Data Article

Data on online and face-to-face course enrollments in a public research university during summer terms

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A B S T R A C T

This data article includes information on institutional data at a large public research university in Southern California. In particular, data on undergraduate student enrollments in online and face-to-face courses during summer terms from 2014 to 2017 cumulating in 72,441 course enrollments from 23,610 undergraduate students in 433 courses is provided. This data includes additional information on the statistical models examining factors influencing student enrollment by course modality and the associations of course modality with course grades. This includes descriptive data and data derived from multi-level logistic regression analyses and multi-way fixed effects linear regression analyses. This data article is associated with the article “Effects of course modality in summer session: Enrollment patterns and student performance in face-to-face and online classes” [1].

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DOI of original article: https://doi.org/10.1016/j.iheduc.2019.100710.

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1. Data

This Data in Brief article is associated with the article “Effects of course modality in summer session: Enrollment patterns and student performance in face-to-face and online classes” [1]. The data provided in this article sheds light on the demographics at a large research university during summer terms (Tables 1–3, Table 8) and models associations of student- and course-level factors influencing course enrollments by course modality (Tables 4–7). In addition, the data describes associations of course modality with student course grades (Tables 9–19).

| Specifications Table |
|----------------------|
| Subject area         | Education          |
| More specific subject area | Higher Education, Online Learning |
| Type of data         | Tables             |
| How data was acquired| Institutional data base of the University of California, Irvine |
| Data format          | Analyzed, raw (upon request) |
| Experimental factors | Course enrollments and student grades by course modality |
| Experimental features| Logistic regression analysis, fixed effects modeling |
| Data source location | Irvine, CA, USA |
| Data accessibility   | Data is within this article. Access to de-identified raw data is available upon request to the corresponding author for researchers with an approved IRB from their home institution. |
| Related research article | This article provides supplemental information for research published in the following study: Fischer, C., Xu, D., Rodriguez, F., Denaro, K., & Warschauer, M. (2020). Effects of course modality in summer session: Enrollment patterns and student performance in face-to-face and online classes, The Internet and Higher Education, 45, 1-9 |

### Table 1
Descriptive information on all summer course enrollments.

|                        | N     | Mean/[%] | SD    |
|------------------------|-------|----------|-------|
| Course grade           | 72,441| 2.89     | 1.07  |
| Online course          | 72,441| 27.7%    |       |
| Female                 | 72,152| 56.3%    |       |
| White                  | 69,556| 12.0%    |       |
| Black                  | 69,556| 2.7%     |       |
| Asian                  | 69,556| 63.1%    |       |
| Hispanic               | 69,556| 21.6%    |       |
| Native                 | 69,556| 0.5%     |       |
| English language learner| 71,290| 43.3%    |       |
| In-state student residency| 72,438| 76.4%    |       |
| Low-income status      | 71,290| 33.6%    |       |
| First-generation status| 71,290| 51.4%    |       |
| Current college GPA    | 72,440| 2.94     | 0.52  |
| Years enrolled in college| 72,434| 2.22     | 1.39  |
| Transfer student status| 71,290| 16.9%    |       |
| College admission score| 61,532| 225.72   | 28.80 |
| Course repetitions     | 72,441| 0.18     | 0.46  |
| Number of online courses| 72,007| 0.85     | 1.25  |
| Number students in course| 72,441| 92.37    | 66.90 |
2. Experimental design, materials and methods

2.1. Details of institutional data

Students enrolled in undergraduate courses at in the 2014 to 2017 summer terms were included in this data. This data includes enrollments from degree-seeking undergraduate students in lecture

