ACUE

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GATEWAY TO GAINS:

Improved Grades, Passing and DFW rates in Gateway Courses Taught by 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, 2020; Lawner, Snow, & Burt, 2019; Lawner, Snow, MacCormack, & Waltje, 2019; Pippins, Hartigan et al., 2021; Pippins, Lawner et al., 2021). All prior evaluations have 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 concurrently 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.

This is the first evaluation to examine the impact of ACUE faculty who take ACUE microcredential courses. We focus on faculty and students at 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 18 faculty who took

ACUE microcredential courses over this time span and who taught gateway courses. Specifically, the changes in course outcomes for students taught in gateway course sections by ACUE faculty are compared to the changes in course outcomes for students taught in gateway course sections by non-ACUE faculty.

The evaluation found significant impacts of ACUE faculty on students' course grades, passing rates, and DFW rates. 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. There is also evidence of heterogeneous effects by race/ethnicity and by class standing.

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.[1]

INTRODUCTION

To connect the dots between faculty development designed to improve instructional practices and the consequent impact on student outcomes, the Association of College and University Educators (ACUE) developed and

[1] To learn more visit acue.org.

offers courses in effective teaching practices 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-certified 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, and Waltje, 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).[2] However, 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 paper aims to understand the impact of the courses on faculty effectiveness, as measured by student course outcomes.

This evaluation uses student-level data to examine the impact that faculty at the University of Southern Mississippi (USM) who took ACUE microcredential courses have on student course outcomes. 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. This evaluation focuses on the 18 faculty who took ACUE microcredential courses over this

[2] Success rates as measured by earning grades A–C or a P (Pass) in courses.

time span and who taught gateway courses. Importantly, we restrict to gateway courses because they are a precursor to numerous academic programs at USM. This leads to several benefits: (a) most students are required to take at least one gateway course, (b) several sections of gateway courses are taught in any given semester, typically by multiple faculty, and (c) we can examine student performance in subsequent courses in the same field of study.[3] To measure the impact of ACUE faculty on student performance in gateway courses, this evaluation uses a difference-in-differences approach that compares the changes in outcomes over time for students who were taught by an ACUE faculty member to the changes in outcomes over time of students taught by non-ACUE faculty members.

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.[4] 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, 117 faculty at USM were taking and/or had completed at least one ACUE microcredential course. Of these 117 ACUE faculty, 18 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).

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 the fall, spring, or summer term; however, they could only take one microcredential course per term to meet

[3] See Pippins, Chasteen et al. (2021).
[4] 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 included tenure-track professors, adjunct professors, visiting professors, and other instructors.

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).

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. Although we were interested in the impact of faculty taking ACUE microcredential courses, we kept both ACUE and non-ACUE faculty in the sample to implement a difference-in-differences estimator, which we discuss in the Methods section.

After identifying ACUE and non-ACUE faculty, we excluded gateway courses taught by graduate students, graduate student course outcomes, courses taught in summer terms, labs that accompany gateway courses, and co-instructed courses, as well as courses with fewer than 10 students enrolled. We further limited our sample to first-time enrollments in gateway courses to reduce the possibility of systematic sorting of students who may drop, fail, or

withdraw from a course after their initial experience with a specific type of faculty. A common way to deal with students sorting is to restrict analyses to the first-time enrollments in gateway courses of freshman students. Although we believed there was minimal potential for students to sort based on ACUE faculty status—given the phase-in of faculty over time to taking ACUE microcredential courses—we restricted to freshmen in alternative analyses.

To determine the impact of ACUE courses on faculty effectiveness (henceforth referred to as the impact of ACUE faculty), we measured several student outcomes: course grades, completion rates, passing rates, and DFW rates. 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 course grades were used as an outcome. At USM, passing grades included "A," "B," "C," "D," "Z," and "P," and 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 shows that the final analytic sample contained 35,241 student-by-course-section-level observations, representing 18,021 non-unique student enrollments in 237 gateway course sections taught among 18 ACUE faculty and 17,220 non-unique student enrollments in 270 gateway course sections taught among 68 non-ACUE faculty between fall 2015 and spring 2020. Because non-ACUE faculty served as a control group for the ACUE faculty, we tested for covariate balance on a set of faculty covariates and presented the results in Table 1. Chi-square tests revealed no significant difference between ACUE and non-ACUE faculty in gender, $\chi^2(1, N = 86) = 1.09$, $p = .297$, years working at USM, $F(1, 84) = 1.19$, $p = .278$, tenure status, $\chi^2(1, N = 86) = .26$, $p = .611$, or rank, $\chi^2(3, N = 86) = 2.90$, $p = .408$.

