UNIVERSITY SYSTEM OF GEORGIA
Research and Policy Analysis

Research and Policy Brief

Undergraduate Course Outcomes by Modality: Online versus Face-to-Face

January 16, 2024

Primary Contact: Lori Hagood (Lori.Hagood@usg.edu) and Pearson Brown (Pearson.Brown@usg.edu)

This analysis examines the differences in course outcomes between online and face-to-face course sections in Spring 2022. The key outcomes explored are course GPA[1], percent of As awarded, pass rate (grade of C or better, including S), and DFW rate (percent of Ds, Fs, Ws, and WFs awarded). Outcomes in online course sections are compared to outcomes in the same course offered face-to-face at the same institution (unless otherwise noted). Methods include descriptive analysis, paired t-tests, and linear regression with fixed effects.

Data Considerations

This analysis uses course grade data in undergraduate level courses (course number < 5000) during Spring 2022. It is important to note that online courses are those where 95 percent or more of the content is delivered via internet, and for this analysis, exclude eCore courses. The analysis focuses on the eight courses at each institution, sector, and system-wide that have the highest online enrollment; a science course is also included in the analysis if the top eight courses did not include a science course. Courses that were graded on a pass/fail basis are excluded and students who withdrew from a course are removed from all outcomes calculations except for a course's DFW rate. In some cases, the top eight courses included courses with a high number of missing grades; these were replaced with courses that had little to no missing grades.

Summary of Findings

In the descriptive analysis comparing performance outcomes between online and face-to-face course sections, there is not one prominent outcome/trend. In some cases, online sections outperform face-to-face sections, and in other cases, face-to-face sections outperform their online counterparts. In many instances, the difference between the online and face-to-face course performance is limited to a few percentage points. Outcomes by modality similarly vary across institutions as well as across courses within the same institution.

Among science courses with the greatest online enrollment, outcomes also vary across institutions. For 11 of the 21 institutions that offered a science course in both an online and in a face-to-face format, the online course section had a lower average course GPA and nine had a lower pass rate compared to the face-to-face counterpart. However, 13 institutions had a higher percent of As awarded and 10 institutions had a lower percent of DFWs awarded in the online science class compared to the face-to-face counterpart.

The results of the t-tests and linear regression, which allow us to summarize the difference in outcomes while only comparing the same course at the same institution, suggest that there is some evidence that face-to-face course sections outperform online course sections. However, the magnitude of the difference is relatively small. For example, online courses system-wide have a mean pass rate of 84 percent while their face-to-face counterparts have a mean pass rate of 85 percent. Though the

[1] Course GPA = (4*number of As + 3*number of Bs + 2*number of Cs + 1*number of Ds)/Total students enrolled, excluding students who withdrew from the course

difference between them is statistically significant according to the t-tests and linear regression results, the difference of a percentage point may not be practically meaningful.

An accompanying data file that provides descriptive comparisons between online and face-to-face course sections for the eight academic areas and courses that have the highest online enrollment system-wide as well as for each sector and institution is available upon request. The results highlighted below come from the System with Science tab within the accompanying data file, which replaced the course with the eighth highest online enrollment with a science course. T-test and regression results are also provided.

