attended etc. We also have overall semester GPA performance for each student as well as performance in every class.

The raw data has 59,736 undergraduate semester student records over those 11 semesters. This reflects 16,806 students. Unfortunately we do not have SAT results for all students. Some students take the ACT in lieu of the SAT, and the University of West Georgia does not require SAT scores for transient students, transfer students (with more than 30 semester hours) or non-traditional students. As such we are left with a final 11,795 students with SAT scores[3].

Of the 11,795 students in the study, 58% are female, 73.9% are white, 22.0% are black and the remaining students are Asian (1.2%), Hispanic (1.2%), Native American (0.2%) and multi-racial (1.5%). The average SAT scores are 501.5 for the verbal test, and 493.4 for the math. The average student age is 21. The youngest student in the study is 13, and the oldest is 70.

Table 1
Characteristics of Students in the Study

	Max	*Average*	*Std*	*Min*		
SATM	800	491.1	74.9	210		
SATV	800	498.0	74.6	200		
Age	69.6	21.2	3.3	12.6		
	Male	Female				
Gender	42%	58%				
Ethnicity	White	Black	Asian	Hispanic	Mixed	Native
	73.9%	22.0%	1.2%	1.2%	1.5%	0.2%

Summer Courses

The University of West Georgia offers typical 16 week fall and spring semesters as well as a summer semester that has sessions of varying lengths. We investigate the impact of the length of a session on student performance by separating the summer GPAs into performance by session. In this way we can compare performance in the shorter sessions to performance in a full 16 week fall or spring semester.

The summer is organized into four major sessions. Session I has 11 consecutive weekdays of teaching, a reading day, and an exam day. Session II has 36 consecutive weekdays of teaching, a reading day, and an exam day and is spread over most of the summer. Sessions III and IV each have 17 consecutive weekdays of teaching, a reading day, and an exam day. In what follows we refer to session I as the three week

[3] Although we are not able to include these students and therefore miss some valuable information, the silver lining is that we do not have to worry about any possible bias due to their inclusion. The study of the differences between the performance of transient, non-traditional, and transfer students, and "regular" students is a paper in its own right.

session, sessions III and IV as four week sessions, and session II as an eight week session. The three week and two four week sessions run consecutively, while Session II begins with Session III and ends with Session IV.

Figure 1
Summer Session Structure

Table 2
Students in the Study by Semester/Session

Semester	*Number of Students*
Spring 2001	4,913
Summer 2001	1,825
Fall 2001	5,500
Spring 2002	5,101
Summer 2002	1,881
Fall 2002	5,760
Spring 2003	5,232
Summer 2003	2,131
Fall 2003	5,946
Spring 2004	5,517
Summer 2004	2,084
Total	**45,890**
Session Length	*Number of Students*
3 Week	1,884
4 Week	4,605
8 Week	3,836
Educ	401
16 Week	37,939
Total	**48,665**

Notes: Since the Summer semesters are further split into several different sessions, the totals are not equal.

There are two other options for taking classes during the summer, Ecore, which is a recent initiative in the University System of Georgia where some core courses can be taken online, and a special Education Session that is only open to education majors.[4] [5]

To study the performance by session, we compute GPAs for all of the possible sessions lengths during the summer. Because we have data for every course for every student, we are able to divide the summer into the several different session lengths instead of relying on the whole summer GPA which is what is typically reported. In this manner we can compare the three, four, and eight week session performances to the performances during the traditional 16 week fall and spring sessions. All the session breakdowns are given in Table 2 above.

We use the demographic, achievement, and structural variables to predict performance in Model 1 below.

---

[4] The Education Session runs at different times due to the need to have certain practicum courses fit the timing of the Elementary/Middle/High School year.

[5] Ecore classes are also available in regular semesters as well. Given that less than 0.5% of all hours in the entire sample are from Ecore classes and that we are interested in in-class performance, we decided to remove the Ecore courses from the sample.

Model 1:

$$GPA_j = f(D3, D4, D8, Educ, Eth, Gen, SATM, SATV, Hrs, StartGPA, Age, Load)$$

GPA_j	GPA earned in session j
D3	Dummy Variable =1 if session j is a 3 Week Summer Session
D4	Dummy Variable =1 if session j is a 4 Week Summer Session
D8	Dummy Variable =1 if session j is an 8 Week Summer Session
Educ	Dummy Variable =1 if session j is an Education Summer Session
Eth	Dummy Variable = 1 if a student is White
Gen	Dummy Variable = 1 if a student is Female
SATM	SAT Math score
SATV	SAT Verbal score
Hrs	Earned Credit Hrs at the start of the semester
StartGPA	GPA at the start of the semester
Age	Age at the start of the semester
Load	Contact hours per week

Table 3
Summary Statistics of the data used to estimate Model 1.

