Success Rate Disparities Between Online and Face-to-Face Economics Courses: Understanding the Impacts of Student Affiliation and Course Modality

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Abstract
Students enrolled in online courses tend to be less successful as measured by the rate of A's, B's, and C's than students enrolled in face-to-face courses. Yet little work has been done addressing whether these gaps vary depending on students' broader relationship with the university, including whether they are degree-seeking students and whether they take any face-to-face courses. We use institutional data on Economics enrollments between 2012 and 2018 at a mid-sized land-grant university to deconstruct online/face-to-face success gaps into a student's term modality (or modalities) and institutional affiliation components. We identify these components by using a fixed effects regression methodology and comparing outcomes across four student groups: affiliated students who are enrolled in exclusively online courses, exclusively face-to-face courses, or in a mix of courses each term, as well as unaffiliated (external) students exclusively taking online courses. Although students in online courses are less successful on average, part of this gap is explained by the student's institutional affiliation and whether they exclusively take online courses. External students are the least successful in online courses while students who are affiliated with the institution fare much better. We examine potential reasons for these patterns using survey data from several online courses. These findings suggest that institutions should take steps to ensure that institutional support services and activities exist and extend to students in online courses.

Online learning has experienced rapid growth in U.S. higher education over the past twenty years, accelerated further by the COVID-19 pandemic (Palvia et al., 2018; Xu & Xu, 2019). As online learning encompasses an increasingly diverse set of programs and a broader student base, it is more important than ever to understand the determinants of student success in online courses.

Online courses have been found to have lower levels of success as measured by the percentage of students earning an A, B, or C course grade. These success rates frequently fall below 70% or 60% and, in some cases, even lower and are typically significantly lower than those found for face-to-face courses (Boston & Ice, 2011; Greenland & Moore, 2014; Hachey, Wladis, & Conway, 2013; Morris, Finnegan, &Wu, 2005; Patterson & McFadden, 2009).

Many studies have found a relationship between success rates and student characteristics. However, few studies have examined the impact of students' *affiliation* with the institution—that is, whether the student is admitted as a degree-seeking student at the college or is taking courses as a non-admitted student. Students' affiliation with the institution shapes their access to support services, their opportunities for substantive interactions with peers and instructors, and other factors that may influence their probability of success (Kuh et al., 2006). We contribute to the deep literature on student success by examining how institutional affiliation relates to student success across course modalities.

This study draws on a novel dataset that includes comprehensive institutional data from seven years (2012-2018) of online and face-to-face economics course enrollments at a Mid-sized Land-Grant University (MLGU). These data allow us to separate students into groups based on their affiliation to the university and their mix of course modalities by term (i.e., exclusively face-to-face, exclusively online, or a mix of modalities). We identify "naïve" gaps in success rates between online and face-to-face economics course enrollments before using multivariate regression to examine how institutional affiliation, typical modality, demographics, and other student characteristics influence success rates independent of modality. Next, we merge these institutional data with results from surveys administered to students in six online economics courses in Fall 2017 and Spring 2018. The surveys elicit student perceptions of online learning and of their own learning strategies, in addition to gathering more detailed information on student background such as work status and family care responsibilities. The survey findings offer additional insight into why success in online course enrollments may vary by institutional affiliation and demographic dimensions as examined in the institutional data.

This study seeks to understand whether and, if so, why institutional affiliation and typical modality influence success in online and face-to-face economics courses. Although studying economics courses in particular is not the goal of this research, it is still of interest for two reasons. First, introductory economics courses are often taken by students from a variety of majors and serve as prerequisites for students outside of the economics major (e.g., business students). Second, these courses frequently have lower than average success rates when compared to non-economics courses (Denny, 2014; Edwards, 2000; Stock et al., 2013).

The paper begins with a brief review of the relevant literature, focusing on research related to institutional conditions, such as student-centered support structures, resources, and activities, and their relationship to student success. It then examines the study's methods and describes the results. Finally, recommendations are presented, and the paper concludes.

Literature Review

A growing number of students are enrolled in fully online degree programs or mixing online with face-to-face enrollments within a term or degree program (Allen & Seaman, 2007; Protopsaltis & Baum, 2019). Therefore, understanding and supporting student success independent of the modality of the course in their degree program is essential to further improving higher education outcomes. To inform our study of the relationship between institutional affiliation and modality success gaps, we begin by outlining the literature on success disparities before addressing the role of institutional conditions specifically.

Success Disparities

There is a deep body of research related to differences in online and face-to-face success rates in higher education at the institutional level, such as at fully online institutions (Boston & Ice, 2011) or at community or technical colleges (Aragon & Johnson, 2008; Wladis, Conway, & Hachey, 2017; Xu & Jaggars, 2014), at the master's or undergraduate degree level (Cochran et al., 2014; Patterson & McFadden, 2009). There is even more research completed at the individual course level (Horspool & Lange, 2012; Johnson & Palmer, 2015; Zhan & Mei, 2013). While some studies show low or no success gaps (Figlio, Rush, & Lin, 2010; Nguyen, 2015), the preponderance of studies show gaps exist (Helms, 2014; Fendler, Ruff, & Shrikhande, 2018).

Many of these studies find a relationship between modality success gaps and student or course characteristics. For example, significant differences in success exist based on gender, academic readiness, and number of online courses taken (Aragon & Johnson, 2008). This success gap can be large for male students (Brown & Liedholm, 2002) but non-existent for female students (Figlio, Rush, & Yin, 2010). Additionally, success rates have been shown to vary by course type, where major course requirements generally have higher success than elective courses and upper division courses have higher success than lower division courses (Greenland & Moore, 2014; Wladis, Conway, & Hachey, 2017).

Some research focuses on success within a particular modality, such as identifying student attributes or behaviors that lead to success in an online course. For example, differences in exhibited learning strategies between younger and older students may reflect differences in the extent of self-regulated learning mastery (Andrade, 2015; Artino, 2007). Online learning often requires a higher level of self-regulated learning mastery than on-campus learning (Nicol & Macfarlane-Dick, 2006). Yet those who are new to online learning may not be aware of the strategies that are conducive to success in an online environment (North, 2016).

Institutional Conditions

Another strand of research focuses on institutional conditions and their corresponding relationship to student success. This literature is of particular relevance to our research question exploring how institutional affiliation and typical modality are related to student success across modalities. Institutional conditions, such as policies, programs, practices, and cultural properties,

shape students' access to support resources, contribute to opportunities for substantive interactions with peers and instructors, and create other environments that may influence success (Kuh et al., 2006; Kuh et al., 2011). Many studies detail how these institutional conditions and the accessibility of resources and activities support success, but there is limited research examining how these institutional conditions differ based on course or program modality and whether such differences explain student success gaps between course modalities. We highlight some work linking institutional conditions to student success and discuss how institutional affiliation can help us understand differences in success between course modalities.