| Table 2 | Descriptive course enrollment information for multi-level logistic regression analysis, full sample. |
|---------|--------------------------------------------------------------------------------------------------|
| All enrollments (N = 60,798) & Face-to-face enrollments (N = 43,855) & Online enrollments (N = 16,943) |
| Mean/[%] & SD & Mean/[%] & SD & Mean/[%] & SD |
| Online course & 27.9% & 0.0% & 100.0% |
| Female & 58.0% & 56.9% & 61.0% |
| White & 10.0% & 9.9% & 10.4% |
| Black & 2.6% & 2.5% & 2.8% |
| Asian & 65.2% & 64.7% & 66.4% |
| Hispanic & 21.8% & 22.5% & 20.0% |
| Native & 0.4% & 0.4% & 0.4% |
| English language learner & 42.9% & 41.8% & 45.9% |
| In-state student residency & 76.2% & 78.6% & 70.0% |
| Low-income status & 35.2% & 36.4% & 32.2% |
| First-generation status & 51.7% & 52.4% & 50.0% |
| Current college GPA & 2.93 & 0.50 & 2.93 & 0.49 & 2.95 & 0.52 |
| Years enrolled in college & 2.25 & 1.02 & 2.26 & 1.01 & 2.22 & 1.04 |
| Transfer student status & 3.7% & 3.9% & 3.2% |
| College admission score & 225.52 & 28.79 & 224.80 & 29.30 & 227.38 & 27.34 |
| Course repetitions & 0.18 & 0.45 & 0.22 & 0.49 & 0.09 & 0.32 |
| Number of online courses & 0.93 & 1.30 & 0.86 & 1.21 & 1.12 & 1.48 |
| Number students in course & 95.08 & 68.22 & 84.07 & 66.00 & 123.59 & 65.55 |

| Table 3 | Descriptive course enrollment information for multi-level logistic regression analysis, restricted sample. |
|---------|--------------------------------------------------------------------------------------------------|
| All enrollments (N = 9741) & Face-to-face enrollments (N = 3436) & Online enrollments (N = 6305) |
| Mean/[%] & SD & Mean/[%] & SD & Mean/[%] & SD |
| Online course & 64.7% & 0.0% & 100.0% |
| Female & 60.1% & 60.0% & 60.1% |
| White & 9.8% & 9.5% & 10.1% |
| Black & 2.7% & 2.7% & 2.7% |
| Asian & 65.9% & 61.3% & 68.4% |
| Hispanic & 21.1% & 26.0% & 18.5% |
| Native & 0.4% & 0.6% & 0.3% |
| English language learner & 44.6% & 39.4% & 47.4% |
| In-state student residency & 72.0% & 80.1% & 67.6% |
| Low-income status & 34.1% & 39.6% & 31.2% |
| First-generation status & 50.9% & 54.8% & 48.8% |
| Current college GPA & 2.92 & 0.53 & 2.88 & 0.54 & 2.95 & 0.52 |
| Years enrolled in college & 1.94 & 0.99 & 1.78 & 0.94 & 2.03 & 1.00 |
| Transfer student status & 2.1% & 1.7% & 2.4% |
| College admission score & 228.41 & 25.45 & 226.70 & 24.80 & 229.34 & 25.76 |
| Course repetitions & 0.11 & 0.35 & 0.14 & 0.37 & 0.10 & 0.33 |
| Number of online courses & 0.89 & 1.31 & 0.63 & 1.01 & 1.03 & 1.43 |
| Number students in course & 140.74 & 80.80 & 125.43 & 91.28 & 149.09 & 73.14 |

2. Experimental design, materials and methods

2.1. Details of institutional data

Students enrolled in undergraduate courses at in the 2014 to 2017 summer terms were included in this data. This data includes enrollments from degree-seeking undergraduate students in lecture
courses that were graded on a letter-grade scale (in contrast to a pass/no-pass distinction) and awarded at least four credit points. Data was provided by the Teaching and Learning Research Center and was compiled from a variety of sources on campus including: Office of Institutional Research, Office of the Registrar, Office of Undergraduate Admissions, Office of Institutional Technology, and the Office of Financial Aid and Scholarships. This project was supported by the UC Irvine Institutional Review Board.

Table 4
Full sample multi-level logistic regression analysis in log-odds units, \( N_{\text{Enrollments}} = 60,798, N_{\text{Courses}} = 431. \)

| \( \beta \) | S.E. | \( z \) | \( p \) | 95\% CI |
|--------|------|-------|------|--------|
| Intercept | –12.2689 | 0.8841 | –13.88 | <0.001 | –14.0017, –10.5361 |