	FULL SAMPLE		***SUB SAMPLE A***		***SUB SAMPLE B***	
	Average	*Std*	*Average*	*Std*	*Average*	*Std*
GPA	2.78	1.00	2.76	1.01	2.76	1.00
Eth	0.73	0.45	0.73	0.44	0.73	0.45
Gen	0.60	0.49	0.60	0.49	0.60	0.49
Age	21.20	3.31	21.18	3.28	21.17	3.25
SATM	491.06	74.88	490.73	74.40	490.76	74.37
SATV	497.99	74.63	496.43	74.16	496.56	74.15
Hrs	46.17	37.10	46.10	37.25	46.09	37.25
Start GPA	2.76	0.66	2.75	0.66	2.75	0.66
LOAD	12.75	4.06	12.23	4.13	12.23	4.13
	# of Observations		# of Observations		# of Observations	
D3	1,884		128		128	
D4	4,605		330		330	
D8	3,836		235		235	
Educ	401		38		38	
Full Term	37,939		2,543		2,412	
Total	48,665		3,274		3,143	

There is ample support in the literature for using ethnicity, gender, SAT scores and starting GPA as predictors of current GPA (see Betts and Morell, 1999, Case and Richardson, 1990, and Cohn, Cohn, Balch, and Bradley, 2004). We also include age and earned hours as measures of maturity and institutional maturity. For first semester freshmen, who have no starting GPA, we try two approaches. To keep the variation among the students while recognizing that the mean high school GPA is much greater than the college GPA, we substitute their High School GPA adjusted to have the same mean as the intercept term of a regression of Starting GPA on Hrs; this is what's reported below. A second approach is to ignore those students or substitute an indicator function. The results show no practical differences between any of these cases[6]. The age of the students is their age at the beginning of the semester Jan 15, May 15 and Aug 25. We define the variable, *Load*, to measure the impact of a student's course load on performance. Not only does course load measure how much time a student spends in class, but it also may alleviate some sample selection issues between regular semesters and summer semesters as students choose their course loads within both types of semesters. To compare course loads effectively across sessions of different length we define the variable Load as the total number of contact hours per week over the evaluation period. So, for example, a student taking a single 3 hour credit course during a 4 week session, would have a lighter load than a student taking 15 hours during a regular Fall or Spring semester. Summary statistics of the data are in Table 3 below.

A limitation of this type of study is that there is no grade for "droppers" and they are left out of the model. This may lead to a bias. Unfortunately this plagues every study of student performance. However, since we are comparing session lengths, and students drop out of all types of sessions, this might mitigate any bias caused by the drop effect.

A more serious problem is that of self-selection by students. Anecdotal evidence suggests that summer students are typically high achievers, who want to get ahead, or those who need to catch up. We do our best to control for student characteristics, and the inclusion of the Load variable, does allow some student self-selection to be controlled for, however there may be some bias that for which we are not entirely able to control.[7]

OLS Results

The results of OLS estimation of Model 1 are given in Table 4. Controlling for a number of past student performance and demographic variables we find that semester lengths of three, four, and eight weeks significantly increase student performance over those achieved during the traditional sixteen week semester. However, the affect of shorter semester lengths are not the same. An F-Test indicates that there is a significant difference in the effect on student performance between the three time-shortened summer semesters. A semester length of four weeks provides the optimal student performance.

White, female, and age are all significant and positively related to student performance. Math SAT score is positive and significant but verbal SAT score is not shown to have a significant effect. Starting semester hours, starting GPA, and Load are all significant and positively related to student performance.