Research has shown that students tend to be more successful when supportive institutional conditions exist, where success can be measured by grades earned, GPA, first-semester performance, persistence and retention, or degree completion (Tinto, 2010). Supportive conditions include those in which students can, for example, access resources such as technology support (Britto & Rush, 2013), create community (McKenna, Gebhardt, & Altringer, 2019), and access academic or mental health support (Cooper, 2010; LaPadula, 2003).

Many resources or activities are only for students who are affiliated with the university (i.e., admitted to the university, are degree-seeking, pay university fees). Examples include academic advising and coaching, wellness and mental health support, technology resources and related support, military and veteran services, many student organizations, and other social events. As a result, students who are unaffiliated (external) have fewer institutional resources and activities available. The evidence shows that having less access to these resources may impact student success. For instance, Stassen (2003) explored success differentials between students who are and are not enrolled in a campus learning communities (i.e., a residential academic program, talent advancement program, or honors college learning community). These findings suggest that first-semester performance and one-year retention is higher for students participating in these programs.

Even among affiliated students, access to institutional resources may differ depending on the student's typical course modality. Some forms of institutional support are available independent of course modality; for instance, technical support is commonly offered by institutions and is crucial to the success of students (Britto & Rush, 2013). However, some forms of support are not made available in the same forms to the face-to-face and the online student, even if they are affiliated. Student services, such as academic advising and coaching, mental health services, or activities that promote a sense of community are institutional conditions that support success (LaPadula, 2003). These services exist for students whether they are physically on campus or not, but they are often implemented differently. For example, at MLGU, academic advising is typically conducted in person for face-to-face students while online students meet with their advisor on the phone or virtually. Additional resources and activities are based physically on the campus, such as campus-based learning programs like residential academic programs, sport clubs and intramurals, and many more student organizations, among others. Affiliated students who take exclusively online courses may have access to these campus-based resources and activities but are unlikely to access them because they do not live nearby.

In general, students have different levels of access to institutional resources and activities depending on whether the student is affiliated with the university and the modality of courses taken by the student. Students who are affiliated with the institution have greater, but potentially different, access to these resources and activities, which may increase their chance for success as compared to students who do not have access to these resources or activities. In this study, we seek to understand how this institutional affiliation is related to student success across course modalities.

Context of the Study

MLGU is a mid-sized public, land-grant research university. As of 2018—the most recent year of data used in this study—the university enrolled about 33,800 students. Most of these students were enrolled in face-to-face programs (85%) of which 85% were undergraduates and 15% were graduate students or in a professional degree program. Approximately 11% were enrolled in online programs. The remaining enrolled students were guest students, employees using their study privilege, study abroad students, and others, such as students external to the university.

The MLGU Economics Department is in the College of Liberal Arts and offers bachelor's (online and face-to-face), master's, and PhD degrees. Admission criteria to the bachelor's programs are identical for the online and face-to-face modalities. As of Spring 2018, there were 484 undergraduate major or minor students (379 declared economics majors face-to-face, 37 declared economics majors online, and 68 declared minors). Each academic term (spring, summer, and fall), the department offers 12 to 15 online courses, ranging from core courses to electives. For each of these courses, one section is offered online, and typically one or more additional sections are offered face-to-face. The prerequisite requirements for individual courses are identical across modalities. Roughly 16% of all economics enrollments during Spring 2018 were taught online.

During the time period under study, all online economics courses at MLGU integrated best practices in course design as described by the Quality Matters standards (https://www.qualitymatters.org/qa-resources/rubric-standards/higher-ed-rubric) and the OLC OSCQR Course Design Review Scorecard (https://onlinelearningconsortium.org/consult/oscqr-course-design-review/). Key elements of course design included the integration of frequent low-stakes assessments, opportunities for students to get to know the instructor and other students, and courses designed for easy navigation. Many courses also benefited from instructional design assistance from the university's centers for learning and teaching. Additionally, the instructors teaching online courses at MLGU frequently teach the same course face-to-face at the same time.

Methods

This research applies simple and multivariate regression methods to two datasets: institutional data on undergraduate economics enrollments at MLGU between Spring 2012 and Spring 2018 ($n = 39,203$) and survey data corresponding to a subset of these enrollments ($n = 97$) in selected online economics courses in Fall 2017 and Spring 2018. We begin by describing the institutional and survey data before detailing the methodology applied to each.

Institutional Data

Enrollment-level data on undergraduate economics courses at the university were retrieved by the university's Office of Institutional Research, Planning, and Effectiveness, Online Division, and Research and Analytics team, and by the authors using university administrative tools. An "enrollment" is defined as a student enrolled in an economics course for a specific modality (online or face-to-face), term, and year (e.g., a student enrolled in Principles of Microeconomics online in Spring 2018). The same student may appear in multiple enrollments during a term if they were enrolled in more than one economics course. Each enrollment is associated with a particular course outcome (an A – F grade or withdrawal).

Two adjustments distinguish the analytical subsample ($n = 39{,}203$) from the entire population of economics enrollments. First, only the 14 courses that had been taught both online and face-to-face at least once in the study period were included. For comparison, a total of 31 undergraduate courses were listed in the 2017-18 course catalog (omitting internships, supervised college teaching, seminars, and independent study courses). However, the 14 courses include all core courses for the economics major and a range of lower- and upper-division electives. Second, some students in the seven-year period took courses in a format that was neither online nor face-to-face. Most of these students were attending MLGU courses outside of the institution through an international study program. These 197 enrollments were dropped from the analysis.

Each enrollment is classified by the modality of that course section in that term (online or face-to-face). They are also separated into four groups based on the student's affiliation with the university and the modality of their other courses during that term (their "typical modality"): (1) affiliated students taking a mix of online and face-to-face courses ("mixed modalities"), (2) affiliated students taking exclusively online courses, (3) students external to the university, and (4) affiliated students taking exclusively face-to-face courses. When discussing results, we will refer to "course modality" when referring to the modality of a certain enrollment and "typical modality" when referring to the mix of modalities for a student in a term.

