

## WHAT HAPPENS NEXT?

Better Subsequent Course Grades and DFW Rates After  
Taking Gateway Courses With ACUE Faculty  
at the University of Southern Mississippi



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## EXECUTIVE SUMMARY

The impact of the Association of College and University Educators (ACUE) credential on student course outcomes has been examined in several previous evaluations (Hecht, 2019; Lawner & Snow, 2018; Lawner & Snow, 2019a, 2019b; Lawner, Snow & Burt, 2019; Lawner & Snow, 2020; Lawner, Snow, MacCormack, & Waltje, 2019; Pippins, Hartigan et al., 2021; Pippins, Lawner et al., 2021). Prior evaluations have generally examined the impact on ACUE faculty who take the ACUE course in effective teaching practices on student outcomes, typically taken over a full academic year, with positive impacts found contemporaneously while faculty were earning their ACUE credential (Hecht, 2019; Lawner & Snow, 2018; Lawner & Snow, 2019a, 2019b; Lawner & Snow, 2020; Lawner, Snow, & Burt, 2019; Lawner, Snow, MacCormack, & Waltje, 2019) and after faculty earned their ACUE credential (Hecht, 2019; Lawner & Snow, 2019b, Lawner & Snow, 2020; Pippins, Hartigan et al., 2021; Pippins, Lawner et al., 2021). However, ACUE also offers microcredential courses, which split up the modules from the course in effective teaching practices into multiple shorter courses taken over separate semesters. Like those who take the ACUE course in Effective Teaching Practices, faculty who complete 25 modules through the ACUE microcredential courses receive the ACUE Certificate in Effective College Instruction. Given the recent expansion of ACUE microcredential course offerings across partnering institutions, it is important to understand the impact of the courses on faculty effectiveness, as measured by student course outcomes.

In a previous evaluation (Pippins, Chasteen et al., 2021), we examined the impact of ACUE faculty who took ACUE microcredential courses on their students' *contemporaneous* gateway course outcomes. In this follow-up, we focused exclusively on those students who took a gateway course with ACUE and non-ACUE faculty then subsequently enrolled in another course in the same field. In other words, we examined the impact of ACUE faculty on students' *subsequent* course outcomes. Our analyses used faculty and student data from the University of Southern Mississippi (USM), which was one of the earliest partnering institutions to offer ACUE microcredential courses to faculty. USM is a



public research university with dual campuses in Hattiesburg and Gulf Park, serving more than 14,000 undergraduate and graduate students. In partnering with ACUE, USM opted to offer microcredential courses that allowed faculty to phase in to taking courses over time; therefore, there are no distinct cohorts of ACUE faculty at USM. From fall 2016 to spring 2020, 117 faculty at USM were taking and/or had completed at least one ACUE microcredential course. This evaluation focuses on the students of the 18 faculty who took ACUE microcredential courses and taught gateway courses between fall 2016 and fall 2019. Specifically, the subsequent course outcomes of students taught in gateway course sections by ACUE faculty are compared to the subsequent course outcomes of students taught in gateway course sections by non-ACUE faculty.

The evaluation found significantly better subsequent course grades and DFW rates for students who took gateway courses with ACUE faculty when compared to students who took gateway courses with non-ACUE faculty. There was no evidence of differences by race/ethnicity.

## ABOUT ACUE

The Association of College and University Educators' (ACUE) mission is to ensure student success and equity through quality instruction. In partnership with colleges, universities, higher education systems, and associations, ACUE prepares and credentials faculty in the evidence-based teaching practices that improve student achievement and close equity gaps. Numerous and independently validated studies confirm that students are more engaged, learn more, and complete courses in greater numbers—more equitably with their peers—when taught by ACUE-credentialed faculty. ACUE's online, cohort-based credentialing programs are delivered through institutional partnerships and open-enrollment courses endorsed by the American Council on Education.<sup>1</sup>

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<sup>1</sup> To learn more visit [acue.org](https://www.acue.org).