Level 1

| Factor | \( \beta \) | S.E. | \( z \) | \( p \) | 95\% CI |
|--------|------|------|------|------|--------|
| Female (vs. Male) | 0.2157 | 0.0400 | 5.39 | <0.001 | 0.1373, 0.2942 |
| Race/Ethnicity (vs. White) | | | | | |
| Black | 0.2003 | 0.1299 | 1.54 | 0.123 | –0.0543, 0.4549 |
| Asian | –0.2439 | 0.0642 | –3.80 | <0.001 | –0.3698, –0.1180 |
| Hispanic | –0.1010 | 0.0745 | –1.36 | 0.175 | –0.2470, 0.0450 |
| Native | –0.2913 | 0.3076 | –0.95 | 0.344 | –0.8941, 0.3116 |
| English language learner | 0.0393 | 0.0446 | 0.88 | 0.377 | –0.0480, 0.1267 |
| In-state student residency | –0.3522 | 0.0569 | –6.18 | <0.001 | –0.4638, –0.2406 |
| Low-income status | –0.0382 | 0.0458 | –0.83 | 0.404 | –0.1279, 0.0515 |
| First-generation status | 0.0717 | 0.0436 | 1.65 | 0.100 | –0.0137, 0.1571 |
| Current college GPA | –0.0098 | 0.0407 | –0.24 | 0.809 | –0.0896, 0.0699 |
| Years enrolled in college | 0.0640 | 0.0233 | 2.74 | 0.006 | 0.0183, 0.1097 |
| Transfer student status | 0.4863 | 0.1293 | 3.76 | <0.001 | 0.2329, 0.7397 |
| College admission score | 0.3062 | 0.0239 | 12.79 | <0.001 | 0.2592, 0.3531 |
| Course repetitions | 0.3361 | 0.0563 | 5.97 | <0.001 | 0.2258, 0.4465 |
| Number of online courses | 0.2633 | 0.0177 | 14.86 | <0.001 | 0.2285, 0.2980 |

Level 2

| Factor | \( \beta \) | S.E. | \( z \) | \( p \) | 95\% CI |
|--------|------|------|------|------|--------|
| Number students in course | 0.0138 | 0.0004 | 31.22 | <0.001 | 0.0129, 0.0146 |

Table 5
Full sample multi-level logistic regression analysis in odds ratio units, \( N_{\text{Enrollments}} = 60,798, N_{\text{Courses}} = 431. \)

| Odds ratio | S.E. | \( z \) | \( p \) | 95\% CI |
|-----------|------|------|------|--------|
| Intercept | 0.0000 | 0.0000 | –13.88 | <0.001 | 0.0000, 0.0000 |

Level 1

| Factor | Odds ratio | S.E. | \( z \) | \( p \) | 95\% CI |
|--------|--------|------|------|------|--------|
| Female (vs. Male) | 1.2408 | 0.0497 | 5.39 | <0.001 | 1.1471, 1.3420 |
| Race/Ethnicity (vs. White) | | | | | |
| Black | 1.2218 | 0.1587 | 1.54 | 0.123 | 0.9471, 1.5760 |
| Asian | 0.7836 | 0.0503 | –3.80 | <0.001 | 0.6909, 0.8887 |
| Hispanic | 0.9039 | 0.0673 | –1.36 | 0.175 | 0.7811, 1.0460 |
| Native | 0.7473 | 0.2299 | –0.95 | 0.344 | 0.4090, 1.3656 |
| English language learner | 1.0401 | 0.0463 | 0.88 | 0.377 | 0.9531, 1.1350 |
| In-state student residency | 0.7031 | 0.0400 | –6.18 | <0.001 | 0.6289, 0.7861 |
| Low-income status | 0.9625 | 0.0440 | –0.83 | 0.404 | 0.8800, 1.0528 |
| First-generation status | 1.0743 | 0.0468 | 1.65 | 0.100 | 0.9864, 1.1701 |
| Current college GPA | 0.9902 | 0.0403 | –0.24 | 0.809 | 0.9143, 1.0725 |
| Years enrolled in college | 1.0661 | 0.0249 | 2.74 | 0.006 | 1.0184, 1.1160 |
| Transfer student status | 1.6262 | 0.2103 | 3.76 | <0.001 | 1.2622, 2.0952 |
| College admission score | 1.3582 | 0.0325 | 12.79 | <0.001 | 1.2959, 1.4235 |
| Course repetitions | 1.3995 | 0.0788 | 5.97 | <0.001 | 1.2533, 1.5628 |
| Number of online courses | 1.3012 | 0.0231 | 14.86 | <0.001 | 1.2568, 1.3472 |

Level 2

| Factor | Odds ratio | S.E. | \( z \) | \( p \) | 95\% CI |
|--------|--------|------|------|------|--------|
| Number students in course | 1.0139 | 0.0004 | 31.22 | <0.001 | 1.0130, 1.0147 |

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The data consisted of student-level demographic, performance, and college career information, as well as course-level information.