Students in the (1) "affiliated, mixed modalities" group generally are admitted, degree-seeking students who take most of their courses face-to-face but supplement with online courses. These students may be observed as enrolled in one or more online and/or face-to-face economics courses in a term. (2) "Affiliated, exclusively online" students are primarily admitted students pursuing their degree fully online in economics, agricultural business, or another major. (3) "External" students are not admitted to MLGU but are enrolled in an occasional course as transfer credit for their home university, as professional development, or for personal interest. Affiliated, exclusively online and external students will exclusively be observed enrolled in online economics courses each term. (4) "Affiliated, exclusively face-to-face" students are only taking face-to-face courses during that term. These students will exclusively be observed enrolled in face-to-face economics courses each term.

Affiliated students include some non-admitted students who are affiliated with the university as a faculty, staff member, or guest student. Students may enroll as a guest if they are on academic probation and hope to increase their GPA or are taking a small number of courses for other reasons. They are eligible to use campus services and participate in activities, and they

may live in campus housing if enrolled in enough credits. In our dataset, 63 enrollments out of 39,203 correspond to guest enrollments. For most guest students, we do not have enough information to definitively ascertain their student group. We observe all enrollments for some of these students, allowing us to correctly classify them as affiliated and exclusively online (12 enrollments) or exclusively face-to-face (6 enrollments). The remaining 45 have been categorized as mixed modalities enrollments.

These typical modality classifications are made based on the entirety of each student's enrollments in each term, not only their economics courses. The institutional dataset includes the total number of online and face-to-face courses in which each student is enrolled each term. Therefore, a student who appears in the dataset in exclusively face-to-face economics enrollments can nonetheless be characterized as a student who takes a mix of modalities if they took at least one non-economics course online that term. This characteristic of the data means that some but not all students in the "affiliated, mixed modalities" group will be observed in both online and face-to-face courses. Of the 3,434 enrollments associated with students in the affiliated, mixed modalities group, 15% (507) are linked to students who are enrolled in both online and face-to-face economics courses in a particular term. This corresponds to about 7% of unique student-terms observed among the affiliated, mixed modalities group.

Summer enrollments required careful consideration. Students who enroll exclusively in online courses during summer terms would by default be considered "affiliated, exclusively online" or "external." However, many of these students are in the "affiliated, mixed modalities" or "affiliated, exclusively face-to-face" group in at least one other term—that is, they are admitted students typically enrolled in a mix of online and face-to-face courses or exclusively face-to-face courses in fall and spring terms. These students' connection to face-to-face courses makes it misleading to classify them as external or exclusively online students. As a result, these summer enrollments are categorized as "affiliated, mixed modalities" students. Summer students enrolled in exclusively online courses who have taken only online courses in previous terms are coded as "affiliated, exclusively online" or "external" students, as appropriate.

Among the enrollments in the analytical sample (n = 39,203 undergraduate enrollments), 37% were associated with students identifying as female (and the remaining 63% identifying as male), 18% with historically underrepresented students, 20.1% with students majoring in Economics, and 21% with first-generation students. The average student age associated with enrollments was 21.1 years old. In terms of the four affiliation-modality groups, (1) 9% of enrollments corresponded to affiliated, mixed modalities students, (2) 3% of enrollments were affiliated, exclusively online students, (3) 6% of enrollments were external, exclusively online students, and (4) 82% of enrollments were affiliated, exclusively face-to-face students. The proportion of exclusively face-to-face students roughly matches the composition of the university. The affiliated, exclusively online group is smaller than seen at MLGU in 2018 in part because there was no fully online degree program in Economics until 2015.

Survey Data

Survey data were collected from students in three online economics courses in Fall 2017 and in Spring 2018, for a total of six course sections. The survey was administered to students enrolled in Principles of Microeconomics (72 students), Intermediate Microeconomics (69

students), and the History of Economic Thought (31 students). These courses were selected because they represented the range of departmental course offerings (i.e., a lower-division general education course, an intermediate required course for majors, and an intermediate elective course for majors).

The survey collected information on student characteristics and demographics that could be linked to both the motivation to pursue and outcomes of online learning. These included whether the student had care responsibilities, whether they were working, the reasons why they were taking this economics course, the reasons why they were taking the course online, and the grade they expected to earn in the course. We also directly assessed the student's online learning attitudes, beliefs, and behaviors using Likert-scale questions discussed in more detail below.

The survey was administered twice each term in an online format: first approximately one month after the start of the term and again in the last month of the term. Students accessed the online survey through the course learning management system. They were encouraged to complete the survey through multiple email communications, but course instructors did not require completion. Of the 172 students enrolled in the three courses, 111 unique students responded during at least one round of the survey, for a total of 167 observations. Only one student responded to the survey in both terms. The survey was identical in each round. Results from the first round of each survey are used (97 observations).

In this study, we focus attention on the 19 Likert-scale questions measuring students' agreement with a range of statements about their learning practices and online learning in general. The statements are listed in Table 1 and categorized according to the theme that they investigate: student characteristics, comfort with technology, community, and self-regulated learning mastery. These survey items were developed by the authors to capture determinants of student success in online courses as discussed in the literature review (McKenna, Gebhardt, & Altringer, 2019; McKenna, Altringer, Gebhardt, & Long, 2022).

Table 1
Likert Scale Survey Questions by Thematic Grouping

Student characteristics
    1. I learn best when taking online classes.
    2. Online learning allows me to have a more flexible schedule
    7. How I learn in online classes is not that different than how I learn in on-campus.
    8. I feel like I can better balance my work and life when taking online classes.
    16. I have support from my family and friends to successfully complete this class.

Comfort with technology
    3. I am comfortable with technology
    4. I am confident that I can find what I need when I use different websites.
Community
    5. I learn best when I feel connected to other students
    6. I learn best when I feel connected to the instructor
    18. My learning is improved when I can connect with classmates through discussions or other ways.

19. I do better in class when I know something personal about my instructor and fellow classmates (such as hobbies or pets).

Self-regulated learning mastery

9. I work through all the required materials in a course. For example, I always read the book and review the class notes, view videos, and complete practice problems.

10. I am persistent and keep trying even when I get something wrong or am frustrated

11. I tend to complete assignments at the last minute.

12. Frequent quizzing or other assignments keeps me on track with studying the course

13. I am good at scheduling time each week to study and work on assignments.

14. My friends and family would say that I have a lot of self-discipline.

15. I usually jump directly to an assignment without reviewing class materials

16. I get help when I need it by emailing the instructor, attending office hours, or posting my questions to a discussion board.

All questions answered on 1-10 scale, where 1 indicates "Strongly disagree" and 10 indicates "Strongly agree."