Table 4
Estimation results from Model 1

	FULL (p-val)	*FULL (probit) (p-val)*	*Subsample A (p-val)*	*Subsample B (p-val)*
Intercept	-0.299	-	-0.834	-0.652
	(0.000)		(0.000)	(0.000)
D3	0.436	0.424	0.566	0.257
	(0.000)	(0.000)	(0.000)	(0.000)
D4	0.442	0.542	0.651	0.349
	(0.000)	(0.000)	(0.000)	(0.000)
D8	0.337	0.175	0.451	0.117
	(0.000)	(0.000)	(0.000)	(0.000)
EDUC	0.661	0.615	0.697	0.636
	(0.000)	(0.000)	(0.000)	(0.000)
ETH	0.088	0.070	0.077	0.094

6 The results from the alternate specifications are available upon request from the authors.

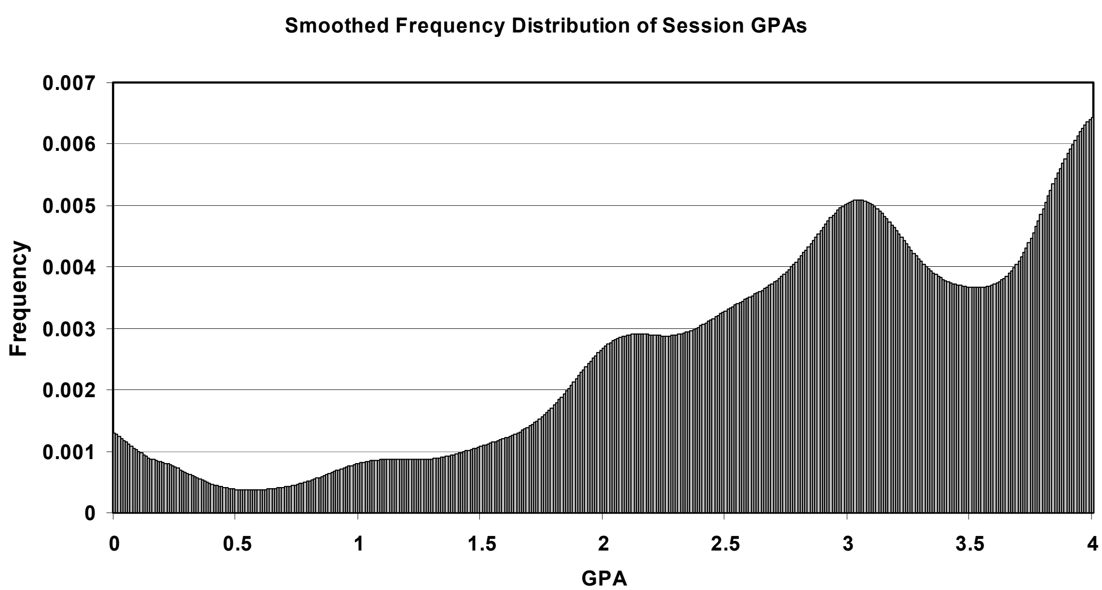
7 A third issue is the fact that all the data comes from one school. This is, unfortunately, common to all studies in the literature. On the positive side, unlike most other studies, our data is school wide and not just from a few classes or a single department.

	(0.000)	(0.001)	(0.000)	(0.000)
GEN	0.145	0.179	0.163	0.194
	(0.000)	(0.000)	(0.000)	(0.000)
SATM (in 10s)	0.004	0.008	0.008	0.009
	(0.000)	(0.000)	(0.000)	(0.000)
SATV (in 10s)	0.001	0.004	0.001	0.003
	(0.161)	(0.000)	(0.707)	(0.040)
HRS	0.004	0.006	0.006	0.006
	(0.000)	(0.000)	(0.000)	(0.000)
STARTGPA	0.698	0.677	0.681	0.720
	(0.000)	(0.000)	(0.000)	(0.000)
AGE	0.017	0.026	0.023	0.023
	(0.000)	(0.000)	(0.000)	(0.000)
LOAD	0.012	0.014	0.012	0.012
	(0.000)	(0.000)	(0.000)	(0.000)
Adj R^2	0.35		0.37	0.36
Prob F-stat	0.000		0.000	0.000
Observations	48,665	48,665	3,274	3,143

Ordered Probit Results

By its nature a GPA can only fall within [0, 4]. If most of the data were well within the boundaries, then OLS would be very well suited to model the data, however there is significant mass on the boundaries (3.0% and 17.0% of the data is equal to 0 and 4 respectively). This can cause OLS to give biased results. In addition, although theoretically a GPA can take any value between 0.00 and 4.00, there are holes in the data as well as significant clumps at certain points. As the frequency distributions below show, there are peaks at GPAs of 0, 1, 2, 3, and 4. For these reasons, we choose to augment our results by using an Ordered Probit model.

Figure 1
Distribution of Session GPAs



We define the categories for the ordered probit model as follows: if the session GPA is greater than 3.5, the session grade is considered to be an A, if the GPA is greater than 2.5, but less than 3.5, the session grade is a B etc. for C, D, and F.