Student-level demographic information included gender (i.e., female, male), racial/ethnic background (i.e., White; Asian or Asian American; Black or African American; Latino or Hispanic; American Indian, Alaska Native, or Pacific Islander), first-generation college student status (i.e., neither parent holds a Bachelor’s degree or higher), low-income status (i.e., derived from family household income

Table 6
Restricted sample multi-level logistic regression analysis in log-odds units, \( N_{\text{enrollments}} = 9,741, N_{\text{courses}} = 34 \).

| \( \beta \) | S.E. | \( z \) | \( p \) | 95% CI |
|---------|--------|------|------|-------|
| Intercept | 1.8922 | 0.3106 | 6.09 | <0.001 | 1.2834 | 2.5011 |

Level 1

| Factor | \( \beta \) | S.E. | \( z \) | \( p \) | 95% CI |
|--------|--------|------|------|------|-------|
| Female (vs. Male) | 0.2243 | 0.0526 | 4.26 | <0.001 | 0.1211 | 0.3275 |
| Race/Ethnicity (vs. White) | | | | | |
| Black | 0.0388 | 0.1698 | 0.23 | 0.819 | -0.2940 | 0.3716 |
| Asian | -0.3399 | 0.0873 | -3.90 | <0.001 | -0.5110 | -0.1689 |
| Hispanic | -0.3326 | 0.0993 | -3.35 | 0.001 | -0.5273 | -0.1380 |
| Native | -0.9827 | 0.3716 | -2.64 | 0.008 | -1.7110 | -0.2544 |
| English language learner | 0.0337 | 0.0589 | 0.57 | 0.567 | -0.0817 | 0.1490 |
| In-state student residency | -0.1522 | 0.0753 | -2.02 | 0.043 | -0.2998 | -0.0046 |
| Low-income status | -0.0830 | 0.0603 | -1.38 | 0.169 | -0.2012 | 0.0353 |
| First-generation status | 0.0187 | 0.0577 | 0.32 | 0.746 | -0.0944 | 0.1318 |
| Current college GPA | 0.0074 | 0.0522 | 0.14 | 0.887 | -0.0949 | 0.1098 |
| Years enrolled in college | 0.0224 | 0.0312 | 0.72 | 0.473 | -0.0387 | 0.0835 |
| Transfer student status | 0.2747 | 0.1812 | 1.52 | 0.130 | -0.0805 | 0.6300 |
| College admission score | 0.1613 | 0.0334 | 4.82 | <0.001 | 0.0995 | 0.2269 |
| Course repetitions | 0.7359 | 0.0825 | 8.92 | <0.001 | 0.5742 | 0.8977 |
| Number of online courses | 0.2011 | 0.0238 | 8.44 | <0.001 | 0.1544 | 0.2477 |

Level 2

| Factor | \( \beta \) | S.E. | \( z \) | \( p \) | 95% CI |
|--------|--------|------|------|------|-------|
| Number students in course | 0.0115 | 0.0005 | 23.23 | <0.001 | 0.0105 | 0.0125 |

Table 7
Restricted sample multi-level logistic regression analysis in odds ratio units, \( N_{\text{enrollments}} = 9,741, N_{\text{courses}} = 34 \).

| Factor | \( \text{Odds ratio} \) | S.E. | \( z \) | \( p \) | 95% CI |
|--------|----------------------|------|------|------|-------|
| Intercept | 6.6341 | 2.0608 | 6.09 | <0.001 | 3.6089 | 12.1953 |