Empirical Strategies

The goals of this study are to determine whether success gaps by course modality are partly explained by students' institutional affiliation and their typical modality and to examine potential reasons for this heterogeneity. In addressing the first research question, we leverage the fact that the institutional data includes variation in both affiliation and typical modality. We use simple differences in conditional means across groups before turning to multivariate regression to control for confounding student and course characteristics. The second half of the analysis uses the survey data to examine whether the experiences and perspectives of affiliated and unaffiliated (external) students who are (or are not) fully online may explain some of the observed variation in student success by group.

This research takes a specific perspective on defining "student success." We consider an enrollment to be successful if the student earns an A, B, or C for the course grade. An unsuccessful enrollment occurs when a student earns a D, F, or withdraws from the course or university. We exclude Ds from our definition of successful students because, at many institutions of higher education including MLGU, students must maintain an overall 2.0 average (i.e., C average) and students must earn a C or better for the course to count towards a major/minor or to transfer to a different college or university.

To disentangle the impacts of current course modality from affiliation and typical modality, we start by finding the difference in success rates across modalities among affiliated, mixed-modality students. As noted above, some of these students are observed in both online and face-to-face economics courses in the dataset. The difference in outcomes by course modality among this group should be less influenced by selection bias because individual characteristics that impact success in both modalities similarly will be canceled out. However, there is still room for some selection on unobservable characteristics because we do not observe every student in both modalities and students may select which courses to take online and which ones to take face-to-face.

We apply multivariate regression to determine whether success rate disparities are explained by affiliation, typical modality, or other student or course characteristics, accounting

for relationships among these factors. Student success is modeled as a linear function of the independent variables. For each enrollment in term t associated with student i and course k, the following linear probability model is estimated using the institutional data:

$$ABC_{ikt} = \beta_0 + \boldsymbol{\beta_1 StudentChars_{it}} + \beta_2 Modality_{ikt} + \beta_3 Group_{it} \quad (1)$$
$$+ \alpha_t^{AY} + \alpha_t^{Term} + \alpha_k^{Course} + \epsilon_{ijt}$$

where $\alpha_t^{AY}, \alpha_t^{Term}$ and α_k^{Course} are academic year, term, and course fixed effects, respectively. As discussed by Xu and Jaggars (2014), course fixed effects are particularly important to account for the possibility that students sort into online (or face-to-face) sections of certain courses for reasons systematically linked to success rates (e.g., perceived difficulty). A stochastic error term, ϵ_{ij} , accounts for all other determinants of the probability that an enrollment will end with an A, B, or C in the course. The vector $\boldsymbol{StudentChars_{it}}$ includes multiple fixed and time-varying characteristics of the student associated with each enrollment. Student characteristics include age, gender, historically underrepresented status as defined by race and ethnicity, whether the student is an Economics major, and whether the student has full-time status. The variable $Modality_{ikt}$ equals 1 if the enrollment was in an online section of course k and 0 if in face-to-face section of the course. Finally, $Group_{it}$ is a categorical variable that indicates which of the four affiliation-modality groups student i was part of in term t. In a variant of this model, the associations between the independent variables and student success are allowed to vary by student group to determine whether there is heterogeneity in the predictors of success.

Students may appear as separate enrollments multiple times per term and/or across terms. Unobserved characteristics may make certain students more or less successful across all of their enrollments. As a result, we assume that error terms ϵ_{ijt} are uncorrelated across enrollments associated with different students and that the error terms are correlated across enrollments of the same student. These assumptions are stated formally in Equations 2 and 3 below:

$$E(\epsilon_{ijt}|StudentChars_{it}, CourseChars_{ijt}, AY_t, Term_t) = 0 \quad (2)$$

$$E(\epsilon_{ijt}, \epsilon_{i'j't'}|x_{ijt}, x_{i'j't'}) = \begin{cases} 0 \ if \ i \neq i' \\ \sigma^2\Omega_i \ if \ i = i', jt \neq j't' \\ \sigma^2 \ if \ i = i', j = j', t = t' \end{cases} \quad (3)$$

This violation of the classical regression assumptions would lead standard errors to be underestimated and is corrected in our analysis using clustered standard errors (Williams, 2000) where clustering is applied at the student level. Clustered standard errors are used both in calculating the statistical significance of differences in means and in the regression analysis.

The analysis of the survey results proceeds similarly to the institutional data, except that only differences in means and simple (univariate) regression analysis are used. The relatively small sample size precludes the use of multivariate regression in this part of the study.

Results

Consistent with previous research, the descriptive institutional data indicates that success rates are higher in face-to-face courses. In online economics courses, 4,646 enrollments out of 6,012 (77%) were successful, whereas 28,940 of 33,191 face-to-face enrollments (87%) were

successful. However, as shown in Table 2, these overall success differentials by delivery method conceal variation by affiliation that is consistent with our predictions about the role of institutional affiliation. Among online enrollments, the group that is not affiliated closely with the university (i.e., external to the university) has significantly lower success rates (74%) relative to affiliated student groups (from 77% to 87%). Meanwhile, there is no statistically significant gap in course outcomes between exclusively face-to-face students and mixed modalities students when enrolled in face-to-face courses.

Comparing outcomes across modalities and across affiliations in Table 2 offers a way of identifying a "current course modality" component of success gaps among the students who have the typical modality of affiliated, mixed modalities. By this measure, the apparent success disparity between face-to-face and online enrollments of 9.91% (87% – 77%) overstates the narrower course modality-only success disparity among mixed modalities students of 6% (86% - 81%).

Table 2

Proportion of Successful Students by Course Modality and Affiliation, 2012–2018

Course Modality	Student Group	Enrollment	Success Rate
Online	**All**	6012	77%
	(1) Affiliated, mixed modalities	2437	81%
	(2) Affiliated, exclusively online	1068	77%*
	(3) External, exclusively online	2507	74%***
Face-to-face	**All**	33191	87%
	(1) Affiliated, mixed modalities	997	86%
	(4) Affiliated, exclusively face-to-face	32194	87%

Stars indicate statistically significant differences in means relative to affiliated, mixed modalities category (conditional on course modality) at the 1%, 5%, and 10% levels. Standard errors are clustered at the student level.

As with success gaps, affiliated, mixed modalities students are also more similar to exclusively face-to-face students in terms of student characteristics than other online groups (Table 3). Affiliated and external students exclusively enrolled in online courses are older, on average, (26.8 and 25.0 years old, respectively) than in face-to-face courses (20.5 years old). The gap is much smaller for affiliated students taking a mix of course modalities (21.8 years old on average). By definition, external students are never Economics majors at MLGU, while other affiliated students who take some or all courses online are more often Economics majors (30% and 40%) than their exclusively face-to-face peers (20%). The same groups of online affiliated students include more women than the affiliated, exclusively face-to-face group, and the opposite is true for external, exclusively online students. The representation of minority students is approximately constant across affiliated groups and higher among external students.

