OER Impact Study Overview

Research Partner: Alamo Colleges

Study Period: Spring 2017 – fall 2018

Design: Concurrent

Programs of Study: General Studies Degree (study sample not limited to a particular major)

Treatment Group: Students first enrolling in spring 2017 or fall 2017

Control Group: Students first enrolling in spring 2017 or fall 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	10,696	–
Removing duplicate records	10,696	0
Removing students younger than 16	10,692	4
Site-specific cleaning (if any)[a]	10,497	195
Removing treatment-eligible students with zero OER courses (historical only)	-	-
Removing control-eligible students with OER courses (historical only)	-	-
Missing prior achievement data	9,513	984
Missing outcome data	9,513	0

[a] For Alamo we removed students who enrolled either before or after our analysis window. For example, we removed students who enrolled prior to spring 2017.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Enrollment status (Part-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

English language learner (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☒ Yes ☐ No; missing ☐ No; other reason
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: TSI Math Assessment	
Outcome measures	
Cumulative GPA (4-point grade scale)	☐ Yes ☒ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Alamo, this was coded as Pell receiving.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			High OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	2,068	0.59	0.49	2,191	0.63	0.48	0.10
Race/Ethnicity (URM = 1)	2,068	0.78	0.41	2,191	0.81	0.39	0.10
Age (constructed from year of birth)	2,068	19.85	4.39	2,191	20.00	5.17	0.03
Pell status (Yes = 1)	2,068	0.59	0.49	2,191	0.63	0.48	0.08

Enrollment status (Part-time = 1)	2,068	0.28	0.45	2,191	0.29	0.48	0.01
English language learner (Yes = 1)	2,068	0.96	0.29	2,191	0.09	0.29	0.04
First-generation student (Yes = 1)	2,068	0.41	0.49	2,191	0.42	0.29	0.02
Military veteran status (Yes = 1)	2,068	0.08	0.26	2,191	0.07	0.25	0.08
Prior achievement variables							
Math placement score	2,068	341.29	14.83	2,191	340.80	14.01	0.03

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: Students at Alamo who enrolled in three or more OER courses on average attained 3.14 more credits than otherwise similar students with no OER courses (0.23 effect size). This difference appears to be associated with racial/ethnic identity, with under-represented minority students enrolled in three or more OER courses students earning 2.82 more credits than otherwise similar students who took no OER courses whereas Asian and White students enrolled in three or more OER courses earn 4.40 more credits than otherwise similar students who took no OER courses.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	3.14	0.39	<.001*	0.23
Student demographic variables				
Gender (Female = 1)	0.52	0.29	.079	
Race/Ethnicity (URM = 1)	-1.35	0.37	<.001*	
Age (constructed from year of birth)	0.06	0.03	.048*	
Pell status (Yes = 1)	-0.40	0.34	.237	
Enrollment status (Part-time = 1)	-7.01	0.32	<.001*	
English language learner (Yes = 1)	3.67	0.50	<.001*	
First-generation student (Yes = 1)	-0.15	0.32	.648	
Military veteran status (Yes = 1)	0.47	0.56	.406	
Campus, SPC (ref.)	n/a			
Campus, SAC	-3.52	0.41	<.001*	
Campus, PAC	-3.31	0.44	<.001*	
Campus, NVC	-1.08	0.54	.045*	
Campus, NLC	-2.66	0.61	<.001*	
Transcript variables				
# Semesters enrolled	12.39	0.22	<.001*	

Starting term, first eligible semester (ref.)	n/a		
Starting term, second eligible semester	-0.47	0.37	.205
Prior achievement variables			
Math placement score	0.15	0.01	<.001*
Valid Control Records for Impact Analysis	2,068		
Valid Treatment Records for Impact Analysis	2,191		
Model R-Squared	0.69		

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative credits attained, reference	4.40	0.68	<.001*
Cumulative credits attained, URM interaction	-1.58	0.70	.024*
Model R-Squared	0.69		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.

[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative credits attained, reference	3.57	0.53	<.001*
Cumulative credits attained, Pell interaction	-0.69	0.58	.231
Model R-Squared	0.69		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Alamo, this was coded as Pell receiving.

[b] *p < .05.

OER Impact Study Overview

Research Partner: Austin Community College District

Study Period: Fall 2016 – Fall 2018

Design: Concurrent

Programs of Study: General Studies (study sample not limited to a particular major)

Treatment Group: Students first enrolling in fall 2016 or spring 2017

Control Group: Students first enrolling in fall 2016 or spring 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	*n*	Δ
Maximal sample in dataset	1,393	–
Removing duplicate records	1,393	0
Removing students younger than 16	1,393	0
Site-specific cleaning (if any)[a]	1,393	0
Removing treatment-eligible students with zero OER courses (historical only)	-	-
Removing control-eligible students with OER courses (historical only)	-	-
Missing prior achievement data	1,021	372
Missing outcome data	981	40

[a] For Austin, no site-specific cleaning was needed.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Enrollment status (Full-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

English language learner (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason[c]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: Texas Success Initiative (TSI) Math Score	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Austin Community College District, this was coded as Pell eligible.
[c] Because of the large number of campuses (13), campus enrolled in was excluded to improve model fit and support model convergence.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

Variable	Control			Low OER			Baseline
	n	M	SD	*n*	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	420	.72	.45	152	.74	.44	0.06
Race/Ethnicity (URM = 1)	420	.65	.48	152	.67	.47	0.06
Age (constructed from year of birth)	420	40.31	4.19	152	20.53	4.55	0.05
Military veteran status (Yes = 1)	420	.02	.15	152	.02	.14	0.11
Enrollment status (Part-time = 1)	420	.75	.43	152	.74	.44	0.05
English language learner (Yes = 1)	420	.06	.25	152	.07	.25	0.01
First-generation student (Yes = 1)	420	.18	.38	152	.18	.38	0.01
Prior achievement variables							
Math placement score	420	344.6	15.21	152	343.8	13.67	0.05

[a] We report baseline difference effect sizes as Hedge's *g* for continuous variables and Cohen's *d* for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: At Austin Community College District, students enrolling in one or two OER courses on average attained 1.88 credits more than otherwise similar students who took no OER courses (0.12 effect size). Enrollment in OER courses did not appear to impact students' cumulative GPA. The effects of OER enrollment on credit attainment or cumulative GPA did not appear to be associated with students' racial/ethnic identity.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: Low OER
Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	*p*[a]	ES[b]
Treatment (Yes = 1)	1.88	0.94	.046*	0.12
Student demographic variables				
Gender (Female = 1)	2.69	0.86	.002*	
Race/Ethnicity (URM = 1)	-1.61	0.82	.050*	
Age (constructed from year of birth)	0.21	0.10	.027*	
Military veteran status (Yes = 1)	4.36	2.57	.090	
Enrollment status (Part-time = 1)	-12.81	0.92	<.001*	
English language learner (Yes = 1)	0.79	1.62	.623	
First-generation student (Yes = 1)	1.05	1.00	.294	
Transcript variables				
# Semesters enrolled	8.96	0.30	<.001*	
Starting term, first eligible semester (ref.)	n/a			

Starting term, second eligible semester	0.83	1.00	.405
Prior achievement variables			
Math placement score	0.10	0.03	<.001*
Valid Control Records for Impact Analysis	420		
Valid Treatment Records for Impact Analysis	152		
Model R-Squared	0.73		

[a] *$p < .05$.