The results of the probit model are also in Table 4. As before, we find that the coefficients on the summer dummies are significant, and that the coefficient on D4 is greater than that on D3 and D8. In fact, the estimates from the probit model are all very close to the earlier OLS analysis, and the probit model serves to confirm our earlier results.

Sub Samples

Since many students are represented more than once in the full data set, there is a possibility of correlation between the error term and the independent variables. Since one semester's GPA will become part of the Cumulative GPA it will show up as part of the starting GPA in a later semester. This could lead to biased estimates although there is reason to believe that the bias will be small – the sample is very wide compared to its length, and one semester's GPA could both lower the cumulative GPA as well as raise it. Nonetheless, as we predict that GPAs will rise overall, it is a possibility worth investigating. To do so we create a randomly drawn subsample (Subsample A) of the original data. This subsample must meet two criteria: 1) No student is represented more than once and 2) The distribution of Freshmen, Sophomore, Junior and Senior must remain the same as the original sample (It is tempting to include every unique individual exactly once, but this would lead to an over sampling of underclassman grades). The results from Subsample A are in Table 4 and are also very close to our previous findings.[8]

The selection of courses offered in the summer is a subset of all courses. In particular the courses offered are generally ones that will attract sufficient students. To investigate the possible impact of this selection bias, we create a second subsample (Subsample B) that only considers regular semester performance in classes that are also offered in summer semesters.[9] The results from Subsample B are also in Table 4. The estimates for the 3, 4, and 8 week summer sessions are not quite as large as before, but remain statistically and economically significant. We see the same pattern of a peak (of about 1/3 of a grade) at 4 weeks.

Do Higher Summer Grades Reflect Greater Learning?

Having found evidence of significant increases in summer grades over the regular semesters, we now ask if these increases reflect an actual increase in learning. To examine this proposition we look at the performance of students in classes with a pre-requisite. We search for a difference between students who have taken the course in the summer vs. those who have taken the course in a regular term. If summer grades are inflated, we would expect to find some correction term for those who took the pre requisite course in the summer (assuming, of course, that the pre-requisite makes a difference in the later course which we test for as well). We choose 4 sets of paired courses:

Accounting Principles I and Accounting Principles II - these are the first two accounting classes offered at the College of Business, and are required for all business majors.

College Algebra and Survey of Calculus - these are standard elementary math courses. They are required for many majors.

Spanish III and Spanish IV - these are the third and fourth courses in Spanish, that are part of a four semester sequence that make up a foreign language requirement for some majors.

We also examine Principles of Microeconomics and Principles of Macroeconomics. Although neither is a pre-requisite for the other, they are certainly linked courses and we would expect that the performance in one would help predict performance in the other.

---

[8] We also estimated a probit model on the subsamples for completeness. The results are very similar, and are available from the authors upon request.

[9] Although classes not offered in the summer are removed when calculating the modified GPA for a regular semester, the load factor remains the same since the students aren't actually taking less classes.

Model 2:

GR = f(Pgr, Lag, Psum, Psum*Pgr, Eth, Gen, SATM, SATV, Hrs, StartGPA, Age)

GR	Grade earned in the later course
Pgr	Grade earned in the pre-requisite course
Lag	Number of semesters since the student took the pre-requisite course
Psum	Dummy Variable =1 if the prerequisite course was taken in the summer
Psum*Pgr	PSUM times the pre-requisite grade
Eth	A Dummy Variable = 1 if a student is White
Gen	Dummy Variable = 1 if a student is Female
SATM	SAT Math score
SATV	SAT Verbal score
Hrs	Earned Credit Hrs at the start of the semester
StartGPA	GPA at the start of the semester
Age	Age at the start of the semester

Summary statistics are in Table 5 below.