Level 1

| Factor | \( \text{Odds ratio} \) | S.E. | \( z \) | \( p \) | 95% CI |
|--------|----------------------|------|------|------|-------|
| Female (vs. Male) | 1.2514 | 0.0659 | 4.26 | <0.001 | 1.1287 | 1.3874 |
| Race/Ethnicity (vs. White) | | | | | |
| Black | 1.0396 | 0.1765 | 0.23 | 0.819 | 0.7453 | 1.4501 |
| Asian | 0.7118 | 0.0621 | -3.90 | <0.001 | 0.5999 | 0.8446 |
| Hispanic | 0.7170 | 0.0712 | -3.35 | 0.001 | 0.5902 | 0.8711 |
| Native | 0.3743 | 0.1391 | -2.64 | 0.008 | 0.1807 | 0.7754 |
| English language learner | 1.0343 | 0.0609 | 0.57 | 0.567 | 0.9216 | 1.1607 |
| In-state student residency | 0.8588 | 0.0647 | -2.02 | 0.043 | 0.7410 | 0.9954 |
| Low-income status | 0.9204 | 0.0555 | -1.38 | 0.169 | 0.8177 | 1.0359 |
| First-generation status | 1.0189 | 0.0588 | 0.32 | 0.746 | 0.9099 | 1.1409 |
| Current college GPA | 1.0075 | 0.0526 | 0.14 | 0.887 | 0.9094 | 1.1161 |
| Years enrolled in college | 1.0227 | 0.0319 | 0.72 | 0.473 | 0.9620 | 1.0871 |
| Transfer student status | 1.3162 | 0.2386 | 1.52 | 0.130 | 0.9227 | 1.8776 |
| College admission score | 1.1750 | 0.0393 | 4.82 | <0.001 | 1.1005 | 1.2546 |
| Course repetitions | 2.0875 | 0.1723 | 8.92 | <0.001 | 1.7757 | 2.4540 |
| Number of online courses | 1.2227 | 0.0291 | 8.44 | <0.001 | 1.1670 | 1.2811 |

Level 2

| Factor | \( \text{Odds ratio} \) | S.E. | \( z \) | \( p \) | 95% CI |
|--------|----------------------|------|------|------|-------|
| Number students in course | 1.0116 | 0.0005 | 23.23 | <0.001 | 1.0106 | 1.0126 |
and household size using 185% of the U.S. poverty line), English language learner status (i.e., Language other than English is students’ first language), and whether or not the student is a California resident. Student performance indicators include, standardized admission test score (i.e., measured through American College Testing (ACT) and the Scholastic Aptitude Test (SAT) scores) and current college grade point averages. College career characteristics included students’ years of enrollment in the institution, transfer student status, the number of online courses taken in college, and whether students repeated courses.

Course-level data includes course grades, course code, department, year and term the course was offered, the number of students enrolled in a course, course modality (i.e., online or face-to-face course modality), and unique instructor identification information.

Table 1 describes the overall data of all summer course enrollments prior to any list-wise deletion.

### 2.2. Data on multi-level logistic regression analysis

The following tables describe descriptive information of (a) all course enrollments, (b) all face-to-face course enrollments, and (c) all online course enrollments. This information is provided for both
Table 9
Two-way fixed effects linear regression analysis; student and course fixed effects; N = 61,401.

|                         | Coef. | Robust S.E. | t     | p      | 95% CI    |
|-------------------------|-------|-------------|-------|--------|-----------|
| Intercept               | −1.3967 | 0.1719     | −8.13 | <0.001 | −1.7336   |
| Online course           | −0.1613 | 0.0332     | −4.86 | <0.001 | −0.2263   |
| *Low-income status      | 0.0330  | 0.0234     | 1.41  | 0.158  | −0.0128   |
| Online course           | 0.0107  | 0.0226     | 0.48  | 0.634  | −0.0335   |
| * First-gen status      | 0.1613  | 0.0332     | 4.86  | <0.001 | 0.0963    |
| Online course           | 0.0330  | 0.0234     | 1.41  | 0.158  | −0.0128   |
| * Medium HS performance (vs. Low HS performance) | −0.0656 | 0.0287     | −2.29 | 0.022  | −0.1218   |
| Online course           | −0.0868 | 0.0312     | −2.79 | 0.005  | −0.1479   |
| Current college GPA     | 1.4198  | 0.0494     | 28.74 | <0.001 | 1.3229   |
| Years enrolled in college | −0.0704 | 0.0116     | −6.06 | <0.001 | −0.0932   |
| Course repetitions      | 0.0281  | 0.0128     | 2.19  | 0.029  | 0.0029    |
| Number of online courses | −0.0008 | 0.0084     | −0.10 | 0.924  | 0.0174    |
| Number students in course | 0.0001  | 0.0001     | 0.59  | 0.554  | −0.0002   |

Table 10
Three-way fixed effects linear regression analysis; student, course, and year fixed effects; N = 61,401.