[b] We report Treatment effect sizes as Hedge's *g* in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at $p < .05$.

Treatment Sample: Low OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	*p*[a]	ES[b]
Treatment (Yes = 1)	0.05	0.10	.589*	–
Student demographic variables				
Gender (Female = 1)	0.46	0.09	<.001*	
Race/Ethnicity (URM = 1)	-0.15	0.08	.082	
Age (constructed from year of birth)	0.06	0.01	<.001*	
Military veteran status (Yes = 1)	0.33	0.26	.209	
Enrollment status (Part-time = 1)	-0.13	0.09	.177	
English language learner (Yes = 1)	0.10	0.17	.526	
First-generation student (Yes = 1)	-0.01	0.10	.948	
Transcript variables				
# Semesters enrolled	0.19	0.03	<.001*	
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	0.11	0.10	.275	
Prior achievement variables				
Math placement score	0.02	0.00	<.001*	
Valid Control Records for Impact Analysis	420			
Valid Treatment Records for Impact Analysis	152			
Model R-Squared	0.24			

[a] *$p < .05$.

[b] We report Treatment effect sizes as Hedge's *g* in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at $p < .05$.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	**B**	**SE**	***p***[b]
Cumulative GPA, reference	0.20	0.16	.206
Cumulative GPA, URM interaction	-0.22	0.18	.237
Model R-Squared	0.24		
Cumulative credits attained, reference	2.76	1.52	.071
Cumulative credits attained, URM interaction	-1.33	1.81	.463
Model R-Squared	0.73		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *$p < .05$.

OER Impact Study Overview

Research Partner: CUNY BMCC

Study Period: Fall 2014 – spring 2016 & fall 2016 – spring/summer 2018

Design: Historical

Programs of Study: Criminal Justice AA Degree (study sample not limited to a particular major)

Treatment Group: Students first enrolling in fall 2016, spring/summer 2017, or fall 2017

Control Group: Students first enrolling in fall 2014, spring/summer 2015, or fall 2015

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	5,477	–
Removing duplicate records	5,477	0
Removing students younger than 16	5,477	0
Site-specific cleaning (if any)[a]	3,870	1,607
Removing treatment-eligible students with zero OER courses (historical only)	2,805	1,065
Removing control-eligible students with OER courses (historical only)	2,805	0
Missing prior achievement data	2,453	352
Missing outcome data	2,453	0

[a] For CUNY BMCC, we limited our sample to those students who started enrollment during a certain window: fall 2016, spring 2017, or fall 2017 for treatment/fall 2014, spring 2015, or fall 2015 for control. For example, we removed students who first enrolled spring 2016 or spring 2018.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Enrollment status (Part-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason

Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason [c]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: CUNY Assessment Test (CAT) Math Placement	
Outcome measures	
Cumulative GPA (4-point grade scale)	☐ Yes ☐ No; missing ☒ No; other reason [d]
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For BMCC, this was coded as Pell-eligible.
[c] There is only a single campus.
[d] The raw GPA data received for the control students (2014-2015) listed GPA as a range of 0-80 identical to cumulative credits.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

Variable	Control n	Control M	Control SD	High OER n	High OER M	High OER SD	Baseline Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	1048	.47	.53	574	.50	.50	0.06
Race/Ethnicity (URM = 1)	1048	.89	.31	574	.89	.31	0.00
Age (constructed from year of birth)	1048	19.02	1.84	574	18.96	1.92	0.04
Pell status (Yes = 1)	1048	.38	.49	574	.38	.49	0.01
Military veteran status (Yes = 1)	1048	.01	.10	574	.01	.08	0.18
English language learner (Yes = 1)	1048	.03	.18	574	.03	.16	0.13
Enrollment status (Part-time = 1)	1048	.12	.31	574	.10	.31	0.07
Prior achievement variables							
Math placement score	1048	74.72	8.60	574	74.89	9.44	0.02

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: Students at BMCC who enrolled in one or two OER courses on average attained 2.44 more credits than otherwise similar students who took no OER courses (0.27 effect size). This difference appears to be associated with Pell status, with Pell-eligible students enrolled in one or two OER courses students earning 3.99 more credits than otherwise similar students who took no OER courses whereas non-Pell-eligible students enrolled in one or two OER courses earned 1.37 more credits than otherwise similar students who took no OER courses.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	2.44	0.69	<.001*	0.27
Student demographic variables				
Gender (Female = 1)	1.06	0.55	.055	
Race/Ethnicity (URM = 1)	-0.62	0.89	.486	
Age (constructed from year of birth)	0.19	0.15	.223	
Pell status (Yes = 1)	-2.08	0.64	<.001*	
Enrollment status (Part-time = 1)	-8.24	0.87	<.001*	
English language learner (Yes = 1)	-1.72	1.59	.282	
Military veteran status (Yes = 1)	-2.52	2.96	.395	
Transcript variables				
# Semesters enrolled	12.83	0.34	<.001*	

Starting term, first eligible semester (ref.)	n/a		
Starting term, second eligible semester	0.16	0.80	.838
Starting term, third eligible semester	4.04	0.80	<.001*
Prior achievement variables			
Math placement score	0.31	0.03	<.001*
Valid Control Records for Impact Analysis	1048		
Valid Treatment Records for Impact Analysis	574		
Model R-Squared	0.67		

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative credits attained, reference	2.07	1.78	.245
Cumulative credits attained, URM interaction	0.41	1.83	.824
Model R-Squared	0.67		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.

[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative credits attained, reference	1.37	0.84	.104
Cumulative credits attained, Pell interaction	2.61	1.21	.032*
Model R-Squared	0.68		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For BMCC, this was coded as Pell-eligible.

[b] *p < .05.