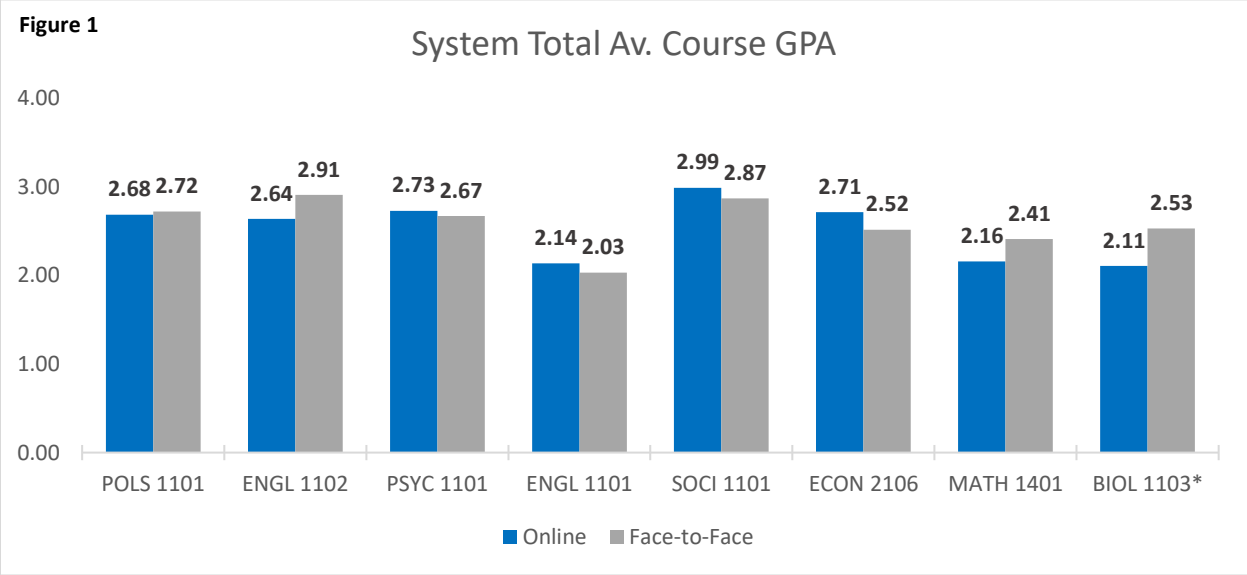
Descriptive Analysis

System Summary

Outcomes at the system level, for the most part, are similar across online and face-to-face course sections (see Table 1). There are some cases where students in the face-to-face version outperform their online counterparts and other cases where online students outperform those taking the same course face-to-face. Where differences in performance arise, the magnitudes are relatively modest: differences range from 0.04-0.42 grade points for course GPA, and 0-12 percentage points for percent of As, DFW, and pass rate.

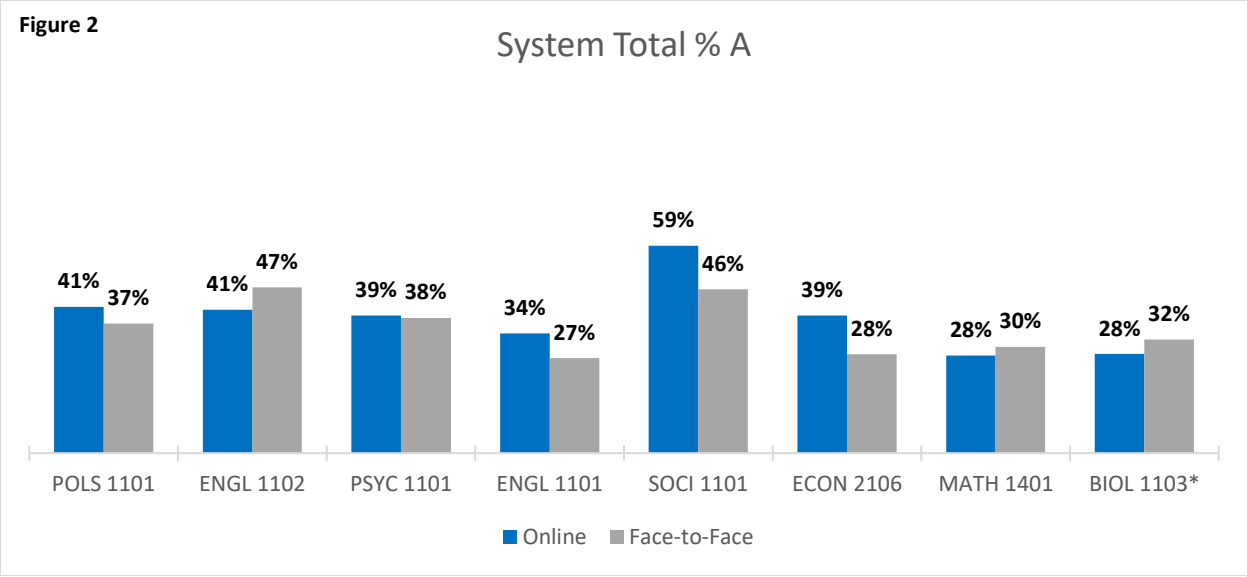
Of the system-wide top eight courses, half had a higher course GPA in the online version compared to its face-to-face counterpart (see Figure 1). In five of the system-wide top eight courses, the online course had a higher percent of As awarded than the face-to-face course section (see Figure 2). The most notable difference in the percent of As awarded is for SOCI 1101, where 59 percent of students enrolled online earned an A compared to 46 percent of students enrolled face-to-face.