## INTRODUCTION

Although decades of scholarship on teaching and learning have identified specific evidence-based teaching practices that improve student outcomes (e.g., Freeman et al., 2011), higher education faculty rarely receive formal, comprehensive training in those practices. To connect the dots between faculty development designed to improve instructional practices and the consequent impact on student outcomes, ACUE developed and offers courses in effective teaching practices. These ACUE courses are based on the Effective Practice Framework—a consensus statement of the teaching skills and knowledge that every college educator should possess to teach effectively, regardless of discipline (Association of College and University Educators, 2016). ACUE also developed an accountability framework to conduct evaluations of its partnerships with colleges and universities. This accountability framework has six levels of evaluation: (1) faculty engagement, (2) faculty learning, (3) faculty implementation, (4) student engagement, (5) course-level student outcomes, and (6) institutional outcomes (see MacCormack et al., 2018). The current evaluation examines the impact of the ACUE faculty on level 5.

The impact of ACUE faculty on student course outcomes has been examined in several previous evaluations, which found evidence of positive effects of ACUE faculty on student completion rates (Lawner, Snow, MacCormack et al., 2019), success rates (Hecht, 2019; Lawner & Snow, 2018), passing rates (Lawner & Snow, 2020), and average grades (Hecht, 2019; Lawner & Snow, 2019a, 2019b; Lawner, Snow, & Burt, 2019).<sup>2</sup> However, this evaluation is distinct from prior evaluations in two main ways. First, this evaluation examines the impact of ACUE faculty who take microcredential courses. All prior evaluations have examined the impact on ACUE faculty who take the ACUE course in effective teaching practices. ACUE also offers microcredential courses. Like those who take the ACUE “full” course, faculty who take ACUE microcredential courses receive the ACUE Certificate in Effective College Instruction, but only after completing at least 25 modules. Given the recent expansion of ACUE microcredential course offerings across partnering institutions, this

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<sup>2</sup> Success rates as measured by earning grades A–C or a P (Pass) in courses.



paper aims to understand the impact of ACUE faculty who take microcredential courses. Second, the outcome measures in this evaluation are students' subsequent course outcomes in a field of study. Prior evaluations have examined outcomes for students who were contemporaneously enrolled in courses taught by ACUE faculty; therefore, they have been unable to isolate any positive impacts attributable to improved instructional quality from changes in grading practices or rigor. Conversely, subsequent course outcomes reveal whether taking gateway courses taught by ACUE faculty had a continued impact on achievement in the same field of study.<sup>3</sup> A growing body of research has identified subsequent performance as an important measure of student learning (see, e.g., Carrell & West, 2010).

To examine the impact of ACUE faculty on students' subsequent course outcomes, this evaluation used student-level data from the University of Southern Mississippi (USM). USM is a public research university with dual campuses in Hattiesburg and Gulf Park, serving more than 14,000 undergraduate and graduate students. In partnering with ACUE, USM opted to offer microcredential courses that allowed faculty to phase in to taking courses over time. From fall 2016 to spring 2020, 117 faculty at USM were taking and/or had completed at least one ACUE microcredential course. We focus on the students of the 18 faculty at USM who took ACUE microcredential courses and taught gateway courses between fall 2016 and fall 2019. These students took subsequent courses in their gateway courses' field of study between spring 2017 and spring 2020.

Methodologically, this evaluation relied on a three-way fixed-effects approach to compare the subsequent course outcomes of students taught in gateway course sections by ACUE faculty to the subsequent course outcomes of students taught in gateway course sections by non-ACUE faculty. The evaluation found that subsequent course grades were higher by .06 grade points (on a 4.0 scale) and DFW rates were lower by .03 percentage points for students who

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<sup>3</sup> Importantly, we examine subsequent courses to gateway courses instead of any course subject because gateway courses are a precursor to numerous academic programs at USM. There is also considerable variation across gateway courses given that (a) most students are required to take at least one gateway course and (b) several sections of gateway courses are taught in any given semester, typically by multiple faculty.



took gateway courses with ACUE faculty compared to students who took gateway courses with non-ACUE faculty. There was no evidence of differences by race/ethnicity.

## DATA AND SETTING

### ACUE Faculty at USM

The data for these analyses came from USM's Office of Institutional Research, which collects, archives, and maintains institutional data for the purpose of analyzing, distributing, and presenting summary information. Faculty at USM first began taking ACUE microcredential courses in fall 2016.<sup>4</sup> The ACUE microcredential courses in effective teaching practices differed from the ACUE "full" course evaluated in prior studies in that faculty must have taken a series of three microcredential courses over three semesters to receive the ACUE Certificate in Effective College Instruction. Faculty at USM were able to take the ACUE microcredential courses in either fall, spring, or summer term; however, they could take only one microcredential course per term to meet the three-course requirement for the ACUE certificate. Most but not all faculty took their courses in three consecutive terms. While taking the ACUE microcredential course, faculty were exposed to the Effective Practice Framework's five major units of study: (1) Designing an Effective Course and Class, (2) Establishing a Productive Learning Environment, (3) Using Active Learning Techniques, (4) Promoting Higher Order Thinking, and (5) Assessing to Inform Instruction and Promote Learning. To satisfy course requirements, faculty actively engaged with content, were required to implement evidence-based practices, and wrote rubric-aligned reflections on their implementation, including citing changes in student behaviors (MacCormack et al., 2018).