Table 5
Summary Statistics by Subject for the data used to estimate Model 2

	ACCOUNTING		MATH		SPANISH		ECONOMICS	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
GR	2.35	1.03	2.13	1.17	2.66	0.89	2.30	1.03
Pgr	2.17	1.00	2.59	1.02	2.64	0.93	2.23	1.05
Lag	1.66	0.95	2.62	1.56	1.40	0.72	2.83	1.23
Eth	0.73	0.44	0.73	0.45	0.67	0.47	0.72	0.45
Gen	0.48	0.50	0.48	0.50	0.74	0.44	0.48	0.50
Age	21.36	2.04	20.10	1.93	21.84	3.09	20.53	2.39
SATM	503.32	73.13	497.49	63.53	487.26	75.23	501.96	76.96
SATV	491.13	68.95	483.48	58.52	509.73	86.45	497.42	76.34
Hrs	54.77	17.19	29.86	16.52	73.18	32.01	34.48	22.32
StartGPA	2.76	0.49	2.66	0.57	3.01	0.49	2.74	0.63
N	542		574		186		1043	
No. of Psum	149		26		43		357	

The results, given in Table 6 below, show that the grade a student earns in a prerequisite course is significant and positively related to student performance in the follow on course. The additional effect of taking the prerequisite during a time shortened summer semester is not significant. This indicates that even though students earn higher grades during the time shortened summer semesters, the effect on a follow on course is no different whether the prerequisite is taken during a shortened session or a traditional sixteen week semester.

As we might expect the significance of other variables depend on the courses being paired. For example, gender is significant for the Spanish and Math classes, but not for Economics or English.

Table 6
Results from OLS estimation of Model 2 by subject.

	ACCT (p-val)	*MATH (p-val)*	*SPAN (p-val)*	*ECON (p-val)*
Intercept	-1.139	-1.245	0.540	-1.929
	(0.035)	(0.049)	(0.396)	(0.000)
Lag	0.070	-0.048	-0.137	-0.005
	(0.082)	(0.153)	(0.071)	(0.656)
Pgr	0.298	0.201	0.358	0.084
	(0.000)	(0.000)	(0.000)	(0.001)
Psum	-0.214	-0.287	0.260	0.159
	(0.295)	(0.624)	(0.487)	(0.558)
Psum*Pgr	0.003	0.136	-0.154	-0.008
	(0.967)	(0.493)	(0.243)	(0.923)
Eth	0.089	-0.037	0.091	0.051
	(0.287)	(0.701)	(0.470)	(0.274)
Gen	0.056	0.210	0.252	0.055
	(0.451)	(0.016)	(0.042)	(0.197)
Age	0.002	0.027	-0.014	0.022
	(0.907)	(0.253)	(0.445)	(0.020)
SATM	0.002	0.002	0.001	0.002
	(0.000)	(0.004)	(0.162)	(0.000)
SATV	0.000	-0.002	-0.001	0.001
	(0.617)	(0.034)	(0.08)	(0.000)
Hrs	-0.005	-0.001	-0.002	0.002
	(0.018)	(0.837)	(0.293)	(0.057)
StartGPA	0.620	0.778	0.547	0.806
	(0.000)	(0.000)	(0.000)	(0.000)
N	542	574	186	1043
Adj R2	0.40	0.30	0.37	0.34

Conclusion, Policy Implications and Future Research

Overall we find that there is a significant improvement from taking shorter courses that cannot be explained solely by student characteristics. Using a very large database and by using more robust models this study provides more definitive results than have been achieved in past studies. Compared to a sixteen week semester, there is an improvement at 8 weeks, 4 weeks, and 3 weeks. We also find that those benefits differ, peaking at four weeks.[10] This complements the results of Scott (2003) who finds that classroom relationships and classroom atmosphere are two important factors that explain why performance is better in intensive courses than the traditional format i.e. there is a better bond between teacher and student when they meet every day than just two or three times a week. While 4 week and 3 week sessions both meet daily, the three week session, with just 11 teaching days, may be to short a time span for that bond to fully develop.

More importantly, we also find that the improved grades are not meaningless – they do reflect greater learning.[11] We find that the grades given for a shortened intensive course have the same significant

[10] Given the discrete nature of the session lengths the peak may actually occur at 5 or 6 weeks. The estimated peak benefit at 4 weeks should actually be considered a lower bound.

[11] Of course we are operating under the presumption that when all else is held equal, a higher grade reflects greater learning.

explanatory power for future performance as those earned during a traditional 16 week semester. This combats the popular perception (among students anyway) that the bar is lowered in some manner during the shortened sessions. This is clearly not the case as we find no evidence of any correction for those grades.

There are some obvious policy implications from this study. Universities wishing to maximize learning with limited resources might consider changing their course structure from predominately sixteen week to four week semesters, a more modular system. A full semester load (12 hours) can be taken in the same time (16 weeks) by taking a traditional semester, or 4 four weeks sessions. Both cases would involve the same amount of class time per week, and so the modular structure would place no additional burden on a student.