Table 1

Characteristics by ACUE Status

Variable	ACUE	Non-ACUE
Female (%)	33.33	47.06
Years at university	4.60	6.28
Tenure (%)	0.61	0.54
Assistant professor (%)	38.89	29.41
Associate professor (%)	22.22	14.71
Professor (%)	0.00	10.29
Instructor (%)	38.89	45.59
Course sections taught	237	270
Student enrollments	18,021	17,220
N	18	68

Table 2 presents sample means at the student-by-course-section level.[5] The sample comprised 69% female students, 51% Pell recipients, and 34% first-generation students. By race/ethnicity, more than half the sample comprised White students (54%), followed by Black students (35%), then students categorized as "Other" (10%).[6] Enrollments also comprised 40% freshmen, 35% sophomores, 15% juniors, and 10% seniors. Average ACT scores in English (22.85) and math (20.50) were slightly above the

[5] Because the means were taken over the entire sample, in which students appear multiple times if they took more than one gateway course title, the sample means might have diverged slightly from actual enrollments at USM.

[6] 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 that were unspecified; they were collapsed due to small sample sizes.

Table 2

Summary Statistics of Analytic Sample

Variable	Mean	SD	Observations
Female (%)	0.69	0.46	35,241
Black (%)	0.35	0.48	35,241
White (%)	0.54	0.50	35,241
Other (%)	0.10	0.30	35,241
Freshman (%)	0.40	0.49	35,241
Sophomore (%)	0.35	0.48	35,241
Junior (%)	0.15	0.36	35,241
Senior (%)	0.10	0.30	35,241
Pell recipient (%)	0.51	0.50	35,241
First generation (%)	0.34	0.47	35,241
ACT English score	22.85	5.22	35,241
ACT math score	20.50	3.93	35,241
Complete course (%)	0.93	0.26	35,241
Pass course (%)	0.81	0.39	35,241
DFW in course (%)	0.28	0.45	35,241
Grade	2.47	1.31	32,090

state averages of 18.2 and 18.1, respectively.[7] Finally, course completion rates at USM were relatively high over time, averaging 93% (Appendix Table 2 suggests no significant changes between the pre-, during-, and post-periods). Importantly, high completion rates may have created a ceiling effect that reduced the margins for significant improvements. In comparison, passing and DFW rates were 81% and 28%, respectively. The average course grade over time was 2.47. In Appendix Table 2, we restrict to ACUE faculty and show how these sample means change over time.

METHODOLOGY

The primary goal of these analyses was to estimate the impact of ACUE faculty on student gateway course performance. To do so, we exploited the variation in timing in which faculty take ACUE courses and employed a difference-in-differences approach with two-way fixed effects. All analyses were conducted using Stata. In our main specification equation (not shown here), the parameters of interest were difference-in-differences estimators that captured the impact of ACUE faculty while and after taking an ACUE course on their students' course performance. Analyses also controlled for student characteristics (English and Math ACT scores, class standing, gender, if first generation, if Pell Grant recipient, and race/ethnicity), as well as course and section characteristics (student enrollments, average ACT, and if course is within a student's intended major).

Following Taylor and Tyler (2012), we made some parameter restrictions to account for collinearity between (a) years relative to faculty taking an ACUE microcredential course, (b) their years of experience, and (c) school year. First, because our outcomes are at the course-section level and course sections change each semester, we included semester fixed effects to control for overall trends in student outcomes that occurred over time in gateway courses at USM. Second, as previously explained, we identified the semesters before, while, and after faculty take the course. We therefore used a set of mutually exclusive dummy variables to parameterize time relative to taking ACUE

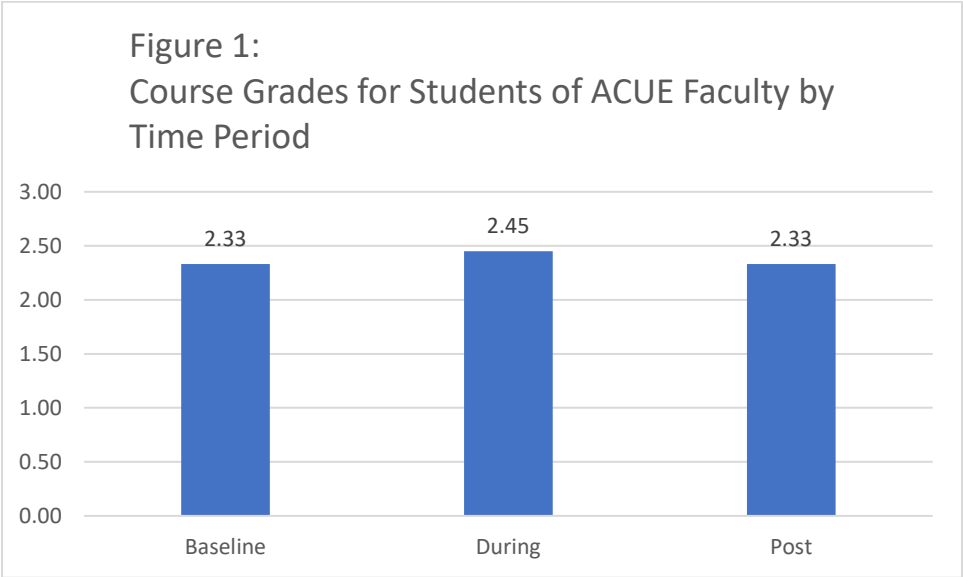
[7] State averages were based on 2018 scores. For more information, visit https://nces.ed.gov/programs/digest/d18/tables/dt18_226.60.asp