OER Impact Study Overview

Research Partner: Bunker Hill Community College

Study Period: Spring 2017 – fall 2018

Design: Concurrent

Programs of Study: General Studies Degree (study sample not limited to a particular major)

Treatment Group: Students first enrolling in spring 2017, fall 2017, spring 2018

Control Group: Students first enrolling in spring 2017, fall 2017, spring 2018

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	10,343	–
Removing duplicate records	10,343	0
Removing students younger than 16	10235	108
Site-specific cleaning (if any)[a]	10,235	0
Removing treatment-eligible students with zero OER courses (historical only)	-	-
Removing control-eligible students with OER courses (historical only)	-	-
Missing prior achievement data	5,575	4,660
Missing outcome data	5,450	125

[a] For Bunker Hill we did not have any site-specific cleaning.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Enrollment status (Part-time = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason [c]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☒ Yes ☐ No; missing ☐ No; other reason
Specific measures: CUNY Assessment Test (CAT) Math Score	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Bunker Hill, this was coded as Pell-eligible.
[c] There is only a single campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			High OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	306	.55	.50	65	.54	.50	0.01
Race/Ethnicity (URM = 1)	306	.70	.46	65	.72	.45	0.07
Age (constructed from year of birth)	306	19.96	3.92	65	20.05	4.51	0.02
Pell status (Yes = 1)	306	.76	.43	65	.77	.42	0.04

Prior achievement variables							
Math placement score	306	47.04	19.05	65	45.08	18.11	0.10

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: At Bunker Hill, enrollment in three or more OER courses did not appear to affect students' cumulative GPA or credits attained. Neither credits attained nor cumulative GPA had different impacts based on students' Pell eligibility or racial/ethnic identify.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	1.75	1.61	.279	-
Student demographic variables				
Gender (Female = 1)	-0.36	1.26	.773	
Race/Ethnicity (URM = 1)	-2.98	1.40	.034*	
Age (constructed from year of birth)	0.24	0.15	.117	
Pell status (Yes = 1)	2.04	1.45	.162	
Transcript variables				
# Semesters enrolled	11.53	0.71	<.001*	
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	-7.90	1.30	<.001*	
Starting term, third eligible semester	-4.97	2.23	.026*	
Prior achievement variables				
Math placement score	0.07	0.03	.043*	
Valid Control Records for Impact Analysis	306			
Valid Treatment Records for Impact Analysis	65			
Model R-Squared	0.56			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Treatment Sample: High OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	-0.03	0.13	.830	–
Student demographic variables				
Gender (Female = 1)	0.26	0.11	.013*	
Race/Ethnicity (URM = 1)	-0.29	0.12	.012*	
Age (constructed from year of birth)	0.04	0.01	.002*	
Pell status (Yes = 1)	-0.23	0.12	.054	
Transcript variables				
# Semesters enrolled	0.25	0.06	<.001*	
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	-0.08	0.11	.442	
Starting term, third eligible semester	0.11	0.19	.551	
Prior achievement variables				
Math placement score	0.01	0.00	.017*	
Valid Control Records for Impact Analysis	306			
Valid Treatment Records for Impact Analysis	65			
Model R-Squared	0.15			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	0.25	0.25	.314
Cumulative GPA, URM interaction	-0.38	0.29	.182
Model R-Squared	0.16		
Cumulative credits attained, reference	6.16	2.98	.039*
Cumulative credits attained, URM interaction	-6.05	3.44	.080
Model R-Squared	0.57		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.21	0.27	.433
Cumulative GPA, Pell interaction	0.24	0.31	.436
Model R-Squared	0.15		
Cumulative credits attained, reference	-1.91	3.29	.562
Cumulative credits attained, Pell interaction	4.71	3.69	.202
Model R-Squared	0.56		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Bunker Hill, this was coded as Pell-eligible.
[b] *p < .05.

OER Impact Study Overview

Research Partner: Central Virginia Community College (CVCC)

Study Period: Fall 2016 – fall/winter 2018

Design: Concurrent comparison group

Programs of Study: Programs of Study: General Studies, AA & AS in Science, and Certificate in General Education (study sample not limited to a particular major)

Treatment Group: Students first enrolling in fall 2016, spring/summer 2017, or fall 2017

Control Group: Students first enrolling in fall 2016, spring/summer 2017, or fall 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	22,409	–
Removing duplicate records	22,409	0
Removing students younger than 16	22,185	224
Site-specific cleaning (if any)[a]	5,437	16,748
Removing treatment-eligible students with zero OER courses (historical only)	-	-
Removing control-eligible students with OER courses (historical only)	-	-
Missing prior achievement data	2,797	2,640
Missing outcome data	2,797	0

[a] For CVCC, we removed students who were dual enrolled in both high school and community college as the literature suggests dual-enrolled students have different enrollment and performance patterns from students exclusively enrolled in community college. We excluded from our sample students who enrolled prior to Fall 2016.

Data Availability for Analysis

SRI analysts considered the following variables for possible including in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was too much missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Enrollment status (Full-time = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason[c]
Prior achievement variables	
English placement score	☒ Yes ☐ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: CS English Blended Placement Test, CS Math Placement Test 1 (Pass/Fail)	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For CVCC, this was coded as Pell eligible.
[c] CVCC has only one campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three

OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			High OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	280	0.29	0.46	161	0.28	0.45	0.04
Race/Ethnicity (URM = 1)	280	0.25	0.44	161	0.27	0.44	0.05
Age (constructed from year of birth)	280	19.19	4.82	161	19.58	6.74	0.07
Pell status (Yes = 1)	280	0.45	0.50	161	0.49	0.50	0.09
Prior achievement variables							
English placement score	280	3.79	0.63	161	3.75	0.71	0.06
Math placement score	280	0.65	0.48	161	0.62	0.49	0.07

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: SRI found that CVCC students enrolling in three or more OER courses on average attained 7.90 credits more than otherwise similar students who did not enroll in any OER courses (0.56 effect size). Students of different Pell status appear to benefit differently: Pell-eligible students enrolling in three or more OER courses on average attained 5.12 credits more than otherwise similar students who took no OER courses, whereas non-Pell eligible students enrolling in three or more OER courses on average attained 10.19 credits more than otherwise similar students who took no OER courses. Enrollment in OER courses did not appear to affect students' cumulative GPA.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	7.90	0.94	<.001*	0.56
Student demographic variables				

Gender (Female = 1)	-1.78	0.88	.045*
Race/Ethnicity (URM = 1)	-2.95	0.93	.002*
Age (constructed from year of birth)	-0.11	0.08	.143
Pell status (Yes = 1)	0.94	0.84	.263
Transcript variables			
# Semesters enrolled	11.66	0.42	<.001*
Starting term, first eligible semester (ref.)	n/a		
Starting term, second eligible semester	-0.48	1.41	.735
Starting term, third eligible semester	3.20	0.84	<.001*
Prior achievement variables			
English placement score	0.38	0.63	.542
Math placement score	3.07	0.90	<.001*
Valid Control Records for Impact Analysis	280		
Valid Treatment Records for Impact Analysis	161		
Model R-Squared	0.79		

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Treatment Sample: High OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	0.00	0.12	1.000	–
Student demographic variables				
Gender (Female = 1)	0.07	0.12	.558	
Race/Ethnicity (URM = 1)	-0.75	0.12	<.001*	
Age (constructed from year of birth)	0.02	0.01	.018*	
Pell status (Yes = 1)	-0.33	0.11	.003*	
Transcript variables				
# Semesters enrolled	0.36	0.05	<.001*	
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	0.42	0.19	.024*	
Starting term, third eligible semester	0.11	0.11	.327	
Prior achievement variables				
English placement score	0.10	0.08	.220	
Math placement score	0.46	0.12	<.001*	
Valid Control Records for Impact Analysis	280			

Valid Treatment Records for Impact Analysis	161
Model R-Squared	0.28

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Studentsa

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.09	0.14	.504
Cumulative GPA, URM interaction	0.37	0.24	.118
Model R-Squared	0.28		
Cumulative credits attained, reference	7.74	1.03	<.001*
Cumulative credits attained, URM interaction	0.66	1.81	.717
Model R-Squared	0.79		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.