The primary benefit of reduced course lengths would be increased student learning. Additional benefits might be less upfront tuition and book costs and easier sequencing of required courses. Spanish I, II, III, and IV could be taken over one sixteen week period rather than four sixteen week semesters. Also, if a student were to switch his major it would be possible to complete a new major is less than one year.

Some of the costs associated with reduced course lengths would be higher administrative costs. These would include registration and record keeping as well as course scheduling and student advisement. Other costs might be imposed on students such as increased commuting cost due to having to be in class five days per week. Also, students would no longer be able to work all day two or three days a week. To accommodate students who work full time, weekend classes might also be considered which would also allow for more efficient utilization of university facilities.

Further study is necessary to evaluate more fully the benefits and costs of changing class structure. The next steps would be to examine the non-traditional and transfer students as well as the patterns in which students might choose to utilize a modular structure (although we've shown an equivalency for a full semester load, there is no reason why a student might not want to double up (or more) on courses using a modular structure. In that case, there will be more class time per week than in a traditional format)

Another topic for further investigation would be a comparison of the requirements of specific summer courses with their full semester (or different length) equivalents.

References

Betts, Julian R., and Darlene Morell. 1999. "The Determinants of Undergraduate Grade Point Average: The Relative Importance of Family Background, High School Resources, and Peer Group Effects." *Journal of Human Resources* 34: 268-93.

Boddy, George W. 1985. "Regular vs. Compressed Semester: A Comparison of Effectiveness for Teaching in Higher Education." Ph.D diss., University of Nebraska.

Borg, Mary O., and Harriet Stranahan. 2002. "The Effect of Gender and Race on Student Performance in Principles of Economics: The Importance of Personality Type." *Applied Economics* 34: 589-598.

Brakenbury, Robert L. 1978. "What Is More Elusive than the Learning of Philosophy?" *Educational Research Quarterly* 3: 93-97.

Case, Donald O., and John V. Richardson. 1990. "Predictors of Student Performance with Emphasis on Gender and Ethnic Determinants." *Journal of Education for Library and Information Science* 30: 163-182.

Caskey, Shella R. 1994. "Learning Outcomes in Intensive Courses." *Journal of Continuing Higher Education* 42: 23-27.

Cohn, Elchanen., Sharon Cohn, Donald Balch, and James Bradley, Jr. 2004. "Determinants of Undergraduate GPAs: SAT Scores, High-School GRA and High-School Rank." *Economics of Education Review* 23: 577-586.

Daniel, Eileen L. 2000. "A Review of Time-Shortened Courses across Disciplines." *College Student Journal* 34: 298-306.

Ewer, Sid., Olen Greer, Wilbur Bridges, and Barry Lewis. 2002. "Class Length and Student Performance: An Extended Study." *International Advances in Economic Research* 8: 160-168.

Geltner, Peter., and Ruth Logan. 2000. "The Influence of Session Length on Student Success." *Research report 2000.4.1.0., Santa Monica College*. http://www.smc.edu/research/T20000410.htm

Messina, Robert C. 1996. "Power Package: An Alternative to Traditional Course Scheduling." *ERIC Document Reproduction Service*, No. ED 396787.

Petrowsky, Michael C. 1996. "The Two Week Summer Macroeconomics Course: Success or Failure?" *ERIC Document Reproduction Service*, No. ED396779.

Rayburn, L. Gayle., and J. Michael Rayburn. 1999. "Impact of Course Length and Homework Assignments on Student Performance." *Journal of Education for Business* 74: 325-331.

Scott, Patricia A. 2003. "Attributes of High-Quality Intensive Courses." *New Directions for Adult and Continuing Education* 97: 29–38.

Scott, Patricia A., and Clifton F. Conrad. 1992. "A Critique of Intensive Courses and an Agenda for Research." In *Higher Education: Handbook of Theory and Research*, edited by John C. Smart. New York: Agathon Press.

Seamon, Marc. 2004. "Short- and Long-Term Differences in Instructional Effectiveness between Intensive and Semester-Length Courses." *Teachers College Record* 106: 852-874.

Spurling, Steven. 2001. "Compression of Semesters or Intensity of Study: What is it that increases student success?" *ERIC Document Reproduction Service*, No. ED467474.

Van Scyoc, Lee J., and Joyce Gleason. 1993. "Traditional or Intensive Course Lengths: a Comparison of Outcomes in Economics Learning." *Journal of Economic Education* 24: 15-22.