Figure 1



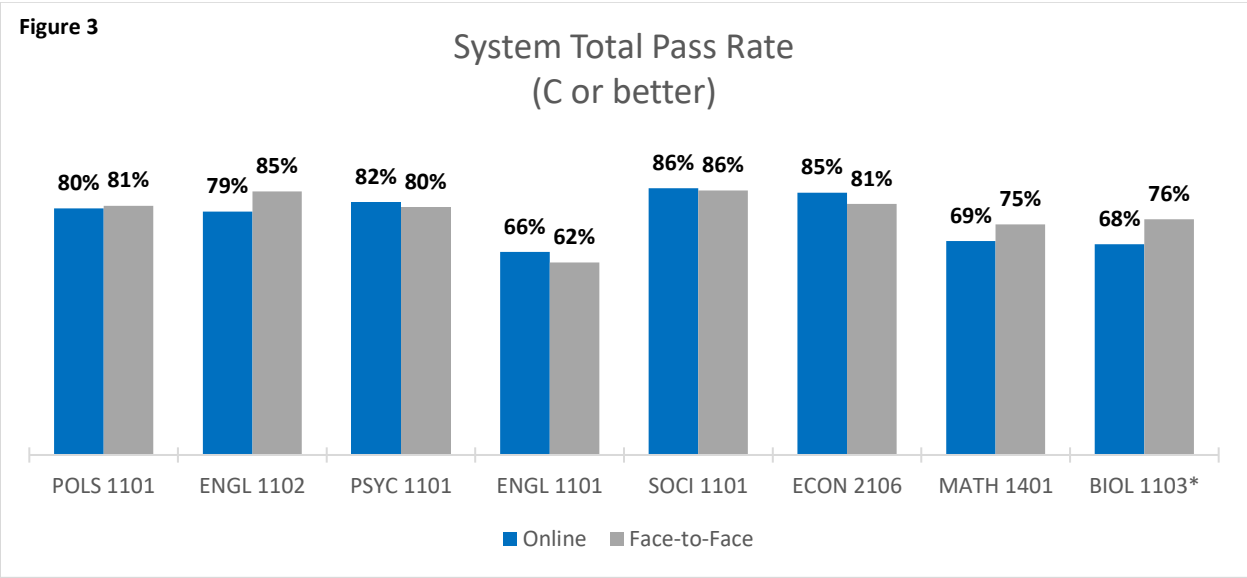
Note: *Course with 8th highest online enrollment was replaced with a science course

Figure 2



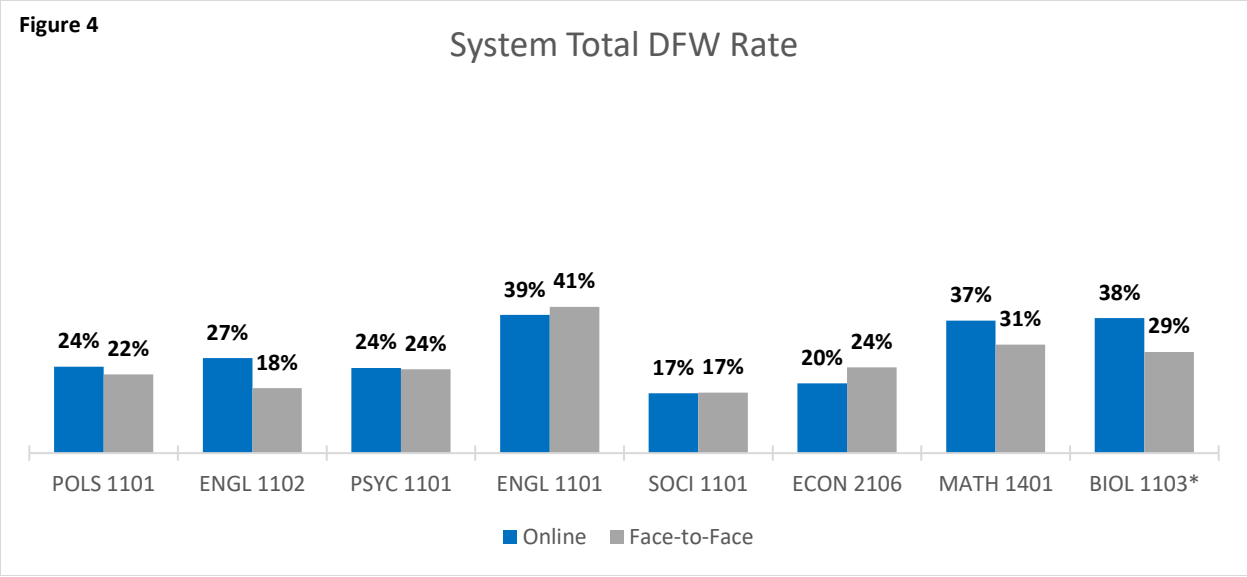
Four of the eight courses had a higher pass rate in the online course sections compared to the face-to-face counterpart, although by only less than 1 to 4 percentage points (see Figure 3). The most notable difference in pass rate is for BIOL 1103 where 76 percent of students passed in the face-to-face sections compared to 68 percent in online sections.