|                         | Coef. | Robust S.E. | t     | p      | 95% CI    |
|-------------------------|-------|-------------|-------|--------|-----------|
| Intercept               | −1.3092 | 0.2824     | −4.64 | <0.001 | −1.8628   |
| Online course           | −0.1681 | 0.0332     | −5.07 | <0.001 | −0.2332   |
| *Low-income status      | 0.0332  | 0.0234     | 1.42  | 0.155  | 0.0126    |
| Online course           | 0.0117  | 0.0226     | 0.52  | 0.605  | −0.0325   |
| * First-gen status      | 0.1681  | 0.0332     | 5.07  | <0.001 | −0.2332   |
| Online course           | 0.0332  | 0.0234     | 1.42  | 0.155  | −0.0325   |
| * Medium HS performance (vs. Low HS performance) | −0.0638 | 0.0286     | −2.23 | 0.026  | −0.1200   |
| Online course           | −0.0856 | 0.0311     | −2.75 | 0.006  | −0.1467   |
| Current college GPA     | 1.4213  | 0.0493     | 28.83 | <0.001 | 1.3246   |
| Years enrolled in college | −0.2185 | 0.3229     | −0.68 | 0.498  | 0.8514    |
| Course repetitions      | 0.0279  | 0.0128     | 2.18  | 0.029  | 0.0028    |
| Number of online courses | −0.0032 | 0.0086     | −0.37 | 0.709  | 0.0200    |
| Number students in course | 0.0002  | 0.0001     | 1.37  | 0.172  | −0.0001   |

Table 11
Three-way fixed effects linear regression analysis; student, course, and instructor fixed effects; N = 61,401.

|                         | Coef. | Robust S.E. | t     | p      | 95% CI    |
|-------------------------|-------|-------------|-------|--------|-----------|
| Intercept               | −1.8425 | 0.2504     | −7.36 | <0.001 | −2.3332   |
| Online course           | −0.0942 | 0.0520     | −1.81 | 0.070  | −0.1961   |
| *Low-income status      | 0.0282  | 0.0230     | 1.23  | 0.220  | −0.0169   |
| Online course           | 0.0068  | 0.0221     | 0.31  | 0.757  | −0.0365   |
| * First-gen status      | 0.0552  | 0.0281     | −1.97 | 0.049  | −0.1102   |
| Online course           | −0.0813 | 0.0306     | −2.66 | 0.008  | −0.1413   |
| * Medium HS performance (vs. Low HS performance) | −0.0552 | 0.0281     | −1.97 | 0.049  | −0.1102   |
| Online course           | −0.0813 | 0.0306     | −2.66 | 0.008  | −0.1413   |
| Current college GPA     | 1.3903  | 0.0486     | 28.81 | <0.001 | 1.3041   |
| Years enrolled in college | −0.0790 | 0.0122     | −6.48 | <0.001 | −0.1029   |
| Course repetitions      | 0.0275  | 0.0127     | 2.17  | 0.030  | 0.0027    |
| Number of online courses | 0.0026  | 0.0083     | 0.31  | 0.754  | −0.0137   |
| Number students in course | −0.0001 | 0.0002     | −0.43 | 0.667  | −0.0004   |
Table 12
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; full sample; N = 61,401.

|                        | Coef.     | Robust S.E. | t       | p          | 95% CI       |
|------------------------|-----------|-------------|---------|------------|--------------|
| Intercept              | -2.3473   | 0.4246      | -5.53   | <0.001     | -3.1795 -1.5151 |
| Online course          | -0.0962   | 0.0521      | -1.85   | 0.065      | -0.1983 -0.0059 |
| *Low-income status     | 0.0282    | 0.0230      | 1.23    | 0.219      | -0.0168 0.0733 |
| Online course          | 0.0071    | 0.0221      | 0.32    | 0.749      | -0.0363 0.0505 |
| *First-gen status      |           |             |         |            |              |
| Online course          | -0.0555   | 0.0281      | -1.98   | 0.048      | -0.1104 -0.0005 |
| *Medium HS performance (vs. Low HS performance) | -0.0815 | 0.0306 | -2.67 | 0.008 | -0.1415 -0.0216 |
| Current college GPA    | 1.3991    | 0.0485      | 28.84   | <0.001     | 1.3040 1.4942 |
| Years enrolled in college | 0.6287 | 0.4878 | 1.29 | 0.197 | -0.3273 1.5847 |
| Course repetitions     | 0.0275    | 0.0127      | 2.17    | 0.030      | 0.0027 0.0523 |
| Number of online courses | 0.0000 | 0.0085      | 0.00    | 0.997      | -0.0166 0.0167 |
| Number students in course | 0.0000 | 0.0002      | 0.16    | 0.875      | -0.0004 0.0003 |