Table 3

*Average Student Characteristics by Course Modality and Affiliation, 2012–2018*

	Affiliated, exclusively face-to-face	Affiliated, mixed modalities		Affiliated, exclusively online		External, exclusively online	
Age	20.47	21.84	***	26.75	***	25.04	***
Minority Student	17%	17%		21%		30%	***
Female	37%	45%	***	47%	***	24%	***
First-Generation Student	22%	22%		40%	***	3%	***
Economics Major	20%	30%	***	40%	***	0%	***
n	32194	3434		1068		2507	

Stars indicate statistically significant differences in means relative to the affiliated, exclusively face-to-face category at the 1%, 5%, and 10% levels. Standard errors are clustered at the student level.

These results suggest that differences in student characteristics may explain part of the success gaps by affiliation and modality. Figure 1 presents the results of estimating the multivariate regression model in Equation (1) by plotting estimated probabilities of success by affiliation, typical modality, and course modality, controlling for student characteristics. If a simplified regression model is estimated that does not account for student group, the course modality success gap conditional on other control variables is 11.1 percentage points and is statistically significant ($p < 0.001$). When affiliation and typical course modality are controlled for, the multivariate regression results are qualitatively consistent with the differences in averages presented in Table 2. As shown in Figure 1, online enrollments have higher rates of success among affiliated, mixed modalities students ($p < 0.10$) and affiliated, fully online students ($p < 0.01$) than among external students. There is a smaller and statistically non-significant gap between mixed and fully online affiliated students when taking online courses ($p = 0.11$).

Figure 1

*Predicted Probability of Success by Affiliation, Typical Modality, and Course Modality*
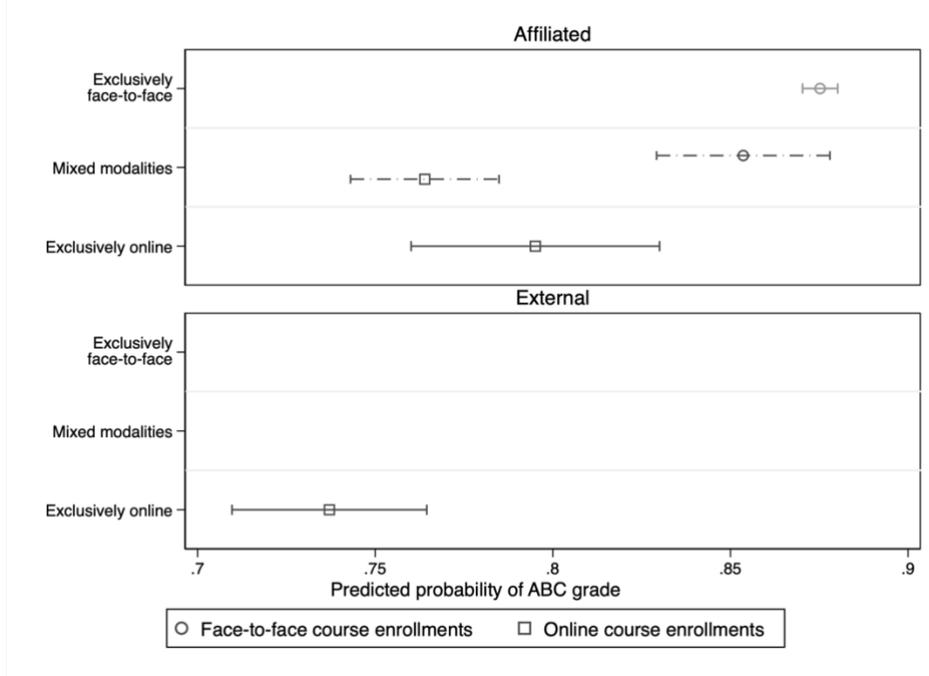
Points indicate predicted probability of success for a given student enrollment holding all other student characteristics constant. Bars indicate 95% confidence intervals for the predicted probabilities. Standard errors are clustered at student level. Estimates control for full-time status, first-generation status, whether student is an Economics major, academic year fixed effects, course fixed effects, and term fixed effects.

Meanwhile, the difference in outcomes between online and face-to-face course enrollments *within* the group of affiliated, mixed modalities students again points to an online/face-to-face success gap, but one that is smaller than the "naïve" success gap without accounting for affiliation and typical course modality. Holding other factors constant, online course enrollments within this group are 9.1 percentage points less likely to end with an A, B, or C grade than face-to-face course enrollments ($p < 0.001$). There is a much smaller difference in outcomes (2.9 percentage points) between face-to-face course enrollments among the mixed modalities group versus those among the exclusively face-to-face students ($p < 0.10$).

To summarize the above findings, we find 1) small success gaps by typical modality alone, 2) moderate success gaps by affiliation alone, and 3) large gaps by course modality alone that 4) shrink when group affiliation and typical modality are controlled for.

Figure 2 summarizes selected regression coefficients from estimating separate models for each of the affiliation-typical modality student groups. These results indicate whether the relationship between success and student characteristics varies across groups. For most characteristics, the impact on outcomes is statistically indistinguishable from zero for the exclusively online and mixed modalities groups. For exclusively face-to-face students, belonging to a minority group, identifying as male, or being first generation are associated with lower rates of success.