Figure 3



The DFW rate is higher in the online sections compared to the face-to-face sections for five of the eight courses and differences range from less than a percentage point to 9 percentage points (see Figure 4). The largest difference in DFW rate is for ENGL 1102 and BIOL 1103; online students in ENGL 1102 had a DFW rate of 27 percent compared to 18 percent in face-to-face sections and online students in BIOL 1103 had a DFW rate of 38 percent compared to 29 percent in face-to-face sections.

Figure 4



For ENGL 1101, SOCI 1101, and ECON 2106, students in the online sections consistently outperform their peers in the face-to-face sections. For ENGL 1102, MATH 1401, and BIOL 1103, students enrolled face-to-face outperformed their online counterparts. Note: for the system-level descriptive analysis, comparisons are made for the same course but not necessarily at the same institution.

Paired T-Tests

The paired t-test allows us to compare outcomes for online and face-to-face course sections for the same course at the same institution (unless otherwise noted). Moreover, the results of this test are used to determine whether the differences are statistically significantly from each other. This analysis includes all courses that have at least one online and face-to-face course section and is not limited to the top eight courses.

Paired T-Test by Institution

According to the paired t-test results, at the system level[2], the average course GPA for online sections is .02 points lower than the average course GPA for face-to-face courses (2.88 vs. 2.90, respectively). These results are statistically significant at the $p < .05$ level though may be too small to be meaningful in practice. Paired t-test results for course GPA are provided in Table 2.

Three institutions (Georgia Highlands, Georgia Southwestern, and Kennesaw State) had significantly lower average course GPAs in online sections compared to face-to-face sections and Gordon State had a significantly higher course GPA in online sections compared to face-to-face sections. In the cases where the difference is significant, the mean difference ranges from 0.09 to 0.24 points. The greatest difference occurs at Gordon State where the course GPA for online courses is 0.24 points greater than the course GPA for face-to-face courses.

Turning to the t-test results presented in the accompanying data file, The pass rate for online courses is a percentage point lower on average ($p < 0.001$) than the face-to-face course counterparts (84% vs. 85%, respectively) —a statistically significant difference that may not be of practical significance. Five institutions (Atlanta Metropolitan, Georgia Southwestern, Kennesaw State, Middle Georgia, and North Georgia) had significantly higher pass rates in face-to-face course sections compared

[2] The system-level paired t-tests only compare outcomes for the same course; the comparison is not restricted to the same institution.

to the online section and Gordon State had significantly higher pass rates in online courses compared to face-to-face sections. In cases where differences are significant, the mean difference in pass rate ranged from two to eight percentage points. The greatest mean difference is at Atlanta Metropolitan, where face-to-face courses have a pass rate that is eight percentage points higher ($p < 0.05$) on average compared to the online counterparts.

For the percent of As awarded, only two institutions had a statistically significant difference between online and face-to-face course sections. Coastal Georgia had a significantly higher percent of As awarded in online courses compared to face-to-face courses ($p < .05$), and Kennesaw State had a significantly higher percent of As awarded in face-to-face courses compared to online courses ($p < .001$).

The DFW rate at the system level is four percentage points higher in online course sections compared to the face-to-face counterparts ($p < 0.001$). Likewise, the DFW rate is statistically significantly higher for online courses at nine institutions and is significantly lower for online courses at one institution (Gordon State), compared to the face-to-face course sections. Mean differences in DFW rates range from four to 10 percentage points.