Twenty-one faculty at USM took an ACUE microcredential course in fall 2016, with an additional 10 to 20 faculty phased in to taking ACUE microcredential courses in each subsequent semester. By spring 2020, there were 117 faculty at USM who were taking and/or had completed at least one ACUE microcredential course. Of these 117 ACUE faculty, 18

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<sup>4</sup> In this paper, we use "faculty" to refer to a variety of non-students who were employed by USM and had teaching responsibilities. This nomenclature includes tenure-track professors, adjunct professors, visiting professors, and other instructors.



taught a subset of gateway course sections between fall 2015 and spring 2020 (see Appendix Table 1 for a list of the gateway course titles and names). After taking a gateway course, a subset of students proceeded to take a subsequent course in the same field of study. These analyses focused on students who took a gateway course between fall 2016 and fall 2019 and later enrolled in a subsequent course in the same field of study between spring 2017 and spring 2020.

### Construction of Analytic Sample

The administrative data provided by USM's Office of Institutional Research spanned from fall 2015 to spring 2020. The data included a faculty-level file that contained faculty characteristics (gender, hire date, rank) and a student-by-course-section-level file that contained course-section characteristics (course name, number, department, and type; term offered), student characteristics (gender, race/ethnicity, intended major, ACT scores), and student course outcomes (final grade). These files were merged to a list of ACUE faculty names that included the terms in which faculty took ACUE microcredential courses. Given the time span of the data and the phase-in of faculty to taking ACUE microcredential courses, we could identify the semesters before, while, and after faculty take an ACUE microcredential course. Because we are interested in the impact of taking a gateway course with ACUE faculty versus non-ACUE faculty on subsequent course outcomes, we excluded the semesters before any faculty at USM began taking ACUE courses, namely fall 2015 and spring 2016.

We next excluded graduate students, gateway courses taught by graduate students, courses taught in summer terms, labs that accompany courses, and co-instructed courses, as well as courses with fewer than ten students enrolled. We then identified the first gateway course that each student took in a field of study, keeping only the earliest gateway course for any student who repeated a course after having originally withdrawn or failed.<sup>5</sup> After identifying the first gateway course for each student, we identified their subsequent course in the same field of study. A subsequent course is defined as a distinct course in the same field of study as the gateway course that was taken after and in a

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<sup>5</sup> To minimize selection bias related to students' systematic sorting into courses taught by certain faculty, it is common in related research to also limit the sample to courses taken by students in their first semester at a college or university. We did not make this limitation in our preferred analytic sample given our relatively small sample size. In an unreported robustness check, limiting to college freshman reduced our already small sample size even more and resulted in statistically imprecise estimates. Importantly, we include student fixed effects in our specification model to limit the possibility of selection bias.



subsequent term to the gateway course. Based on the restrictions applied when identifying students' initial gateway courses, the subsequent course for some students may not have been taken in the term that immediately follows the gateway course. Additionally, some students had multiple options of subsequent courses because they took multiple courses in the same field of study as, and in the same term after taking, their gateway course. For these students, we used the course with the lowest course number. For example, if a student simultaneously takes Biology 300 and Biology 310 after having taken Biology 250, we use Biology 300 as the subsequent course. Importantly, results were not sensitive to randomizing our choice of subsequent course. We therefore chose subsequent courses with the lowest course number for ease of replicability and consistency.

To determine the impact of ACUE gateway courses on student subsequent course performance (henceforth referred to as the impact of ACUE faculty), we measured several student subsequent course outcomes: grades, completion rates, passing rates, and DFW rates. Subsequent course grades were converted from an alphabetic scale to a numeric equivalent (A = 4, B = 3, C = 2, D = 1, F = 0). Students who withdrew from a course before receiving a final grade or had grades that could not be converted to a numeric scale (e.g., P) were not included in analyses when subsequent course grades were used as an outcome. At USM, subsequent course passing grades included "A," "B," "C," "D," "Z," and "P," and subsequent course DFW grades included "D," "F," "W," and NP. Students who received course grades of "NA," "AUD," or "I" were excluded from all analyses.