Figure 2

Determinants of Success by Affiliation and Typical Modality
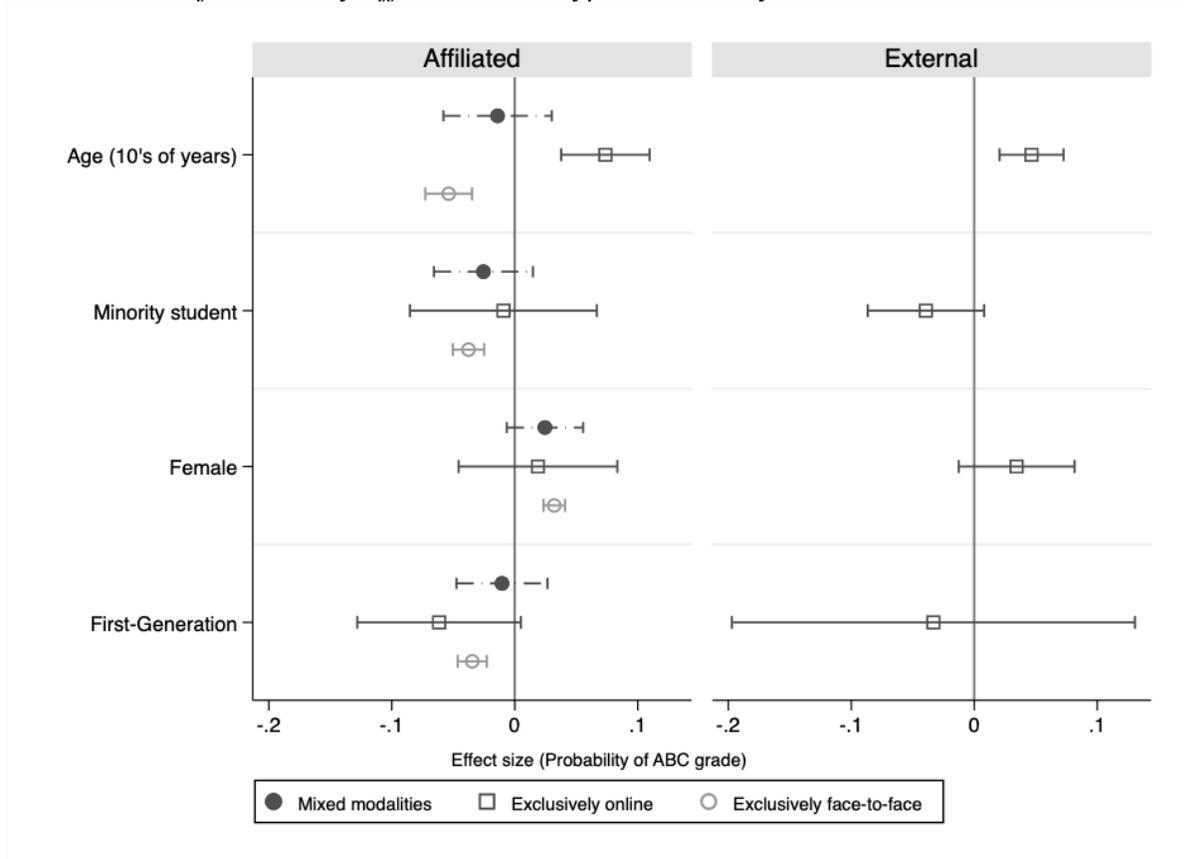
Bars indicate 95% confidence intervals. Standard errors are clustered at student level. In addition to variables shown, estimates include controls for full-time status, first-generation status, whether student is an Economics major, academic year fixed effects, course fixed effects, and term fixed effects.

However, student age has significant and opposite impacts on student success depending on course modality and affiliation. For students taking exclusively online courses regardless of affiliation, a ten-year increase in age is associated with a five- to seven-percentage-point *increase* in the probability of course success. The same increase in age among exclusively face-to-face students is associated with a five-percentage-point *decrease* in the probability of success. Given that the average probability of course success in the sample is 86%, a five-point decrease represents a 5.8% effect size relative to the mean.

The summary statistics and regression results using the population of economics course enrollments suggest that students who are successful in online courses tend to be those affiliated with the university and older exclusively online students. To better understand the relationship between affiliation, typical modality, age, and other student characteristics, we disaggregate the survey data by affiliation (Table 4) before examining the relationship between affiliation and the self-reported reported answers to selected survey questions (Figure 3).

As reported in Table 4, about a quarter of the survey data enrollments were associated with affiliated, mixed modalities students (22 of 97), and another quarter were external to the

institution (28). The largest group was affiliated, exclusively online students (47). The affiliated, exclusively online enrollments have the highest success rates in online courses, followed by the affiliated, mixed modalities student enrollments and external student enrollments. Compared to students enrolled in a mix of modalities, exclusively online students are older, less likely to be female, more likely or as likely to be working, more likely to have children, and more likely to be providing care for children or others.

Table 4

Online Enrollment Outcomes by Affiliation, Typical Modality, and Age and Student Characteristics (Survey Sample)

	Affiliated, mixed modalities	Affiliated, exclusively online		External, exclusively online	
Outcomes					
% A, B, or C grade	73%	96%	**	64%	
% A,B, or C by age group (n)					
22 and under	79% (19)	100% (10)	**	46% (11)	*
23 and over	33% (3)	95% (37)		77% (17)	***
Student characteristics					
Age	21.27	28.79	***	25.25	***
Minority Student	9%	19%		29%	*
Female	77%	40%	***	36%	***
First-Generation Student	23%	47%	**	0%	**
Economics Major	27%	40%		0%	**
Working	50%	72%	*	50%	
Children at home	5%	19%	**	11%	
Caring for children or others	5%	26%	***	18%	
n	*22*	*47*		*28*	

Stars indicate statistically significant differences in means relative to affiliated, mixed modalities category at the 1%, 5%, and 10% levels. Standard errors are clustered at the student level.

The gaps in average success rates by student group in Table 4 conceal a relationship between age and outcomes similar to that which was observed in the institutional data. Within the survey sample, students who are 23 years of age or older make up 79% of affiliated, exclusively online students, 61% of external students, and only 14% of affiliated, mixed modalities students. Among external students, older students have success rates (77%) that are comparable to those of younger affiliated, mixed modalities students (79%). The small number of older students in the latter group mean that comparisons are suggestive but should be interpreted with caution.

To better understand sources of variation in outcomes across affiliations, we compare levels of agreement to the 19 Likert scale survey questions. Student groups had largely similar

responses on all but seven questions. The results for these areas of difference are presented in Figure 3. They include both technology questions, two student characteristics questions, one community question, and two self-regulated learning mastery questions. Figure 1 generally shows the difference between a given student group and the affiliated, mixed modalities group, except for Question 1, where the difference is relative to the affiliated, exclusively online group. Negative values indicate lower levels of agreement among the given group.

The results indicate that students who study *exclusively* online often have different perspectives on online learning than those who also take face-to-face courses. Both groups of exclusively online students expressed greater concerns about technology than the mixed modalities group. Their average level of agreement remained high (between 8.42 and 8.98) but was between 0.56 and 0.80 points lower than the responses for their mixed modalities peers (9.22 and 9.55 for each of the two technology questions). Scheduling flexibility was also less salient for exclusively online students, with similar levels of agreement and differences as the technology question.

External students stand out from their affiliated peers in three respects. Most broadly, this group is less likely to feel that they "learn best when taking online classes" than affiliated exclusively online students, with levels of agreement that were on average about one point lower (5.68 average) than their affiliated peers (6.64 average). There is suggestive evidence of a similar gap with affiliated, mixed modalities students. The difference in means between affiliated, exclusively online and external students was significant at the 10% level, and the difference between affiliated, mixed modalities and external students fell short of conventional significance levels ($p = 0.168$).