Paired T-Test by Course

For this analysis, we compare outcomes by modality for each of the eight courses with the greatest online enrollment at the system level[3].

The paired t-test results show that online ENGL 1102 courses had a course GPA that was 0.32 points lower on average ($p < 0.01$) compared to face-to-face ENGL 1102 courses. Likewise, online ENGL 1102 courses had a pass rate that was nine percentage points lower and a DFW rate that was 14 percentage points higher on average ($p < 0.001$), compared to face-to-face ENGL 1102 courses. In contrast, ENGL 1101 and SOCI 1101 offered online had statistically significantly higher average course GPAs compared to their face-to-face counterparts ($p < .05$). For the top eight courses, the percentage of As awarded was the only significant difference in outcomes at the system level; online courses had an A rate of 38% compared to 34% for face-to-face courses ($p < .01$).

Linear Regression with Fixed Effects

Linear regression models allow us to estimate the difference in outcomes by modality and test whether the magnitude of those differences are statistically significant. Using fixed effects for institutions allows the comparison in course outcomes to be made within the same institution. Likewise, we also add in fixed effects for course acronym (e.g. ENGL, POLS) which focuses the comparison of outcomes within the same course subject[4]. The linear regression results for Model 3 include all fixed effects and are the focus of the following discussion. Figure 3 shows the regression results for the impact of online course modality on course GPA, Figure 4 shows the impact on pass rate, Figure 5 show the impact on percent of As awarded, and Figure 6 shows the impact of online course modality on course DFW rate. The linear regression models suggest that online courses have a lower pass rate by 1.6 percentage points ($p < 0.01$), and a higher DFW rate by 3.1 percentage points ($p < 0.001$) relative to their face-to-face counterparts (courses with the same course acronym, taught at the same institution). These findings are consistent with the paired t-test results.

[3] The system-level paired t-tests only compare outcomes for the same course; the comparison is not restricted to the same institution.

[4] There were not enough degrees of freedom to include fixed effects for the course (ENGL 1101) so we only included fixed effects for course acronym (ENGL). This means that all courses with the same acronym were compared regardless of course number/level.

Table 1

Online v. Face-to-Face: Grades in Eight Courses with Highest Online Enrollment Spring 2022

System Total

Course	Online						Face-to-Face					
	Total Enrolled	Av. Class Size	Av. Course GPA	% A	Pass Rate (C or better)	DFW Rate	Total Enrolled	Av. Class Size	Av. Course GPA	% A	Pass Rate (C or better)	DFW Rate
POLS1101	7,944	41	2.68	41.3%	79.9%	24.4%	10,729	33	2.72	36.6%	80.7%	22.2%
ENGL1102	6,596	21	2.64	40.5%	78.9%	26.8%	20,518	19	2.91	46.8%	85.4%	18.3%
PSYC1101	3,782	37	2.73	38.8%	81.8%	24.0%	5,080	33	2.67	38.2%	80.1%	23.7%
ENGL1101	3,354	19	2.14	33.8%	65.8%	39.0%	7,360	18	2.03	26.9%	62.4%	41.3%
SOCI1101	2,822	37	2.99	58.5%	86.4%	16.9%	4,298	33	2.87	46.3%	85.7%	17.1%
ECON2106	2,487	44	2.71	38.8%	84.9%	19.7%	3,037	36	2.52	27.9%	81.3%	24.2%
MATH1401	2,416	28	2.16	27.6%	69.3%	37.4%	4,183	24	2.41	30.0%	74.7%	30.6%
BIOL1103*	1,366	27	2.11	28.0%	68.2%	38.1%	1,851	24	2.53	32.0%	76.4%	28.6%

Notes: Online courses exclude eCore

*Course with 8th highest online enrollment was replaced with a science course; if no science course is listed the institution had no online science courses in Spring 2022

Course GPA = (4*number of As + 3*number of Bs + 2*number of Cs + 1*number of Ds)/Total students enrolled, excluding students who withdrew from the course