microcredential courses. Semesters before taking an ACUE course (pre period) were the omitted category for ACUE faculty, and dummy variables took on a value of 1 if faculty were concurrently enrolled in an ACUE course (during period) and/or if faculty had already received an ACUE certificate (post period). Third, we used the number of years since faculty had been hired at USM as a proxy for teaching experience. Although there are limitations to using years at USM in place of total years of teaching experience, we chose to include the former given (a) its availability, (b) the importance of separating the impact of ACUE faculty from the impact of increasing job experience, and (c) the plausibility that there exist returns to the first few years of teaching at a new institution; this might have been particularly important in our analyses given that in our sample ACUE faculty had been at USM for, on average, 4.6 years and non-ACUE for 6.28 years (see Table 1). Nevertheless, to the extent that the number of years at USM is correlated with total years of teaching experience, our estimates should be unbiased.

The set of control variables and fixed effects enabled the use of within-faculty over-time variation, which accounts for unobserved differences in teaching quality as well as nonrandom differences in selection of students to specific faculty. Therefore, our estimates reflect the gains/losses in achievement of students taught in gateway courses by an ACUE faculty before, while, and after taking ACUE courses compared to the gains/losses in achievement of students taught in gateway courses by non-ACUE faculty.

RESULTS

Course Grades. The DID estimates for the impact of ACUE faculty on student course grades were significant in the during period, $b = .12$, $SE = .03$, 95% CI [0.06, 0.18], $p < .001$, but not significant in the post period, $b = –.00$, $SE = .04$, 95% CI [–0.08, 0.07], $p = .923$. Specifically, the grades of students taught by ACUE faculty increased, on average, .12 points (on a 4.0 scale) from the pre-ACUE period to the during-ACUE period, controlling for changes among students taught by non-ACUE faculty (Figure 1).



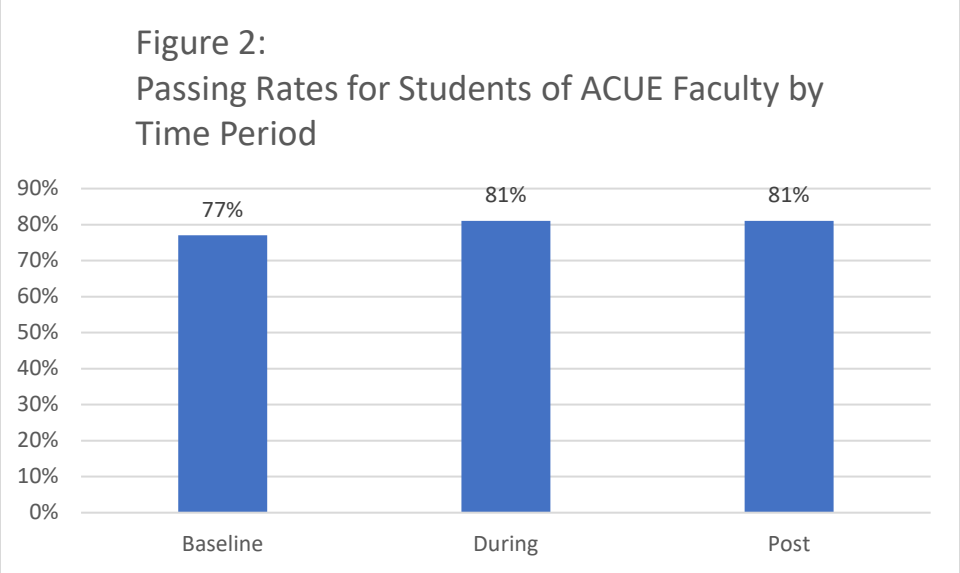
Note. The outcomes above reflect the regression-adjusted means.

Follow-up analyses restricted to college freshman to minimize bias related to any potential unobserved sorting of students to ACUE faculty over time. Although we believed it was unlikely that students selectively sort into (or out of) courses taught by ACUE faculty in the exact years that faculty begin or complete their ACUE course, the ability to sort would be least likely by freshman students given their relatively limited knowledge about different faculty. We observed 14,158 student-by-course-section-level outcomes when we restricted to college freshmen.