[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	0.05	0.16	.766
Cumulative GPA, Pell interaction	-0.10	0.21	.626
Model R-Squared	0.28		
Cumulative credits attained, reference	10.19	1.17	<.001*
Cumulative credits attained, Pell interaction	-5.07	1.58	.002*
Model R-Squared	0.80		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For CVCC, this was coded as Pell eligible.

[b] *p < .05.

OER Impact Study Overview

Research Partner: Forsyth Technical Community College

Study Period: fall 2017 – fall 2018

Design: Concurrent

Programs of Study: General Studies Degree (study sample not limited to a particular major)

Treatment Group: Students first enrolling in fall 2017

Control Group: Students first enrolling in fall 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	10,447	–
Removing duplicate records	10,447	0
Removing students younger than 16	10,447	0
Site-specific cleaning (if any)[a]	7,489	2,958
Removing treatment-eligible students with zero OER courses (historical only)	-	-
Removing control-eligible students with OER courses (historical only)	-	-
Missing prior achievement data	3,088	4,401
Missing outcome data	3,019	69

[a] For Forsyth Tech, we limited our sample to those students who started enrollment in Fall of 2017.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Enrollment status (Part-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☐ Yes ☐ No; missing ☒ No; other reason [c]
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason [d]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: Developmental Math Assessment (DMA)	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Forsyth Tech, this was coded as Pell-eligible.
[c] All students were first enrolled in the same term.
[d] There is only a single campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			High OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	565	.61	.49	140	.60	.49	0.03
Race/Ethnicity (URM = 1)	565	.37	.48	140	.36	.48	0.02
Age (constructed from year of birth)	565	21.83	6.32	140	21.79	6.83	0.01
Pell status (Yes = 1)	565	.40	.49	140	.39	.49	0.04

Enrollment status (Part-time = 1)	565	.55	.50	140	.57	.50	0.04
Military veteran status (Yes = 1)	565	.02	.13	140	.02	.15	0.14
Prior achievement variables							
Math placement score	565	23.37	6.30	140	23.41	5.76	0.01

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: Forsyth Tech students who enrolled in three or more OER courses earned statistically similar credits to otherwise similar students who took no OER courses. Forsyth Tech students who enrolled in three or more OER courses earned statistically lower cumulative GPA than otherwise similar students who took no OER courses, specifically 0.16 fewer points on a 4.0 GPA scale (-0.18 effect size). Neither credits attained nor cumulative GPA had different impacts based on students' Pell eligibility or racial/ethnic identity.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	-3.37	2.30	.144	-
Student demographic variables				
Gender (Female = 1)	3.87	1.84	.036*	
Race/Ethnicity (URM = 1)	-5.15	1.96	.009*	
Age (constructed from year of birth)	0.86	0.14	<.001*	
Pell status (Yes = 1)	1.73	1.96	.378	
Enrollment status (Part-time = 1)	-11.68	1.80	<.001*	
Military veteran status (Yes = 1)	-0.59	6.64	.929	
Transcript variables				
# Semesters enrolled	7.89	1.25	<.001*	
Prior achievement variables				
Math placement score	0.65	0.15	<.001*	
Valid Control Records for Impact Analysis	565			
Valid Treatment Records for Impact Analysis	140			
Model R-Squared	0.19			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at $p < .05$.

Treatment Sample: High OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	-0.16	0.08	.048*	-0.18
Student demographic variables				
Gender (Female = 1)	0.26	0.06	<.001*	
Race/Ethnicity (URM = 1)	-0.20	0.07	<.001*	
Age (constructed from year of birth)	0.02	0.00	<.001*	
Pell status (Yes = 1)	-0.03	0.07	.617	
Enrollment status (Part-time = 1)	0.08	0.06	.179	
Military veteran status (Yes = 1)	0.06	0.23	.781	
Transcript variables				
# Semesters enrolled	0.30	0.04	<.001*	
Prior achievement variables				
Math placement score	0.04	0.01	<.001*	
Valid Control Records for Impact Analysis	565			
Valid Treatment Records for Impact Analysis	140			
Model R-Squared	0.21			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at $p < .05$.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.15	0.10	.118
Cumulative GPA, URM interaction	-0.01	0.16	.968
Model R-Squared	0.21		
Cumulative credits attained, reference	-5.62	2.87	.051
Cumulative credits attained, URM interaction	6.03	4.60	.191
Model R-Squared	0.20		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.16	0.10	.103
Cumulative GPA, Pell interaction	0.02	0.16	.918
Model R-Squared	0.21		
Cumulative credits attained, reference	-3.16	2.90	.277
Cumulative credits attained, Pell interaction	-0.54	4.55	.905
Model R-Squared	0.19		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Forsyth Tech, this was coded as Pell-eligible.
[b] *p < .05.

OER Impact Study Overview

Research Partner: SUNY Herkimer County Community College (HCCC)

Study Period: Fall 2013 – spring 2015 & fall 2016 - spring 2018

Design: Historical

Programs of Study: Liberal Arts & Sciences, General Studies Associate of Arts (AA) (study sample not limited to a particular major)

Treatment Group: Students first enrolling in fall 2016, spring 2017, fall 2017, or spring 2018

Control Group: Students first enrolling in fall 2013, spring 2014, fall 2014, or spring 2015

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	11464	–
Removing duplicate records	11464	0
Removing students younger than 16	11464	0
Site-specific cleaning (if any)[a]	7760	3704
Removing treatment-eligible students with zero OER courses (historical only)	7212	548
Removing control-eligible students with OER courses (historical only)	6158	1054
Missing prior achievement data	3296	2862
Missing outcome data	3224	72

[a] For Herkimer we needed to remove students who had a first semester of data outside of the analysis window. For example, students who started in Summer of 2016 or Fall of 2018 were excluded.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Enrollment status (Full-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

English language learner (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☐ Yes ☐ No; missing ☒ No; other reason[c]
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason[d]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: Math Course Placement Exam	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Herkimer, this was coded as Pell receiving.
[c] Semesters enrolled was excluded from the impact analysis for Herkimer due collinearity with the starting term variable.
[d] Herkimer has only one campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			High OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	1289	.59	.49	681	.59	.49	.02