### Summary Statistics

Table 1 reports the average faculty characteristics of ACUE and non-ACUE faculty in our final analytic sample. Seventeen ACUE faculty taught students in gateway courses who went on to take a subsequent course in the field of study. In comparison, 56 non-ACUE faculty taught students in gateway courses who went on to take a subsequent course in the field of study. In terms of demographics, balance tests revealed no significant differences between ACUE and non-ACUE faculty in gender,  $\chi^2(1, N = 71) = 0.66, p = .418$ ; tenure status,  $\chi^2(1, N = 71) = 0.01, p = .917$ ; or years



working at USM,  $F(1, 71) = 0.30, p = .583$ . However, because we used student-by-course-section-level outcomes, in which students were unequally weighted in their assignments to faculty, we included faculty characteristics as control variables in our specification model.

**Table 1.** Faculty Characteristics by ACUE Status, fall 2016–fall 2019

Variable	ACUE	Non-ACUE
Female (%)	.65	.54
Tenure (%)	.64	.66
Years at university	5.52	6.01
Course sections taught	103	194
Student enrollments	2,306	2,562
<i>N</i>	17	56

Table 2 presents summary statistics for student characteristics. Because our main outcomes of interest are subsequent course performance, we first examined whether students who take gateway courses with ACUE faculty are more or less likely to enroll in a subsequent course in the same field of study. We found no significant difference in the probability of subsequent course enrollment between the two groups of students,  $b = -.001, SE = .008, 95\% \text{ CI } [-0.027, 0.014], p = .481$ .<sup>6</sup> Importantly, the demographics of students who enrolled in subsequent courses were also nearly identical between students who took gateway courses with ACUE and non-ACUE faculty, providing no observable evidence of bias between the two groups of students.

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<sup>6</sup> To calculate the likelihood of enrolling in a subsequent course, we started with the analytic sample used in Pippins, Chasteen et al. (2021) and restricted to the subsample of students who took a gateway course between fall 2016 and fall 2019. We then applied the same methodology, replacing the outcome with a dichotomous variable that equaled 1 if a student enrolled in a subsequent course in a field of study between spring 2017 and spring 2020, and 0 otherwise.

**Table 2.** Summary Statistics by ACUE Status, fall 2016–fall 2019

Variable	ACUE	Non-ACUE
Enrolled in subsequent course (%)	.19	.19
Female (%)	.78	.80
Black (%)	.32	.32
White (%)	.59	.59
Other (%)	.09	.09
Freshman (%)	.46	.57
Sophomore (%)	.46	.36
Junior (%)	.07	.05
Senior (%)	.02	.01
Pell recipient (%)	.48	.48
First generation (%)	.28	.28
ACT English score	24.38	23.92
ACT math score	21.65	21.22

*Notes:* The “other” race/ethnicity category included all students whose race/ethnicity was not identified as White or Black in the USM data. These races/ethnicities included American Indian, Asian, Hispanic, Multiracial, and Pacific Islander, as well as those who were unspecified; they were collapsed due to small sample sizes. The averages for the variable “Enrolled in subsequent course” comes from a larger sample of data in which we have all students who took a gateway course between fall 2016 and fall 2019. The outcome was coded 1 if a student enrolled in a subsequent course in a field of study between spring 2017 and spring 2020; it was coded 0 otherwise.

## METHODOLOGY

To examine the extent to which taking a gateway course with an ACUE faculty impacts subsequent course performance, we conducted descriptive analyses using a three-way fixed-effects approach (cf. Xu & Solanki, 2020). The key explanatory variable is a dichotomous variable coded to 0 (the reference group) if a student took the gateway

course section with non-ACUE faculty and to 1 if they took the gateway course section with ACUE faculty. Because ACUE faculty may begin and complete the ACUE microcredential course at different times, they are defined as ACUE faculty in both the years *while* and the years *after* they complete the course. Otherwise, faculty are defined as non-ACUE faculty in the years prior to taking the ACUE course or if they never began an ACUE course during the sample period.