Follow-up analyses that restrict to college freshman reveal that DID estimates were significant in the during period, b = .17, SE = .05, 95% CI [0.08, 0.27], p = .001, but not significant in the post period, b = .01, SE = .07, 95% CI [–0.12, 0.14], p = .859. Specifically, the grades of freshmen taught by ACUE faculty increased, on average, .17 points (on a 4.0 scale) from the pre-ACUE period to the during-ACUE period, controlling for changes among freshmen taught by non-ACUE faculty.

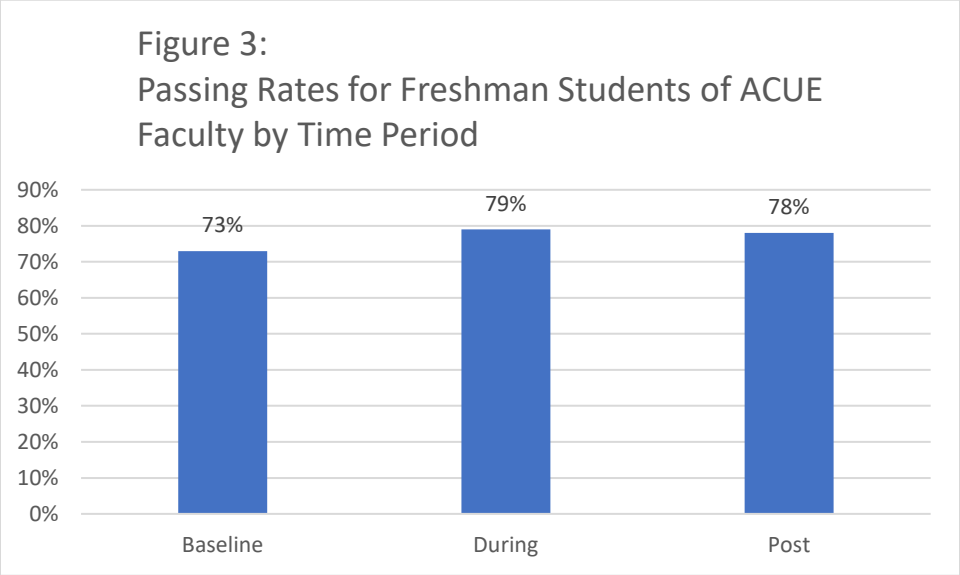
Passing Rates. The DID estimates for the impact of ACUE faculty on student passing rates were significant in both the during period, b = .04, SE = .01, 95% CI [0.02, 0.06], p < .001, and the post period, b = .04, SE = .01, 95% CI [0.02, 0.06], p = .001. Specifically, the passing rates of students taught by ACUE faculty increased, on average, 4.3 percentage

points from the pre-ACUE period to the during-ACUE period, controlling for changes among students taught by non-ACUE faculty (Figure 2). Similarly, the passing rates of students taught by ACUE faculty increased, on average, 3.9 percentage points from the pre-ACUE period to the post-ACUE period, controlling for changes among students taught by non-ACUE faculty.



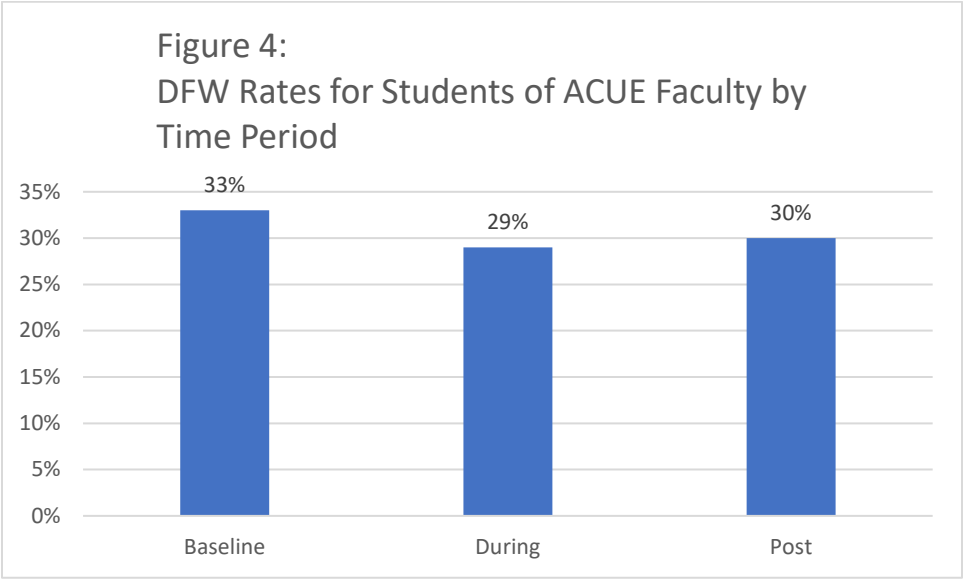
Note. The outcomes above reflect the regression-adjusted means.