Second, external students are more likely to describe connection with other students as supporting their learning in the course, reporting average agreement of 6.46 on a 1 to 10 scale to the statement, "I learn best when I feel connected to other students," compared to 4.00 for affiliated, mixed modalities students and 5.30 for exclusively online students affiliated with the university. All groups had high levels of agreement for the analogous community statement regarding connection to the instructor, with a slightly higher (but statistically comparable) average of 8.11 for external students compared to affiliated, mixed modalities students (7.50).

Finally, external students expressed the most doubts about their study habits and time management ability. While mixed modalities students expressed relatively strong agreement with the statements "My friends and family would say that I have a lot of self-discipline" (8.50) and "I am good at scheduling time each week to study and work on assignments" (7.91), external students' levels of agreement were approximately 1.1 points lower on average for both statements. These gaps were significantly larger than those for affiliated, fully online students.

Figure 3

Differences in Response to Seven Selected Likert Scale Survey Questions by Affiliation and Typical Modality
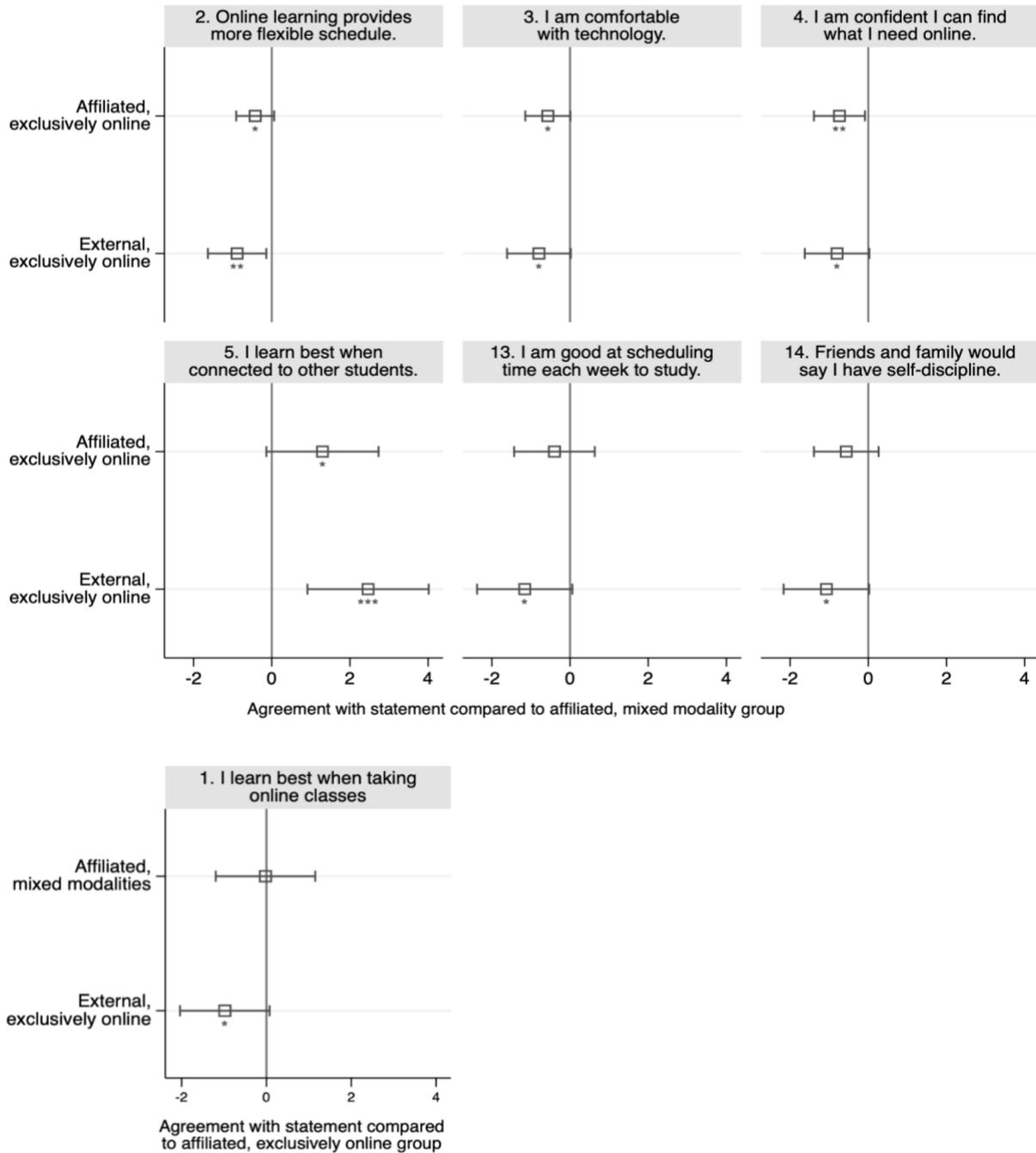
Bars indicate 95% confidence intervals on parameter estimates. Stars indicate statistically significant difference relative to comparison group at the 1%, 5%, and 10% levels. Standard errors are clustered at student level. *N* = 97 for all questions except Question 3, where *N* = 96.

The institutional data suggested that the relationship between age and student success differed for exclusively online students, raising the possibility that online students' perspectives on technology, self-regulated learning mastery, or community could mediate the age-success relationship. Of the seven Likert scale survey questions where responses differed by affiliation, only responses to the "I learn best when I feel connected to other students" question was systematically (and positively) correlated with age ($p < 0.05$). To the extent that older external students are 1) more community seeking and 2) more likely to be successful than their younger counterparts, there is suggestive evidence of a community-age-affiliation link.

The survey data confirmed that students' experiences, behaviors, and concerns in online courses vary systematically by their typical modality and affiliation. Students who exclusively take online courses are less confident in their use of technology and less likely to see online learning as a source of flexibility in their schedules than their mixed modalities peers. Compared to affiliated students, external students also expressed stronger concerns about effective study habits and interests in course community, with the latter being heightened among older external students.

Discussion and Conclusion

This study blended institutional data on seven years of online and face-to-face economics course enrollments at a mid-sized land-grant university with survey data from a subset of these courses to reexamine success gaps by course modality. Unlike previous work, we deconstructed these success gaps into typical modality, course modality, and affiliation components. We eliminated multiple sources of selection bias in a multivariate regression framework by using a rich set of control variables, applying course fixed effects, and leveraging novel data on mixed modalities students. The survey data elicited students' perceptions of online learning and their own behaviors in online classrooms.