Fixed effects included student fixed effects, term fixed effects, and next-course fixed effects. Student fixed effects controlled for observed and unobserved, time-invariant student characteristics. Excluding student fixed effects could lead to biased estimates if students sort into (or away from) courses taught by ACUE faculty based on faculty reputation. For example, students who are willing to work harder (i.e., are academically motivated) may select into courses taught by ACUE faculty if these faculty tend to have broadly better reputations in their fields and students desire recommendations. We therefore included student fixed effects to minimize the possibility of selection bias. Term fixed effects controlled for overall variation in students' subsequent course outcomes and faculty composition that occurs across terms at USM. Finally, next-course fixed effects controlled for selection into students' subsequent course. For example, students who had a negative experience in a gateway course taught by ACUE faculty (e.g., almost fails course) might have intentionally chosen to take their subsequent course with non-ACUE faculty. We therefore included next-course fixed effects, a combination of course section and term, to control for the additional potential for selection. As a result, the variation from our estimation strategy comes from students who took exactly the same subsequent course section in a field of study in which some students took their gateway course with ACUE faculty and others with non-ACUE faculty.<sup>7</sup>

Additional controls in our model included course-section characteristics (enrollment count), faculty characteristics (gender, experience, whether tenure-track) and time-varying student characteristics (class standing, Pell recipient, whether taking a course in their intended major). We clustered standard errors at the student and subject

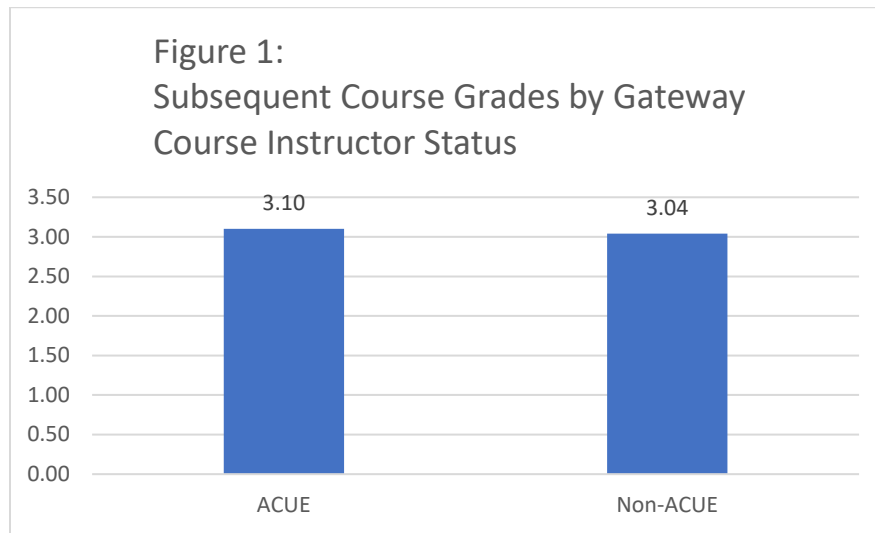
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<sup>7</sup> Notably, we did not include gateway course fixed effects in our preferred model. This is primarily because, of the ten gateway courses, only six were in a duplicate field of study—three courses in biology and three in math (see Appendix Table 1). However, estimates are largely unchanged when we add gateway course fixed effects.

level to control for correlations between courses taken by the same student and for correlations between classes within the same subject area.

## RESULTS

**Course Grades.** There was a marginally significant difference in subsequent course grades between students who took gateway courses with ACUE faculty and students who took gateway courses with non-ACUE faculty,  $b = .064$ ,  $SE = .027$ , 95% CI  $[-0.006, 0.134]$ ,  $p = .067$ . Specifically, students who took gateway courses with ACUE faculty earned subsequent course grades that were on average .06 points higher (on a 4.0 scale) than students who took gateway courses with non-ACUE faculty (see Figure 1).