Follow-up analyses that restrict to college freshman reveal that DID estimates were significant in the during period, b = .06, SE = .02, 95% CI [0.03, 0.10], p < .001, and in the post period, b = .05, SE = .02, 95% CI [0.01, 0.09], p = .027. Specifically, the passing rates of freshmen taught by ACUE faculty increased, on average, 6.4 percentage points from the pre-ACUE period to the during-ACUE period, controlling for changes among freshmen taught by non-ACUE faculty. Similarly, the passing rates of students taught by ACUE faculty increased, on average, 4.7 percentage points from the pre-ACUE period to the post-ACUE period, controlling for changes among students taught by non-ACUE faculty (Figure 3).



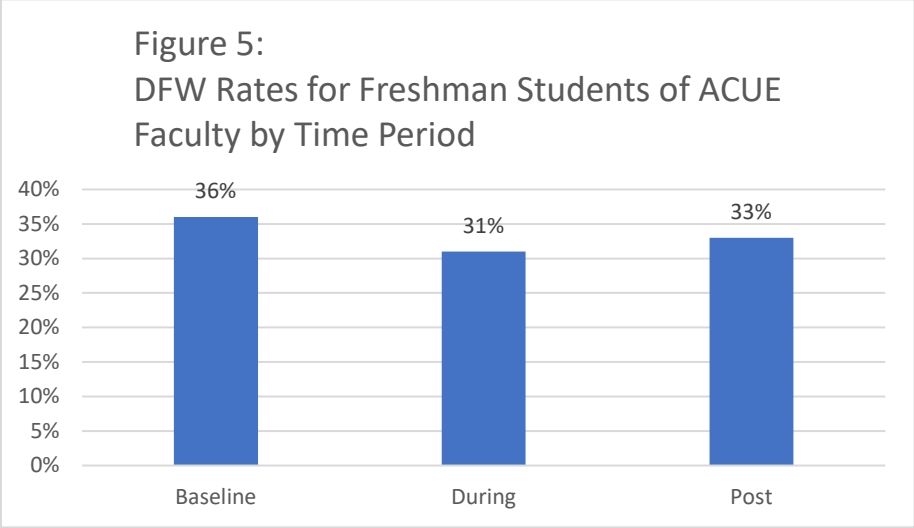
Note. The outcomes above reflect the regression-adjusted means.

DFW Rates. The DID estimates for the impact of ACUE faculty on student DFW rates were significant in both the during period, $b = -.04$, $SE = .01$, 95% CI [–0.06, -0.02], $p < .001$, and the post period, $b = -.03$, $SE = .01$, 95% CI [–0.05, –0.00], $p = .025$. Specifically, the DFW rates of students taught by ACUE faculty decreased, on average, 3.8 percentage points from the pre-ACUE period to the during-ACUE period, controlling for changes among students taught by non-ACUE faculty. Similarly, the DFW rates of students taught by ACUE faculty decreased, on average, 2.9 percentage points from the pre-ACUE period to the post-ACUE period, controlling for changes among students taught by non-ACUE faculty (see Figure 4).



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

Follow-up analyses that restrict to college freshman reveal that DID estimates were significant in the during period, $b = -.05$, $SE = .02$, 95% CI [–0.09, –0.02], $p = .002$, but not significant in the post period, $b = -.03$, $SE = .02$, 95% CI [–0.08, 0.01], $p = .147$. Specifically, the DFW rates of freshmen taught by ACUE faculty decreased, on average, 5.3 percentage points from the pre-ACUE period to the during-ACUE period, controlling for changes among freshmen taught by non-ACUE faculty (see Figure 5).



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

Course Completion. The DID estimates for the impact of ACUE faculty on student course completion were not significant in either the during period, b = .00, SE = .01, 95% CI [–0.01, 0.02], p < .580, or the post period, b = .01, SE = .01, 95% CI [–0.00, 0.03], p = .168. Results therefore provide no evidence of a differential improvement in completion rates over time between ACUE faculty and non-ACUE faculty.

Follow-up analyses that restrict to college freshman also reveal no evidence of an impact of ACUE faculty on student course completion in either the during period, b = .01, SE = .01, 95% CI [–0.01, 0.03], p = .485, or the post period, b = .02, SE = .01, 95% CI [–0.01, 0.05], p < .153.