Race/Ethnicity (URM = 1)	1289	.38	.48	681	.38	.48	.00
Age (constructed from year of birth)	1289	20.85	5.59	681	21.01	6.23	.03
Pell status (Yes = 1)	1289	.69	.46	681	.67	.47	.05
Enrollment status (Full-time = 1)	1289	.96	.19	681	.96	.20	.03
English language learner (Yes = 1)	1289	.03	.17	681	.04	.18	.13
Prior achievement variables							
Math placement score	1289	4.59	2.91	681	4.86	3.11	.09

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: At HCCC, students enrolling in three or more OER courses do not appear to achieve different outcomes from otherwise similar students who took no OER courses for either credits accumulated or cumulative GPA.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	1.05	0.82	.201	–
Student demographic variables				
Gender (Female = 1)	1.25	0.80	.118	
Race/Ethnicity (URM = 1)	-4.00	0.83	<.001*	
Age (constructed from year of birth)	0.26	0.07	<.001*	
Pell status (Yes = 1)	-3.50	0.90	<.001*	
Enrollment status (Full-time = 1)	17.23	2.14	<.001*	
English language learner (Yes = 1)	-6.65	2.42	.006*	
Transcript variables				
Starting term, first eligible semester (ref.)	–			
Starting term, second eligible semester	-6.02	1.57	<.001*	
Starting term, third eligible semester	-14.68	0.88	<.001*	
Starting term, fourth eligible semester	-23.86	1.50	<.001*	
Prior achievement variables				
Math placement score	1.69	0.14	<.001*	
Valid Control Records for Impact Analysis	1289			
Valid Treatment Records for Impact Analysis	681			

Model R-Squared	0.26

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Treatment Sample: High OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	0.01	0.04	.731	–
Student demographic variables				
Gender (Female = 1)	0.16	0.04	<.001*	
Race/Ethnicity (URM = 1)	-0.27	0.04	<.001*	
Age (constructed from year of birth)	0.02	0.00	<.001*	
Pell status (Yes = 1)	-0.27	0.04	<.001*	
Enrollment status (Full-time = 1)	0.02	0.10	.884	
English language learner (Yes = 1)	0.25	0.12	.031*	
Transcript variables				
Starting term, first eligible semester (ref.)	–			
Starting term, second eligible semester	-0.02	0.08	.863	
Starting term, third eligible semester	0.04	0.04	.373	
Starting term, fourth eligible semester	-0.06	0.07	.447	
Prior achievement variables				
Math placement score	0.06	0.01	<.001*	
Valid Control Records for Impact Analysis	1289			
Valid Treatment Records for Impact Analysis	681			
Model R-Squared	0.15			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for

students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.03	0.05	.529
Cumulative GPA, URM interaction	0.12	0.08	.142
Model R-Squared	0.15		
Cumulative credits attained, reference	0.92	1.04	.373
Cumulative credits attained, URM interaction	0.32	1.69	.847
Model R-Squared	0.26		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.11	0.07	.104
Cumulative GPA, Pell interaction	0.19	0.08	.027*
Model R-Squared	0.15		
Cumulative credits attained, reference	-0.68	1.45	.638
Cumulative credits attained, Pell interaction	2.54	1.76	.147
Model R-Squared	0.26		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Herkimer, this was coded as Pell receiving.
[b] *p < .05.

OER Impact Study Overview

Research Partner: SUNY Monroe

Study Period: fall 2014 – spring 2015 & fall 2017 – spring 2018

Design: Historical

Programs of Study: Biology (study sample limited to Biology majors)

Treatment Group: Students first enrolling in fall 2017, spring 2018

Control Group: Students first enrolling in fall 2014, spring 2015

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	*n*	Δ
Maximal sample in dataset	713	–
Removing duplicate records	713	0
Removing students younger than 16	712	1
Site-specific cleaning (if any)[a]	416	296
Removing treatment-eligible students with zero OER courses (historical only)	368	48
Removing control-eligible students with OER courses (historical only)	368	0
Missing prior achievement data	-	-
Missing outcome data	368	0

[a] For SUNY Monroe, we removed students who started before or between our analysis windows. For example, we removed students who started before Fall 2013 or between Spring 2015 and Summer 2017 inclusive.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Enrollment status (Full-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason

Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☐ Yes ☐ No; missing ☒ No; other reason[c]
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason[d]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☐ Yes ☒ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: None	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For SUNY Monroe, this was coded as Pell eligible.
[c] Semesters enrolled was excluded from the impact analysis for Monroe due collinearity with the starting term variable.
[d] Monroe has a single campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

Variable	Control			Low OER			Baseline
	n	M	SD	*n*	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	93	.57	.50	59	.58	.42	0.02
Race/Ethnicity (URM = 1)	93	.25	.44	59	.25	.44	0.00
Age (constructed from year of birth)	93	21.14	3.81	59	21.59	4.66	0.11
Pell status (Yes = 1)	93	.59	.50	59	.56	.50	0.07
Enrollment status (Part-time = 1)	93	.22	.43	59	.27	.45	0.12
First-generation student (Yes = 1)	93	.56	.50	59	.59	.50	0.08

[a] We report baseline difference effect sizes as Hedge's *g* for continuous variables and Cohen's *d* for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: At SUNY Monroe, enrollment in one or two OER courses does not appear to be associated with either credit attainment or cumulative GPA.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: Low OER
Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	*p*[a]	ES[b]
Treatment (Yes = 1)	1.26	4.07	.758	–
Student demographic variables				
Gender (Female = 1)	1.31	4.18	.755	
Race/Ethnicity (URM = 1)	3.14	4.69	.505	
Age (constructed from year of birth)	2.10	0.53	<.001*	
Pell status (Yes = 1)	-2.16	4.32	.619	
Enrollment status (Full-time = 1)	-6.27	5.03	.215	
First-generation student (Yes = 1)	-0.56	4.16	.894	
Transcript variables				
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	4.48	4.38	.308	
Valid Control Records for Impact Analysis	93			
Valid Treatment Records for Impact Analysis	59			
Model R-Squared	0.16			

[a] *$p < .05$.

[b] We report Treatment effect sizes as Hedge's *g* in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at $p < .05$.

Treatment Sample: Low OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	*p*[a]	ES[b]
Treatment (Yes = 1)	0.16	0.11	.164	–
Student demographic variables				
Gender (Female = 1)	0.16	0.12	.172	
Race/Ethnicity (URM = 1)	0.03	0.13	.826	
Age (constructed from year of birth)	0.03	0.01	.091	
Pell status (Yes = 1)	-0.42	0.12	<.001*	
Enrollment status (Full-time = 1)	0.01	0.14	.970	
First-generation student (Yes = 1)	-0.13	0.12	.252	
Transcript variables				
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	0.10	0.12	.421	
Valid Control Records for Impact Analysis	93			
Valid Treatment Records for Impact Analysis	59			
Model R-Squared	0.15			

[a] *$p < .05$.