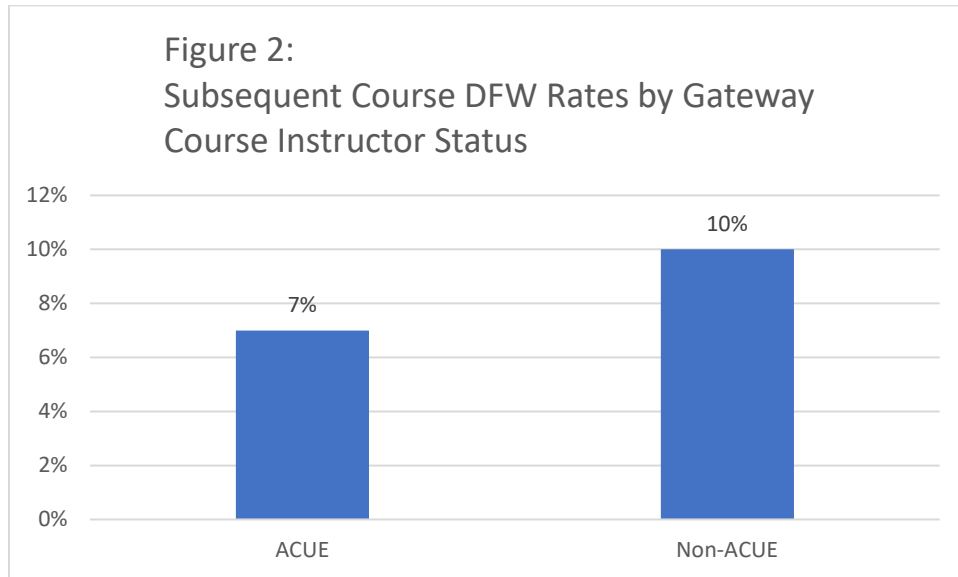


*Note.* The outcomes above reflect the regression-adjusted means.

**Passing Rates.** There was no significant difference in subsequent course passing rates between students who took gateway courses with ACUE faculty and students who took gateway courses with non-ACUE faculty,  $b = .004$ ,  $SE = .011$ , 95% CI  $[-0.024, 0.032]$ ,  $p = .726$ .

**DFW Rates.** There was a significant difference in subsequent course DFW rates between students who took gateway courses with ACUE faculty and students who took gateway courses with non-ACUE faculty,  $b = -.030$ ,  $SE = .010$ , 95% CI  $[-0.057, -0.003]$ ,  $p = .035$ . Specifically, DFW rates in subsequent courses were 3 percentage points lower for

students who took gateway courses with ACUE faculty compared to students who took gateway courses with non-ACUE faculty (see Figure 2).



Note. The outcomes above reflect the regression-adjusted means.

**Course Completion.** There was no significant difference in subsequent course completion rates between students who took gateway courses with ACUE faculty and students who took gateway courses with non-ACUE faculty,  $b = -.001$ ,  $SE = .005$ , 95% CI  $[-0.013, 0.011]$ ,  $p = .790$ .

## HETEROGENEITY

In this section, we report on additional analyses that examined whether the impact on subsequent course outcomes from taking gateway courses with ACUE versus non-ACUE faculty differed by race/ethnicity. The results are largely null, indicating that the overall effects presented above were not masking heterogeneous effects across racial/ethnic groups. Whereas in previous papers we examined effect heterogeneity using interactions between race/ethnicity and our main variable(s) of interest, here we chose to perform subgroup analyses given our reliance on student fixed effects.

**Course Grades.** There was no significant difference in subsequent course grades between taking a gateway course with ACUE faculty and taking a gateway course with non-ACUE faculty when restricting to Black students,  $b =$



.039,  $SE = .061$ , 95% CI [-0.118, 0.196],  $p = .547$ ; White students,  $b = .071$ ,  $SE = .039$ , 95% CI [-0.028, 0.170],  $p = .124$ ; or other-raced students,  $b = .266$ ,  $SE = .137$ , 95% CI [-0.086, 0.617],  $p = .110$ . Therefore, there is no evidence to suggest that the marginally significant positive association between ACUE faculty and subsequent course grades is primarily driven by any particular racial or ethnic group(s).

**Passing Rates.** There was no significant difference in subsequent course passing rates between taking a gateway course with ACUE faculty and taking a gateway course with non-ACUE faculty when restricting to Black students,  $b = .014$ ,  $SE = .023$ , 95% CI [-0.045, 0.073],  $p = .580$  or White students,  $b = .014$ ,  $SE = .012$ , 95% CI [-0.018, 0.046],  $p = .308$ . Although there was a significant difference in subsequent course passing rates between taking a gateway course with ACUE faculty and taking a gateway course with non-ACUE faculty when restricting to other-raced students,  $b = .056$ ,  $SE = .021$ , 95% CI [0.003, 0.109],  $p = .042$ , the sample of other-raced students is small ( $n = 210$ ) and we cannot reject equality across groups. Therefore, we cannot conclude that the null finding between ACUE faculty and subsequent course grades masks heterogeneity by race or ethnicity.