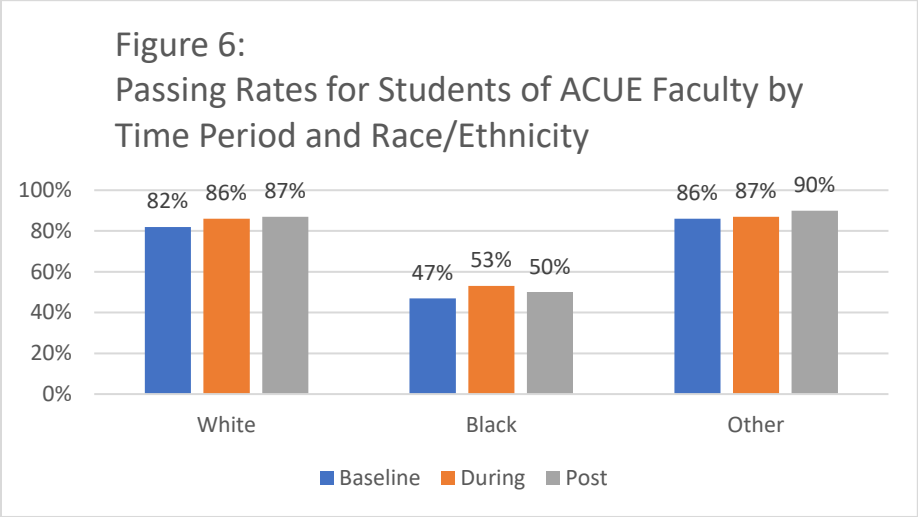
HETEROGENEITY

Additional analyses examined the heterogenous impact of ACUE faculty on student course outcomes by race/ethnicity. We employed a fully interacted model whereby indicators for race were interacted with every variable in our main specification equation (c.f., Denning, 2017).

Course Grades. Using White students as the comparison, there were no significant interactions between race and the impact of ACUE faculty on course grades for Black students in either the during period, b = .01, SE = .04, 95% CI [–0.07, 0.09], p = .776, or the post period, b = –.04, SE = .04, 95% CI [–0.11, 0.03], p = .251. Similarly, there were no significant interactions between race and the impact of ACUE faculty on course grades for "Other" students in either the during period, b = .05, SE = .06, 95% CI [–0.08, 0.17], p = .459, or the post period, b = –.01, SE = .06, 95% CI [–0.12, 0.11], p = .912. These results therefore provided no evidence that there was a differential impact of ACUE faculty on student course grades for Black or "Other" students compared to White students.

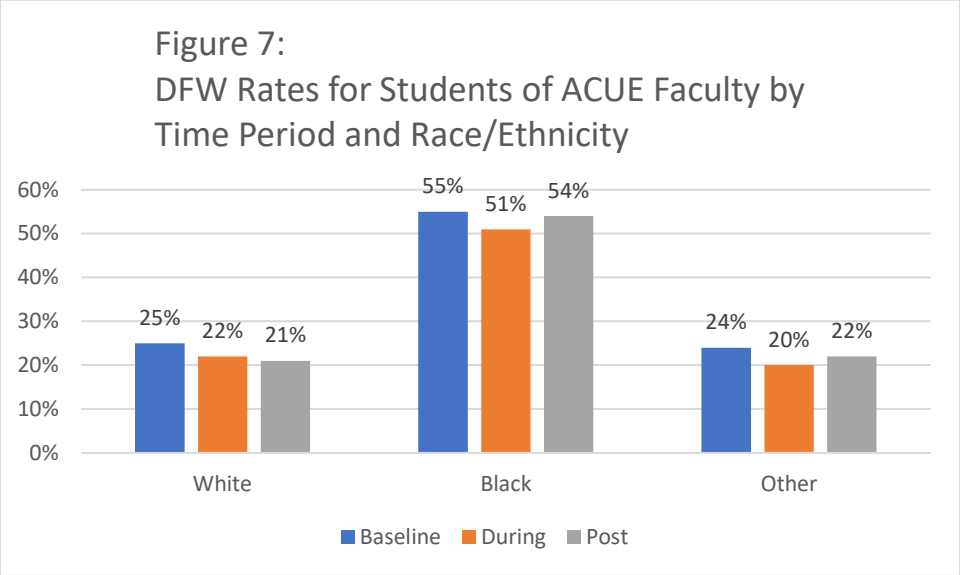
Passing Rates. Using White students as the comparison, there was no significant interaction between race and the impact of ACUE faculty on passing rates for Black students in the during period, b = .02, SE = .01, 95% CI [–0.01, 0.04], p = .130; however, there was a significant interaction between race and the impact of ACUE faculty on passing rates for Black students in the post period, b = –.02, SE = .01, 95% CI [–0.05, –0.00], p = .025. Conversely, there were no

significant interactions between race and the impact of ACUE faculty on passing rates for "Other" students in either the during period, *b* = .01, *SE* = .02, 95% CI [–0.03, 0.05], *p* = .566, or the post period, *b* = –.01, *SE* = .02, 95% CI [–0.05, 0.02], *p* = .505. In summary, passing rates increased more for White students (5.1 percentage points) than for Black students (2.5 percentage points) from the pre-ACUE period to the post-ACUE period, controlling for changes among students taught by non-ACUE faculty (see Figure 6).