[b] We report Treatment effect sizes as Hedge's *g* in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at $p < .05$.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Studentsa

	Treatment Impact Estimates		
Outcome Variable	**B**	**SE**	***p***[b]
Cumulative GPA, reference	0.14	0.13	.286
Cumulative GPA, URM interaction	0.07	0.26	.798
Model R-Squared	0.15		
Cumulative credits attained, reference	2.75	4.74	.563
Cumulative credits attained, URM interaction	-5.83	9.41	.536
Model R-Squared	0.17		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *$p < .05$.

Impact Analysis for Pell Studentsa

	Treatment Impact Estimates		
Outcome Variable	**B**	**SE**	***p***[b]
Cumulative GPA, reference	0.31	0.18	.085
Cumulative GPA, Pell interaction	-0.26	0.24	.276
Model R-Squared	0.16		
Cumulative credits attained, reference	-5.02	6.40	.435
Cumulative credits attained, Pell interaction	10.93	8.62	.207
Model R-Squared	0.17		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For SUNY Monroe, this was coded as Pell eligible.
[b] *$p < .05$.

OER Impact Study Overview

Research Partner: Montgomery College

Study Period: Fall 2017 – Fall 2018

Design: Concurrent

Programs of Study: General Studies Degree (study sample not limited to a particular major)

Treatment Group: Students first enrolling in fall 2017

Control Group: Students first enrolling in fall 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	1,284	–
Removing duplicate records	1,284	0
Removing students younger than 16	1,282	2
Site-specific cleaning (if any)[a]	1,282	0
Removing treatment-eligible students with zero OER courses (historical only)	-	-
Removing control-eligible students with OER courses (historical only)	-	-
Missing prior achievement data	1,282	0
Missing outcome data	1,282	0

[a] For Montgomery College, no site-specific cleaning was required.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Enrollment status (Part-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☐ Yes ☐ No; missing ☒ No; other reason [c]
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason [d]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: Algebra Placement Exam	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Montgomery, this was coded as Pell-eligible.
[c] All students were first enrolled in the same term.
[d] There is only a single campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			High OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	171	.59	.49	76	.59	.49	0.00
Race/Ethnicity (URM = 1)	171	.70	.46	76	.64	.48	0.14
Age (constructed from year of birth)	171	19.33	4.47	76	19.25	3.48	0.02
Pell status (Yes = 1)	171	.48	.50	76	.47	.50	0.02

Enrollment status (Part-time = 1)	171	.17	.37	76	.16	.37	0.04
Prior achievement variables							
Math placement score	171	77.73	26.69	76	77.43	27.02	0.01

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: Students at MCC who enrolled in three or more OER courses on average attained 7.30 more credits than otherwise similar students who took no OER courses (0.51 effect size). Enrollment in three or more OER courses did not appear to affect students' cumulative GPA. Neither credits attained nor cumulative GPA had different impacts based on students' Pell eligibility or racial/ethnic identify.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: High OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	7.30	1.50	<.001*	0.51
Student demographic variables				
Gender (Female = 1)	2.95	1.39	.035*	
Race/Ethnicity (URM = 1)	-2.11	1.49	.159	
Age (constructed from year of birth)	-0.05	0.17	.786	
Pell status (Yes = 1)	-0.65	1.39	.634	
Enrollment status (Part-time = 1)	-11.04	1.86	<.001*	
Transcript variables				
# Semesters enrolled	10.78	1.14	<.001*	
Prior achievement variables				
Math placement score	0.17	0.03	<.001*	
Valid Control Records for Impact Analysis	171			
Valid Treatment Records for Impact Analysis	76			
Model R-Squared	0.54			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Treatment Sample: High OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	0.21	0.11	.060	–
Student demographic variables				
Gender (Female = 1)	0.33	0.11	.002*	
Race/Ethnicity (URM = 1)	-0.36	0.11	.002*	
Age (constructed from year of birth)	0.02	0.01	.181	
Pell status (Yes = 1)	-0.15	0.10	.141	
Enrollment status (Part-time = 1)	0.10	0.14	.482	
Transcript variables				
# Semesters enrolled	0.33	0.09	<.001*	
Prior achievement variables				
Math placement score	0.01	0.00	<.001*	
Valid Control Records for Impact Analysis	171			
Valid Treatment Records for Impact Analysis	76			
Model R-Squared	0.25			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	0.09	0.19	.653
Cumulative GPA, URM interaction	0.20	0.24	.406
Model R-Squared	0.26		
Cumulative credits attained, reference	6.92	2.53	.007*
Cumulative credits attained, URM interaction	0.59	3.11	.849
Model R-Squared	0.54		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	0.14	0.15	.370
Cumulative GPA, Pell interaction	0.16	0.22	.474
Model R-Squared	0.26		
Cumulative credits attained, reference	7.88	2.04	<.001*
Cumulative credits attained, Pell interaction	-1.22	2.93	.677
Model R-Squared	0.54		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Montgomery, this was coded as Pell-eligible.
[b] *p < .05.

OER Impact Study Overview

Research Partner: Pierce

Study Period: Fall 2016 – Fall 2018

Design: Concurrent

Programs of Study: AA-DTA (Associate of Arts – Direct Transfer Agreement) (study sample not limited to a particular major)

Treatment Group: Students enrolled in fall 2016, spring/summer 2017, or fall/winter 2017

Control Group: Students enrolled in fall 2016, spring/summer 2017, or fall/winter 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	1574	–
Removing duplicate records	1574	0
Removing students younger than 16	1574	0
Site-specific cleaning (if any)[a]	1524	50
Removing treatment-eligible students with zero OER courses (historical only)	–	
Removing control-eligible students with OER courses (historical only)	–	
Missing prior achievement data	496	1028
Missing outcome data	496	0

[a] For Pierce, we dropped records outside of the analysis window; Students with a first term of data after Fall 2018. Additional we excluded those who were flagged as not seeking a degree.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Enrollment status (Full-time = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
First-generation student (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☒ Yes ☐ No; missing ☐ No; other reason
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☒ Yes ☐ No; missing ☐ No; other reason
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: Mathematics placement exam	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Pierce, this was coded as Pell receiving.
[c] Pierce has three campuses.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			Low OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	168	.45	.50	192	.44	.50	.04
Race/Ethnicity (URM = 1)	168	.35	.48	192	.31	.46	.10
Age (constructed from year of birth)	168	22.19	5.69	192	22.14	6.80	.01

Pell status (Yes = 1)	168	.34	.47	192	.32	.47	.05
Military veteran status (Yes = 1)	168	.01	.12	192	.02	.12	.19
First-generation student (Yes = 1)	168	.60	.49	192	.61	.49	.05
Prior achievement variables							
Math placement score	168	95.93	64.84	192	97.45	71.54	.02