**DFW Rates.** There was no significant difference in subsequent course DFW rates between taking a gateway course with ACUE faculty and taking a gateway course with non-ACUE faculty when restricting to Black students,  $b = -.054$ ,  $SE = .031$ , 95% CI [-0.134, 0.026],  $p = .144$ ; White students,  $b = -.023$ ,  $SE = .014$ , 95% CI [-0.060, 0.015],  $p = .179$ , or other-raced students,  $b = -.035$ ,  $SE = .042$ , 95% CI [-0.143, 0.074],  $p = .499$ . Therefore, there is no evidence to suggest that the significant negative association between ACUE faculty and subsequent course DFW rates is primarily driven by any particular racial or ethnic group(s).

**Course Completion.** There was no significant difference in subsequent course completion rates between taking a gateway course with ACUE faculty and taking a gateway course with non-ACUE faculty when restricting to Black students,  $b = .015$ ,  $SE = .013$ , 95% CI [-0.019, 0.048],  $p = .310$ ; White students,  $b = -.006$ ,  $SE = .009$ , 95% CI [-0.028, 0.016]; or other-raced students,  $b = .007$ ,  $SE = .010$ , 95% CI [-0.019, 0.034],  $p = .510$ . Therefore, we cannot conclude that the null finding between ACUE faculty and subsequent course completion rates masks heterogeneity by race or ethnicity.



## DISCUSSION

This evaluation found evidence that ACUE faculty at USM had lasting positive impacts on student learning in the same field of study. Specifically, students who took gateway courses with ACUE faculty received marginally better grades and significantly fewer DFW grades in subsequent courses compared to students who took gateway courses with non-ACUE faculty. Examining heterogeneity also suggested that the impacts are constant across race/ethnicity.

These results most directly complement our previous evaluation, Pippins, Chasteen et al. (2021), which found that course grades, passing rates, and DFW rates improved for students of ACUE faculty in the years while and after faculty took the ACUE microcredential course. Relative to the pre-ACUE period, there were significant improvements for students of ACUE faculty in course grades, passing rates, and DFW rates in the during-ACUE period, controlling for changes in student outcomes in course sections taught by non-ACUE faculty. Similarly, relative to the pre-ACUE period, there were significant improvements for students of ACUE faculty in passing rates and DFW rates in the post-ACUE period, controlling for changes in student outcomes in course sections taught by non-ACUE faculty. Our results also add to other prior research finding an impact of ACUE faculty on student course outcomes (Hecht, 2019; Lawner & Snow, 2018; Lawner & Snow, 2019a, 2019b; Lawner, Snow, & Burt, 2019; Lawner, Snow, MacCormack, & Waltje, 2019). However, this study extends all previous research by demonstrating the impact of the ACUE faculty who took the ACUE microcredential course (as opposed to the full ACUE course) on students' subsequent course performance. Therefore, not only do ACUE faculty improve student performance over time within their own gateway courses, but they also have a lasting impact on their students' performance; that is, their students tend to outperform their peers in subsequent courses in a field of study.

Given a relatively small sample size, analyses examining heterogeneity produced statistically imprecise estimates. Future research should continue to explore whether effects may vary by race/ethnicity. Additionally, because we look at multiple outcomes, future analyses should account for multiple hypothesis testing. Multiple hypothesis



testing can lead to potential problems if results that appear to be statistically significant are purely by chance.

Finally, future research should consider the mechanisms through which students of ACUE faculty tend to outperform students of non-ACUE faculty in subsequent courses. Some possible mechanisms include broadly better instructional quality and improved student engagement in gateway courses taught by ACUE faculty leading those students to better learn the material in the gateway course, making it easier to build upon that knowledge in the subsequent course.

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## APPENDIX

<b>Appendix Table 1. Gateway Courses at USM</b>	
Course title	Course name
BSC 110	Principals of Biological Science I
BSC 250	Human Anatomy and Physiology I
BSC 251	Human Anatomy and Physiology II
CHE 106	General Chemistry I
HIS 101	World Civilizations
MAT 99	Intermediate Algebra
MAT 100	Quantitative Reasoning
MAT 101	College Algebra
PSY 110	General Psychology
SOC 101	Principles of Sociology