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

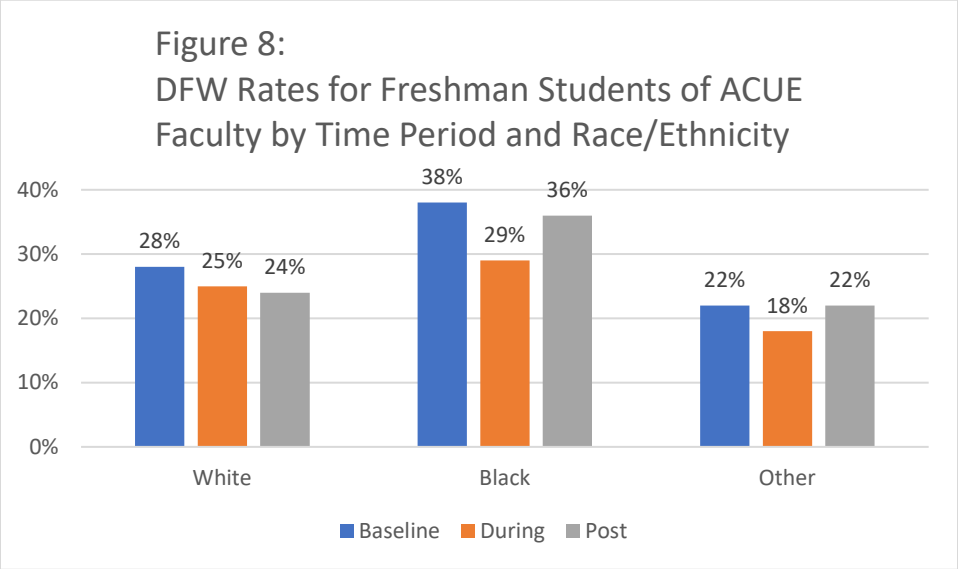
DFW Rates. Using White students as the comparison, there was no significant interaction between race and the impact of ACUE faculty on DFW rates for Black students in the during period, *b* = –.01, *SE* = .01, 95% CI [–0.04, 0.02], *p* = .460; however, there was a significant interaction between race and the impact of ACUE faculty on DFW rates for Black students in the post period, *b* = .03, *SE* = .01, 95% CI [0.01, 0.05], *p* = .015. Conversely, there were no significant interactions between race and the impact of ACUE faculty on DFW rates for "Other" students in either the during period, *b* = –.01, *SE* = .02, 95% CI [–0.05, 0.03], *p* = .593, or the post period, *b* = .02, *SE* = .02, 95% CI [–0.02, 0.06], *p* = .338. In summary, DFW rates decreased more for White students (4.4 percentage points) than for Black students (1.3 percentage points) from the pre-ACUE period to the post-ACUE period, controlling for changes among students taught by non-ACUE faculty (see Figure 7).



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

Course Completion. Using White students as the comparison, there were no significant interactions between race and the impact of ACUE faculty on course completion rates for Black students in either the during period, $b = –.00$, $SE = .01$, 95% CI [–0.02, 0.01], $p = .643$, or the post period, $b = –.01$, $SE = .01$, 95% CI [–0.02, 0.01], $p = .343$. Conversely, there was a marginally significant interaction between race and the impact of ACUE faculty on course completion rates for "Other" students in the during period, $b = .02$, $SE = .01$, 95% CI [–0.00, 0.05], $p = .084$; however there was no significant interaction between race and the impact of ACUE faculty on course completion rates for "Other" students in the post period, $b = .00$, $SE = .01$, 95% CI [–0.02, 0.02], $p = .980$.

College Freshmen. Like the main analyses, we also examine the heterogenous impact of ACUE faculty by race/ethnicity after restricting to college freshman. Here, we only report significant effects. Using White students as the comparison, there was a significant interaction between race and the impact of ACUE faculty on DFW rates for Black students in the during period, $b = –.06$, $SE = .02$, 95% CI [–0.11, –0.01], $p = .013$. Specifically, DFW rates decreased more for Black students (8.8 percentage points) than for White students (2.8 percentage points) from the pre-ACUE period to the during-ACUE period, controlling for changes among students taught by non-ACUE faculty (see Figure 8).