The results indicated that current course modality only explained a portion of success gaps between online and face-to-face enrollments. Being unaffiliated with the institution (external) also resulted in lower rates of success. Conversely, affiliated mixed modalities students perform similarly to their exclusively face-to-face peers when taking online courses. The relationship between student characteristics and success also varied systematically across affiliation and typical modality. Among exclusively online students, older students tend to be more successful, while the opposite is true among exclusively face-to-face students.

Our survey of students in three online courses revealed that students' behaviors and concerns in online courses vary by student group. First, exclusively online students were less likely than their mixed modalities peers to describe online courses as allowing for scheduling flexibility. This gap may stem in part from the constraints faced by exclusively online students and their broader positionality. As our survey data confirmed, these programs often serve students with pre-existing work and care responsibilities that make attending in-person classes challenging.

External, exclusively online students may not see online courses as a *source* of flexibility in their academic schedules but instead as partly a *response* to scheduling inflexibility in the rest of their lives. Mixed modality students, by contrast, may see choosing online courses as part of shaping their overall schedule of coursework around other responsibilities and preferences.

Second, students who are most distant from the brick-and-mortar campus—external, exclusively online students—were the least confident about their ability to effectively use technology or manage their time. Similar but generally smaller differences are present for exclusively online students who are affiliated with the institution (e.g., online degree-seeking students). These gaps may have multiple sources. Affiliation shapes access to relevant support services such as technical support, mental health resources, and academic coaching. We would expect external, exclusively online students to have the least access to these resources among students enrolled in online courses, followed by affiliated, exclusively online students, and finally affiliated, mixed modalities students. Moreover, the scheduling considerations discussed above may trump concerns about technology mastery for exclusively online students. Self-selection by technology preferences may be more salient for mixed modality students.

Finally, external, exclusively online students express the greatest interest of all groups in developing class community, followed by affiliated, exclusively online students. There is suggestive evidence that interest in cultivating community is one explanation for the age-affiliation-success relationship observed in the institutional data. The experience of students outside of the classroom may again play a role in these findings. While mixed modalities and affiliated online students may have a sense of *macro* (institution-level) community through their interaction with peers on campus, in other classes, and in residence halls, external and exclusively online students are less likely to. The latter group may seek out *micro* (class-level) forms of community more often. A similar effect may be in play for older students if they feel disconnected from the campus community of (traditionally aged) students.

Attention to heterogeneity among online students is even more critical in the aftermath of the COVID-19 pandemic, which introduced online learning to an unprecedented number and range of students—from K-12 to adult learners (Kaiser & McKenna, 2021). To serve this wide range of students, institutions and instructors will need to recognize that students will come to online courses with different needs and concerns. The pandemic may have also changed online students in ways that this study is unable to capture because data collection occurred prior to the pandemic (2018). Awareness of online learning rose dramatically in 2020 and 2021. Students and their families may have formed opinions of online education based on rapid shifts from face-to-face to online or hybrid modalities. The perceptions of affiliated and external students at MLGU may have changed during this time, with effects that are not clear *a priori*. We also acknowledge that we cannot rule out potential bias in our estimates. Fixed effects account for time-invariant course characteristics that may explain success gaps and may be correlated with modality. Similarly, we account for some of the unobservable differences between students by examining the success gap by course modality *among* the group of students who are enrolled in both types of courses, although the data do not include enrollments in both modalities for most mixed modalities students. Despite these methodological choices, student characteristics other than affiliation and typical modality may drive the success gaps that we observed.

Our findings are a reminder that there is no *single* "modality success gap." Students' perspectives on and challenges in online courses differ depending on their broader affiliation with the university and access to its resources and activities. We believe that these insights should inform strategies for the institution and its instructors. As online learning encompasses a broader range of programs and students, reducing course modality success gaps will require interventions tailored to the needs of students across the affiliation-typical modality spectrum. We propose three recommendations for institutions and instructors based on our results.

First, supportive institutional conditions, and the corresponding resources and activities, must exist and be appropriate for and accessible to students across course modalities. As institutions continue to expand online courses and programs, and students increasingly mix the modalities of their courses within terms and enroll in online programs, resources and activities should be developed that support the common and different needs of these students. For example, the institution should ensure that core student support services have robust face-to-face and virtual counterparts (e.g., online Writing Center appointments, mental health support, technology support), provide opportunities for social engagement and community-building activities for students within and across modalities, and develop resources and activities specifically for the face-to-face student (e.g., residential academic program) and the online student (e.g., program to help develop the online student's self-efficacy skills).

Second, there needs to be proactive outreach to students across modalities communicating the availability of those institutional resources and activities. Instructors play a key role in this recommendation and should gather information about students' relationship with the institution and comfort with online learning and technology. They can then respond accordingly with messaging strategies that range from collective to individual outreach (Gebhardt & McKenna, 2019) offering technology resources, suggesting study strategies, and, in general, sharing resources and activities. To avoid singling students out, instructors can send the entire class reminders about useful resources or community-building activities. This may help bridge success gaps, particularly for fully online students who are more likely to be disconnected from these resources. For example, our results indicated that students who are taking exclusively online courses may actually be less confident than mixed modalities students in their understanding of relevant technologies and in their ability to manage coursework.

Finally, the institution and its instructors need to know and accept that some resources and activities may only support success with certain groups of students. For example, an instructor should build in opportunities for community building in online courses, while recognizing that students will vary in their self-perceived need for such opportunities. As discussed above, external students in a given online class may appreciate moments of virtual interaction more than affiliated peers who find fulfilling sources of community through on-campus activities. Previous work has found that opportunities for community development and student engagement with peers and instructors can be effectively developed in online courses and can promote student success (Rovai, 2002; Schaeffer & Konetes, 2010; Shelton, Hung, & Lowenthal, 2017).

Online economics courses at MLGU included community-building components in their online courses such as discussion boards. McKenna, Gebhardt, and Altringer (2019) and McKenna, Altringer, Gebhardt, & Long (2022) propose a framework for optimal discussion

board structure and present evidence that these forums can, when well designed, provide a robust sense of community for online students. If older and external students are more likely to recognize the importance of this engagement, they may position themselves to be more successful. Instructors could hold a meta-conversation with students about the benefits of engagement with instructors and peers to encourage all students to make the most of these opportunities.

The improved understanding of differences in success rates from this study may steer colleges and universities to conduct targeted research to better understand why these differences exist and then develop and maintain adequate student support services, course design support for faculty, and interventions to eliminate success gaps. The results suggest that success gaps can be narrowed by being aware that students' challenges as online learners will vary based on their backgrounds and broader relationship to the university and taking proactive steps to connect students who may feel disconnected from the institution to their peers and to campus resources.

Declarations

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