Table 13
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; low-income sample; N = 21,465.

|                        | Coef.     | Robust S.E. | t       | p          | 95% CI       |
|------------------------|-----------|-------------|---------|------------|--------------|
| Intercept              | -1.4120   | 0.5880      | -2.40   | 0.016      | -2.5646 -0.2594 |
| Online course          | -0.1767   | 0.0764      | -2.31   | 0.021      | -0.3264 -0.0270 |
| Current college GPA    | 1.3970    | 0.0741      | 18.85   | <0.001     | 1.2518 1.5423 |
| Years enrolled in college | -1.4270 | 0.5084 | -2.81 | 0.005 | -2.4237 -0.4304 |
| Course repetitions     | 0.0803    | 0.0190      | 4.23    | <0.001     | 0.0431 0.1175 |
| Number of online courses | -0.0208 | 0.0136      | -1.53   | 0.126      | -0.0474 0.0059 |
| Number students in course | -0.0002 | 0.0003      | -0.75   | 0.452      | -0.0008 0.0004 |

Table 14
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; non-low-income sample; N = 39,936.

|                        | Coef.     | Robust S.E. | t       | p          | 95% CI       |
|------------------------|-----------|-------------|---------|------------|--------------|
| Intercept              | -2.35969  | 0.42688     | -5.53   | <0.001     | -3.1964 -1.5229 |
| Online course          | -0.12178  | 0.05495     | -2.22   | 0.027      | -0.2295 -0.0141 |
| Current college GPA    | 1.39555   | 0.06269     | 22.26   | <0.001     | 1.2727 1.5184 |
| Years enrolled in college | 0.66896 | 0.43523    | 1.54    | 0.124      | -0.1842 1.5221 |
| Course repetitions     | 0.00043   | 0.01690     | 0.03    | 0.980      | -0.0327 0.0336 |
| Number of online courses | 0.01095 | 0.01074     | 1.02    | 0.308      | -0.0101 0.0320 |
| Number students in course | 0.00002 | 0.00022     | 0.08    | 0.938      | -0.0004 0.0005 |

Table 15
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; first-generation student sample; N = 31,596.

|                        | Coef.     | Robust S.E. | t       | p          | 95% CI       |
|------------------------|-----------|-------------|---------|------------|--------------|
| Intercept              | -3.4786   | 0.5097      | -6.82   | <0.001     | -4.4778 -2.4795 |
| Online course          | -0.1671   | 0.0621      | -2.69   | 0.007      | -0.2887 -0.0454 |
| Current college GPA    | 1.4720    | 0.0687      | 21.44   | <0.001     | 1.3374 1.6066 |
| Years enrolled in college | 1.2429 | 0.4363    | 2.85    | 0.004      | 0.3878 2.0981 |
| Course repetitions     | 0.0607    | 0.0160      | 3.79    | 0.000      | 0.0293 0.0921 |
| Number of online courses | -0.0114 | 0.0120      | -0.95   | 0.343      | -0.0349 0.0121 |
| Number students in course | 0.0002 | 0.0003      | 0.83    | 0.409      | -0.0003 0.0007 |
the full sample (all course enrollments) and a restricted sample that only includes courses that were offered as both online and face-to-face courses in the same term (Tables 2 and 3). These descriptive information are provided after listwise deletion. In addition, Tables 4–7 provide additional information on the two-level logistic regression models [2]. The models were conducted applying the `meqrrlogit` syntax in Stata 15 [3]. In particular, course enrollments (level 1) were nested into courses (level 2).

### Table 16
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; non-first-generation student sample; \( N = 29,805 \).

| Coef.    | Robust S.E. | t     | p      | 95% CI    |
|----------|-------------|-------|--------|-----------|
| Intercept| -0.8502     | 0.3920| -2.17  | 0.030     | -1.6186   | -0.0818  |
| Online course| -0.1131     | 0.0642| -1.76  | 0.078     | -0.2389   | 0.0127   |
| Current college GPA| 1.3185     | 0.0684| 19.27  | <0.001    | 1.1844    | 1.4526   |
| Years enrolled in college| -0.6983     | 0.4583| -1.52  | 0.128     | -1.5966   | 0.2001   |
| Course repetitions| 0.0010      | 0.0203| 0.05   | 0.960     | -0.0388   | 0.0408   |
| Number of online courses| 0.0156      | 0.0120| 1.30   | 0.193     | -0.0079   | 0.0390   |
| Number students in course| -0.0002     | 0.0003| -0.92  | 0.358     | -0.0007   | 0.0003   |