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: Pierce students who enrolled in one or two OER courses did not on average earn greater numbers of credits than otherwise similar students who took no OER courses. Pierce students who enrolled in one or two OER courses on average had cumulative GPAs that were 0.44 points lower than otherwise similar students who took no OER courses
(-.40 effect size). Neither Pell recipient status nor racial/ethnic identity were associated with whether OER course enrollment affected earned credits or cumulative GPA.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: Low OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	0.13	1.33	.920	–
Student demographic variables				
Gender (Female = 1)	-1.65	1.31	.211	
Race/Ethnicity (URM = 1)	0.86	1.41	.523	
Age (constructed from year of birth)	0.11	0.11	.352	
Pell status (Yes = 1)	-4.01	1.54	.010*	
Military veteran status (Yes = 1)	3.43	5.62	.542	
First-generation student (Yes = 1)	0.98	1.36	.474	
Transcript variables				
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	-2.67	1.82	.145	
Starting term, third eligible semester	2.21	2.11	.294	
Campus, first campus (ref.)	n/a			
Campus, second campus	-1.26	1.83	.493	
Campus, third campus	0.71	1.48	.632	
Prior achievement variables				
Math placement score	0.07	0.01	<.001*	

Valid Control Records for Impact Analysis	168
Valid Treatment Records for Impact Analysis	192
Model R-Squared	0.72

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Treatment Sample: Low OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student who took no OER courses.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	-0.44	0.11	<.001*	-.40
Student demographic variables				
Gender (Female = 1)	0.24	0.11	.024*	
Race/Ethnicity (URM = 1)	-0.19	0.11	.102	
Age (constructed from year of birth)	0.03	0.01	<.001*	
Pell status (Yes = 1)	-0.26	0.13	.041*	
Military veteran status (Yes = 1)	-0.17	0.46	.717	
First-generation student (Yes = 1)	0.02	0.11	.832	
Transcript variables				
Starting term, first eligible semester (ref.)	n/a			
Starting term, second eligible semester	0.12	0.15	.427	
Starting term, third eligible semester	0.26	0.17	.133	
Campus, first campus (ref.)	n/a			
Campus, second campus	0.01	0.15	.970	
Campus, third campus	0.10	0.12	.406	
Prior achievement variables				
Math placement score	<0.01	<0.01	<.001*	
Valid Control Records for Impact Analysis	168			
Valid Treatment Records for Impact Analysis	192			
Model R-Squared	0.22			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.43	0.13	.001*
Cumulative GPA, URM interaction	-0.02	0.23	.913
Model R-Squared	0.23		
Cumulative credits attained, reference	0.54	1.63	.743
Cumulative credits attained, URM interaction	-1.19	2.80	.670
Model R-Squared	0.72		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	-0.48	0.13	<.001*
Cumulative GPA, Pell interaction	0.12	0.23	.596
Model R-Squared	0.23		
Cumulative credits attained, reference	0.89	1.62	.583
Cumulative credits attained, Pell interaction	-2.28	2.79	.414
Model R-Squared	0.72		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Pierce, this was coded as Pell receiving.
[b] *p < .05.

OER Impact Study Overview

Research Partner: Santa Ana

Study Period: Fall 2016 – Fall 2018

Design: Concurrent

Programs of Study: Liberal Arts (study sample not limited to a particular major)

Treatment Group: Students enrolling in fall 2016, spring/summer 2017, or fall 2017

Control Group: Students enrolling in fall 2016, spring/summer 2017, or fall 2017

Data Cleaning

We report the maximal student sample for each of the three conditions in the pre-cleaned dataset and the remaining samples after conducting each data cleaning step. Please note that the final student counts in this table may vary from the analytic samples for our models depending on the specific covariates and outcome data available for each student record. Also, if propensity score matching was employed to achieve baseline equivalence, then that would also cause the analytic samples to vary from these final student counts.

	Student Sample	
Data Cleaning Step	n	Δ
Maximal sample in dataset	14174	–
Removing duplicate records	14174	0
Removing students younger than 16	13785	389
Site-specific cleaning (if any)[a]	–	
Removing treatment-eligible students with zero OER courses (historical only)	–	
Removing control-eligible students with OER courses (historical only)	–	
Missing prior achievement data	7364	6421
Missing outcome data	7364	0

[a] For Santa Ana, no site-specific cleaning was necessary.

Data Availability for Analysis

SRI analysts considered the following variables for possible inclusion in the impact analysis. The table below details which variables were included and, if they were excluded, why. The most common reason for variable exclusion was excessive missingness in the data, either because the institution did not report the data at all or because too few students had usable data.

Variable	Included in Impact Analysis
Student demographic variables	
Treatment vs. Comparison condition	☒ Yes ☐ No; missing ☐ No; other reason
Gender (Female = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Race/Ethnicity[a] (URM = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Age (constructed from year of birth)	☒ Yes ☐ No; missing ☐ No; other reason
Pell status[b] (Yes = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Military veteran status (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Enrollment status (Full-time = 1)	☒ Yes ☐ No; missing ☐ No; other reason
Graduated high school (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
English language learner (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason

First-generation student (Yes = 1)	☐ Yes ☒ No; missing ☐ No; other reason
Transcript variables	
# Semesters enrolled	☐ Yes ☐ No; missing ☒ No; other reason[c]
First term (relative to sample eligibility)	☒ Yes ☐ No; missing ☐ No; other reason
Campus enrolled in	☐ Yes ☐ No; missing ☒ No; other reason[d]
Prior achievement variables	
English placement score	☐ Yes ☒ No; missing ☐ No; other reason
Math placement score	☒ Yes ☐ No; missing ☐ No; other reason
Standardized test	☐ Yes ☒ No; missing ☐ No; other reason
Specific measures: Santa Ana's institutional math placement: Math Diagnostic Testing Project	
Outcome measures	
Cumulative GPA (4-point grade scale)	☒ Yes ☐ No; missing ☐ No; other reason
Cumulative credits attained	☒ Yes ☐ No; missing ☐ No; other reason

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identify as any other race/ethnicity identify were coded as one.
[b] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Santa Ana, this was coded as Pell eligible.
[c] Semesters enrolled was excluded from the impact analysis for Santa Ana due to collinearity with the starting term variable.
[d] Santa Ana has only one campus.

Descriptive Statistics

After completing variable identification, SRI analysts conducted baseline checks between the treatment students and control students in accordance with What Works Clearinghouse v4.0 Group Design Standards. Analysts considered the student samples to be sufficiently similar for analysis purposes if the effect size of the baseline difference on prior achievement was less than 0.25. If the student samples had a baseline difference greater than 0.25 standard deviations, then analysts used propensity score matching and propensity score weighting to construct comparable analytic samples and conduct analyses (see the Methods section of the technical appendix for full matching details).

We defined three levels of treatment for the purpose of conducting impact analyses. We considered treatment students to have received a "high dosage" of OER courses if they enrolled in at least three OER courses. We considered treatment students to have received a "low dosage" of OER courses if they enrolled in either one or two OER courses. We considered control students to have received "no dosage" of OER courses, which is the definition of our control condition.

The table below provides descriptive statistics for the variables included in the impact analysis. Variables not included in the analysis are intentionally left blank.