Other Grades = K, NR, O, U

Table 2

Course GPA: Online versus Face-to-Face
Paired T-test Results by Institution

Institution	# of course pairs	Online Mean	Face-to-Face Mean	Difference	t	Significance
Abraham Baldwin Agricultural College	31	2.82	2.82	0.00	-0.033	
Albany State University	95	2.50	2.50	0.00	-0.021	
Atlanta Metropolitan State College	26	2.11	2.31	-0.19	-1.427	
Augusta University	64	3.28	3.22	0.06	1.200	
Clayton State University	68	2.63	2.75	-0.12	-1.607	
College of Coastal Georgia	39	3.00	2.86	0.14	1.311	
Columbus State University	72	2.72	2.73	-0.01	-0.101	
Dalton State College	27	3.01	3.05	-0.04	-0.309	
East Georgia State College	25	2.01	2.10	-0.09	-0.762	
Fort Valley State University	36	2.80	2.62	0.19	0.400	
Georgia College & State University	5	3.56	3.39	0.17	0.958	
Georgia Gwinnett College	112	2.84	2.85	-0.01	-0.171	
Georgia Highlands College	67	2.68	2.81	-0.13	-2.013	*
Georgia Institute of Technology	41	3.63	3.57	0.07	0.973	
Georgia Southern University	135	2.88	2.88	0.00	-0.037	
Georgia Southwestern State University	51	2.66	2.87	-0.21	-2.447	*
Georgia State University	264	2.89	2.89	-0.01	-0.226	
Gordon State College	40	2.84	2.59	0.24	2.119	*
Kennesaw State University	335	3.09	3.18	-0.09	-3.279	**
Middle Georgia State University	82	2.84	2.90	-0.07	-0.955	
Savannah State University	40	2.41	2.41	-0.01	-0.076	
South Georgia State College	28	2.47	2.57	-0.10	-0.910	
University of Georgia	44	3.62	3.67	-0.05	-1.197	
University of North Georgia	120	2.94	3.02	-0.08	-1.886	
University of West Georgia	94	2.91	2.81	0.11	1.933	
Valdosta State University	82	2.77	2.75	0.03	0.425	
System Total	**2,023**	**2.88**	**2.90**	**-0.02**	**-2.040**	*

Notes: * p<0.05, ** p<0.01, *** p<0.001
System total t-test only compares the same course; comparison is not made within the same institution

Table 3

Regression Results for Impact of Online Course Modality on Course GPA

	Model 1	Model 2	Model 3
online_ind	-0.0167	0.0163	-0.0351
	(-1.44)	(0.66)	(-1.82)
N	16,301	16,301	16,301
r2	0	0.06	0.25
Institution Fixed Effects	NO	YES	YES
Course Acronym Fixed Effects	NO	NO	YES

t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

Note: the number of observations in the regression models is the number of course sections, whereas for the paired t-tests the number of observations is the number of courses so sample sizes will be different.

Table 4

Regression Results for Impact of Online Course Modality on Course Pass Rate

	Model 1	Model 2	Model 3
online_ind	-0.0124***	-0.00504	-0.0156**
	(-4.55)	(-0.69)	(-3.58)
N	16,301	16,301	16,301
r2	0.00	0.10	0.25
Institution Fixed Effects	NO	YES	YES
Course Acronym Fixed Effects	NO	NO	YES

t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

Note: the number of observations in the regression models is the number of course sections, whereas for the paired t-tests the number of observations is the number of courses so sample sizes will be different.

Table 5

Regression Results for Impact of Online Course Modality on Percent of As Awarded

	Model 1	Model 2	Model 3
online_ind	0.00975*	0.0181*	0.00152
	(2.36)	(2.71)	(0.17)
N	16,301	16,301	16,301
r2	0.00	0.09	0.25
Institution Fixed Effects	NO	YES	YES
Course Acronym Fixed Effects	NO	NO	YES

t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

Note: the number of observations in the regression models is the number of course sections, whereas for the paired t-tests the number of observations is the number of courses so sample sizes will be different.

Table 6

Regression Results for Impact of Online Course Modality on Course DFW Rate

	Model 1	Model 2	Model 3
online_ind	0.0284***	0.0183*	0.0318***
	(9.74)	(2.20)	(5.54)
N	16,301	16,301	16,301
r2	0.01	0.10	0.25
Institution Fixed Effects	NO	YES	YES
Course Acronym Fixed Effects	NO	NO	YES

t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

Note: the number of observations in the regression models is the number of course sections, whereas for the paired t-tests the number of observations is the number of courses so sample sizes will be different.