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

DISCUSSION

This evaluation provided evidence that student course outcomes improved in gateway courses taught by faculty who took ACUE microcredential courses between fall 2016 and spring 2020. Improvements in average course grades, passing rates, and DFW rates occurred for students in gateway course sections taught by ACUE faculty while faculty were taking ACUE microcredential courses. Improvements in student passing rates and DFW rates also occurred in the years after faculty completed the ACUE microcredential course, demonstrating the sustained impact of receiving an ACUE certificate. Examining interactions with race/ethnicity showed that these sustained impacts of ACUE-certified faculty on student passing rates and DFW rates were larger for White students than for Black students.

Improvements in student passing rates and DFW rates remained apparent after restricting our sample to college freshmen. Although there were only sustained improvements in passing rates in the post period, the magnitudes of estimates in the during period were larger for college freshman than for the full sample, indicating that freshmen may see a particular benefit from ACUE faculty in gateway course sections. Importantly, examining interactions with race/ethnicity showed that the impact on DFW rates was 6 percentage points larger for Black freshmen than for White freshmen.

These results add to 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 the previous research by demonstrating the impact of the ACUE faculty who took the ACUE microcredential course as opposed to the full ACUE course, thus furthering our knowledge on the impact of different types of ACUE course offerings. No previous evaluations have examined the impact of the ACUE microcredential course.

One limitation of the current study is that the analyses do not account for clustering of outcomes, such as within sections, courses, instructors, or individuals. Accounting for clustering of units is common to empirical work as the nonindependence of units can affect the standard errors and thus statistical significance. However, given that some instructors teach multiple gateway course titles and that courses include some sections taught by ACUE faculty and others taught by non-ACUE faculty, it is unclear whether courses should be considered nested within faculty or vice versa. How data should be clustered is additionally complicated by students who are taught by both ACUE faculty and non-ACUE faculty. In these cases, the interdependence of observations makes it more difficult to find significant differences because it means that the observations across clusters—e.g., students across faculty—are correlated. Furthermore, the benefit of the ACUE course on students' growth mindset, for example, could carry over into those students' outcomes in their other courses. Therefore, the complicated nature of the data makes for a more conservative test of the ACUE impact in some ways, and a more liberal test in other ways—variations that could balance each other out. However, future research should account for at least one aspect of the clustered nature of the data.

Future research should also explore why improvements in student outcomes were, on one hand, larger for Black freshmen than for White freshmen while faculty were earning their credential and, on the other hand, broadly larger for White students than for Black students in the years after faculty were credentialed. One possible reason is that, while taking an ACUE microcredential course, ACUE faculty at USM have access to interactive resources. For example, USM

held weekly meetings for ACUE faculty. To the extent that these meetings allowed for discussions on fostering racially inclusive environments, they may have been particularly consequential for Black freshmen. Therefore, reduced access to these interactive resources might explain why improvements were not sustained for Black freshman. Conversely, certain structural and curriculum changes might have been adopted that partially explain broader sustained improvements.

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APPENDIX

Appendix Table 1 *Gateway Courses at USM*	
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

Appendix Table 2

Summary Statistics for Students of ACUE Faculty by Time Period

Variable	Pre-mean	*SD*	Obs	During-mean	*SD*	Obs	Post-mean	*SD*	Obs
Female (%)	0.70	0.46	5,389	0.69	0.46	5,289	0.72	0.45	8,349
Black (%)	0.38	0.48	5,389	0.34	0.47	5,289	0.39	0.49	8,349
White (%)	0.52	0.50	5,389	0.55	0.50	5,289	0.52	0.50	8,349
Other (%)	0.10	0.30	5,389	0.11	0.31	5,289	0.09	0.29	8,349
Freshman (%)	0.48	0.50	5,389	0.38	0.49	5,289	0.36	0.48	8,349
Sophomore (%)	0.31	0.46	5,389	0.37	0.48	5,289	0.38	0.49	8,349
Junior (%)	0.13	0.34	5,389	0.16	0.36	5,289	0.17	0.38	8,349
Senior (%)	0.08	0.28	5,389	0.09	0.29	5,289	0.08	0.28	8,349
Pell recipient (%)	0.52	0.50	5,389	0.51	0.50	5,289	0.53	0.50	8,349
First generation (%)	0.40	0.49	5,389	0.36	0.48	5,289	0.27	0.44	8,349
ACT English score	22.47	5.16	5,389	23.05	5.20	5,289	22.82	5.29	8,349
ACT Math score	20.16	3.87	5,389	20.65	3.92	5,289	20.47	4.00	8,349
Complete (%)	0.92	0.27	5,389	0.93	0.26	5,289	0.94	0.24	8,349
Passing (%)	0.77	0.42	5,389	0.82	0.38	5,289	0.82	0.38	8,349
DFW (%)	0.33	0.47	5,389	0.27	0.45	5,289	0.28	0.45	8,349
Grade	2.33	1.39	4,963	2.47	1.28	4,895	2.38	1.27	7,514