Propensity score matching was used to establish baseline.[a]	☒ Yes ☐ No

[a] If propensity score matching was used, then all sample sizes for descriptive statistics and impact analyses report propensity score-weighted analytic sample sizes.

	Control			Low OER			Baseline
Variable	n	M	SD	n	M	SD	Diff. ES[a]
Student demographic variables							
Gender (Female = 1)	2993	.45	.50	2141	.44	.50	0.02
Race/Ethnicity (URM = 1)	2993	.88	.33	2141	.84	.36	0.18

Age (constructed from year of birth)	2993	20.04	5.64	2141	20.22	5.17	0.03
Pell status (Yes = 1)	2993	.51	.50	2141	.51	.50	0.00
Enrollment status (Full-time = 1)	2993	.31	.46	2141	.28	.45	0.07
Prior achievement variables							
Math placement score	2993	3.82	1.29	2141	3.70	1.27	0.04

[a] We report baseline difference effect sizes as Hedge's g for continuous variables and Cohen's d for dichotomous variables in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report absolute values of ES for baseline checks.

Impact Analyses

Summary Findings: Students enrolled in one or two OER courses on average earned 5.16 more credits than otherwise similar students who took no OER (0.27 effect size). This difference appears to be associated with Pell status, with Pell-eligible students enrolled in one or two OER courses students earning 6.90 more credits than otherwise similar students whereas non-Pell-eligible students enrolled in one or two OER courses earned 3.38 more credits than otherwise similar students who took no OER.

Students enrolled in one or two OER courses on average have cumulative GPAs 0.19 points greater than otherwise similar students (0.19 effect size). This difference appears to be associated with Pell status, with Pell-eligible students enrolled in one or two OER courses students having GPAs 0.30 points greater than otherwise similar students whereas non-Pell-eligible students enrolled in one or two OER courses had GPAs 0.07 points greater than otherwise similar students.

The tables below provide the results of the impact analyses conducted for this research partner. All analyses are conducted using ordinary least squares (OLS) regression. If propensity score matching was used, then all impact analyses use propensity score-weighted analytic samples. Please see the Methods section of the technical appendix for analysis details.

Treatment Sample: Low OER

Outcome: Cumulative Credits Attained

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative credits attained/attempted, meaning they can be interpreted as credit counts. For example, an impact estimate for Treatment of 6.0 would indicate that a Treatment student was estimated to attempt/attain 6.0 more credits than an otherwise identical Control student.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	5.16	0.43	<.001*	0.27
Student demographic variables				
Gender (Female = 1)	2.17	0.43	<.001*	
Race/Ethnicity (URM = 1)	-7.75	0.65	<.001*	
Age (constructed from year of birth)	0.19	0.04	<.001*	
Pell status (Yes = 1)	-0.26	0.43	.545	
Enrollment status (Full-time = 1)	11.14	0.49	<.001*	
Transcript variables				
Starting term, first eligible semester (ref.)	–			
Starting term, second eligible semester	-11.85	0.79	<.001*	
Starting term, third eligible semester	-7.25	0.64	<.001*	
Starting term, fourth eligible semester	-22.04	0.49	<.001*	

Prior achievement variables				
Math placement score	1.76	0.18	<.001*	
Valid Control Records for Impact Analysis	2993			
Valid Treatment Records for Impact Analysis	2141			
Model R-Squared	0.40			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Treatment Sample: Low OER

Outcome: Cumulative GPA

Impact estimates (β) are reported as unstandardized coefficients of students' cumulative GPA, meaning they can be interpreted on a 4-point grade scale. For example, an impact estimate for Treatment of 0.30 would indicate that a Treatment student was estimated to receive a course grade that was approximately one grade step higher (e.g., B to B+) than an otherwise identical Control student.

Variable	β	SE	p[a]	ES[b]
Treatment (Yes = 1)	0.19	0.03	<.001*	0.19
Student demographic variables				
Gender (Female = 1)	0.22	0.03	<.001*	
Race/Ethnicity (URM = 1)	-0.41	0.04	<.001*	
Age (constructed from year of birth)	0.04	0.00	<.001*	
Pell status (Yes = 1)	-0.09	0.03	<.001*	
Enrollment status (Full-time = 1)	0.05	0.03	.078	
Transcript variables				
Starting term, first eligible semester (ref.)	–			
Starting term, second eligible semester	-0.08	0.05	.072	
Starting term, third eligible semester	0.19	0.04	<.001*	
Starting term, fourth eligible semester	-0.36	0.03	<.001*	
Prior achievement variables				
Math placement score	0.11	0.01	<.001*	
Valid Control Records for Impact Analysis	2993			
Valid Treatment Records for Impact Analysis	2141			
Model R-Squared	0.19			

[a] *p < .05.

[b] We report Treatment effect sizes as Hedge's g in accordance with What Works Clearinghouse v4.0 Group Design Standards. We report effect size only for the Treatment variable. The Treatment effect size is reported only when the treatment is statistically significant at p < .05.

Subgroup Impact Analyses

We conducted subgroup analyses to explore the extent to which enrolling in OER courses may have different impacts on (a) under-represented minority students and (b) Pell-eligible and/or Pell-receiving students. The tables below provide the results of the subgroup impact analyses conducted for this research partner.

We conducted our subgroup analyses by adding an interaction effect to the model (for example, Treatment*Pell). Significant interaction effects indicate that the treatment effect is different for students in the subgroup. The statistical models are otherwise identical to the main impact analyses, using the same propensity score weights (if using matched samples) and covariates.

We report the results of our subgroup impact analyses below. We report two impact estimates for each model. First, we report the treatment impact estimate for the reference group (non-URM and non-Pell students). Second, we report the interaction effect of the treatment with the appropriate subgroup.

Impact Analysis for URM Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	0.24	0.07	<.001*
Cumulative GPA, URM interaction	-0.07	0.07	.365
Model R-Squared	0.19		
Cumulative credits attained, reference	5.11	1.15	<.001*
Cumulative credits attained, URM interaction	0.06	1.24	.965
Model R-Squared	0.40		

[a] Race/ethnicity was coded as under-represented minority (URM) status. Students identifying as Asian or White were coded as zero. Students identifying as any other race/ethnicity identify were coded as one.
[b] *p < .05.

Impact Analysis for Pell Students[a]

	Treatment Impact Estimates		
Outcome Variable	B	SE	p[b]
Cumulative GPA, reference	0.07	0.04	.046*
Cumulative GPA, Pell interaction	0.23	0.05	<.001*
Model R-Squared	0.19		
Cumulative credits attained, reference	3.38	0.61	<.001*
Cumulative credits attained, Pell interaction	3.51	0.86	<.001*
Model R-Squared	0.41		

[a] The meaning of "Pell status" varies by institution. Some institutions reported Pell receiving whereas some reported Pell eligibility. For Santa Ana, this was coded as Pell eligible.
[b] *p < .05.