### Table 17
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; low high school student performance sample; \( N = 14,105 \).

| Coef.    | Robust S.E. | t     | p      | 95% CI    |
|----------|-------------|-------|--------|-----------|
| Intercept| -4.2781     | 1.1226| -3.81  | <0.001    | -6.4790   | -2.0772  |
| Online course| -0.0512     | 0.0943| -0.54  | 0.587     | -0.2360   | 0.1336   |
| Current college GPA| 1.3710     | 0.1192| 11.50  | <0.001    | 1.1373    | 1.6047   |
| Years enrolled in college| 0.7204     | 0.5723| 1.26   | 0.208     | -0.4016   | 1.8424   |
| Course repetitions| 0.0813      | 0.0250| 3.25   | 0.001     | 0.0323    | 0.1303   |
| Number of online courses| -0.0013     | 0.0185| -0.07  | 0.944     | -0.0377   | 0.0351   |
| Number students in course| -0.0003     | 0.0004| -0.78  | 0.438     | -0.0011   | 0.0005   |

### Table 18
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; medium high school student performance sample; \( N = 28,948 \).

| Coef.    | Robust S.E. | t     | p      | 95% CI    |
|----------|-------------|-------|--------|-----------|
| Intercept| -1.0214     | 0.3339| -3.06  | 0.002     | -1.6760   | -0.3668  |
| Online course| -0.1072     | 0.0701| -1.53  | 0.127     | -0.2446   | 0.0303   |
| Current college GPA| 1.3269     | 0.0642| 20.66  | <0.001    | 1.2011    | 1.4528   |
| Years enrolled in college| -1.2393     | 0.3831| -3.23  | 0.001     | -1.9903   | -0.4884  |
| Course repetitions| 0.0561      | 0.0184| 3.04   | 0.002     | 0.0199    | 0.0922   |
| Number of online courses| 0.0073      | 0.0123| 0.60   | 0.551     | -0.0168   | 0.0314   |
| Number students in course| 0.0004      | 0.0003| 1.35   | 0.176     | -0.0002   | 0.0009   |

### Table 19
Four-way fixed effects linear regression analysis; student, course, instructor, and year fixed effects; high school student performance sample; \( N = 18,348 \).

| Coef.    | Robust S.E. | t     | p      | 95% CI    |
|----------|-------------|-------|--------|-----------|
| Intercept| -2.1836     | 0.4223| -5.17  | <0.001    | -3.0114   | -1.3558  |
| Online course| -0.2254     | 0.0790| -2.86  | 0.004     | -0.3802   | -0.0706  |
| Current college GPA| 1.5488     | 0.0864| 17.93  | <0.001    | 1.3795    | 1.7181   |
| Years enrolled in college| -0.0375     | 0.0217| -1.73  | 0.083     | -0.0800   | 0.0049   |
| Course repetitions| -0.0303     | 0.0258| -1.18  | 0.239     | -0.0809   | 0.0202   |
| Number of online courses| -0.0110     | 0.0149| -0.74  | 0.459     | -0.0401   | 0.0181   |
| Number students in course| -0.0005     | 0.0003| -1.72  | 0.085     | -0.0012   | 0.0001   |
2.3. Data on multi-way fixed effects modelling

The following table describes descriptive information for (a) all course enrollments, (b) all course enrollments of low-income students, (c) all course enrollments of first-generation college students, and (d) all course enrollments of students in the lower high school performance subgroup. This information is displayed separately by online and face-to-face course enrollments (Table 8). The descriptive information of time-variant variables is provided after listwise deletion (also accounting for missingness in the grouping variables (i.e., low-income status, first-generation college student status, high school performance indicator). In addition, Tables 9–19 provide additional information on the multi-way fixed effects linear regression models [4,5]. The models sequentially introduced student, course, year, and instructor fixed effects and were conducted applying the xtreg syntax in Stata 15 [6]. Please note that these tables do not display coefficients for the course, instructor, and year series of dummy variables.

Acknowledgements

This work is supported by the Teaching and Learning Research Center at the University of California, Irvine and the National Science Foundation through the EHR Core Research Program (ECR), Award 1535300. The views contained in this article are those of the authors, and not of their institutions or the National Science Foundation.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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