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CONTINUOUS IMPROVEMENT:

Improved Grades in Sections Taught by ACUE Faculty at Purdue University Northwest in the Year After They Earned Their Credential

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Executive Summary

Recent evaluations provide evidence of positive effects of the Association of College and University Educators (ACUE) credential on student course outcomes (Hecht, 2019; Lawner & Snow, 2018; Lawner & Snow, 2019a; Lawner & Snow, 2019b; Lawner, Snow & Burt, 2019; Lawner et al., 2019; Lawner & Snow, 2020; Pippins et al., 2021). While nearly all the prior evaluations have examined the student impact of faculty earning the ACUE credential that occurred concurrently while faculty were earning the credential, a subset have also examined student outcomes in the year(s) after faculty earned their ACUE credential (Hecht, 2019; Lawner & Snow, 2019b, Lawner & Snow, 2020; Pippins et al., 2021). To understand the impact of the ACUE credential and the effects of faculty development on student outcomes more fully, it is important to study the continued impact after faculty have earned their credential, as well as the impact during academic disruptions and across a variety of institution types.

This evaluation examines the impact of the ACUE course on student course outcomes at Purdue University Northwest (PNW). PNW is a metropolitan university with two campuses in Northwest Indiana. It serves approximately 9,300 undergraduate and graduate students. This evaluation focuses on a cohort of PNW faculty who earned their ACUE credential in the 2018-2019 school year. The differences in outcomes over time in course sections taught by these ACUE faculty are compared to the differences in outcomes over time in statistically matched course sections taught by non-ACUE faculty.

The evaluation found that there was a significant impact of the ACUE faculty on students' average course grades in the year after faculty earned their credential. Relative to the baseline year, students in course sections taught by ACUE faculty had significantly higher grades in the year after faculty earned their credential. Importantly, there was not a significant improvement in students' average course grades among matched course sections over the same time period.

The evaluation was already underway when the COVID-19 pandemic forced all of higher education to make major adjustments to how instruction was delivered to students. This unanticipated event added a level of complexity to measuring the effects of the ACUE faculty at PNW, but also offers an opportunity to consider how the findings help illuminate the role of faculty development in managing institutional change.

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

Aiming to improve student outcomes through quality college instruction, the Association of College and University Educators (ACUE) developed an accountability framework to conduct evaluations of its partnerships with colleges and universities where faculty are credentialed in effective college instruction through ACUE's courses in effective teaching practices (see MacCormack et al., 2018). 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. The current study evaluates the impact of the ACUE course in Effective Teaching Practices on level 5.

The impact of ACUE faculty on student outcomes has been evaluated in several prior evaluations. Evaluations using course-level data have found evidence of positive effects of ACUE credentialling on student success rates (Lawner & Snow, 2018; Hecht, 2019) and average grades (Hecht, 2019; Lawner & Snow, 2019a; Lawner & Snow, 2019b; Lawner, Snow, & Burt, 2019).[2] More recent evaluations using student-level data have found that not only were students taught by ACUE faculty more likely to complete and pass their courses, but a course completion gap closed for Black students and a course passing gap closed for Pell-eligible students (Lawner, Snow, MacCormack et al., 2019; Lawner & Snow, 2020).

While many of the prior evaluations examined the student impact of faculty earning the ACUE credential that occurred concurrently while faculty were earning the credential, a subset have also examined student outcomes in the

[1] To learn more visit acue.org.
[2] Success rates as measured by earning grades A-C or a P (Pass) in courses.

year(s) after faculty earned their ACUE credential (Hecht, 2019; Lawner & Snow, 2019b, Lawner & Snow, 2020; Pippins et al., 2021). To understand the sustainability of the impact of the ACUE credential, it is important to study the continued impact after faculty have earned their credential, as well as the impact during academic disruptions and across a variety of institution types.

This evaluation uses course-section level data to examine the impact of the ACUE course in Effective Teaching Practices on student outcomes at Purdue University Northwest (PNW), a metropolitan university with two campuses in Northwest Indiana that serve approximately 9,300 undergraduate and graduate students. The evaluation focuses on the second cohort of faculty, Cohort B, at PNW who completed the ACUE course and received an ACUE credential during the 2018-2019 academic year. To determine the impact of the ACUE credential, the analysis adopts a difference-in-differences approach, comparing the differences in student outcomes over time in course sections taught by ACUE faculty to the differences in student outcomes over time in course sections taught by non-ACUE faculty.

Methods

Participants and Procedures

At PNW, a cohort of 29 faculty (Cohort B) earned an ACUE credential in the 2018-2019 academic year. This evaluation examines the change over time in courses taught by 27 of the ACUE faculty in Cohort B compared to a set of statistically matched courses taught by non-ACUE faculty.

The Institutional Research office at PNW provided administrative data that was aggregated at the course-section level. The data included course-section characteristics (course name, number, department, term offered, student enrollment counts) and student aggregates by class standing, course completions, and final grades. The data also included faculty demographics, such as faculty rank (e.g., Associate Professor), hire date, and gender.

To ensure that course sections taught by ACUE and non-ACUE faculty were similar except for the faculty ACUE status, we implemented Coarsened Exact Matching (CEM) using four criteria: course name, course number, academic term, and faculty rank.[3] Several restrictions were made prior to implementing CEM. First, because Cohort A consisted of faculty who earned an ACUE credential in the 2017-2018 academic year—the pre-period for Cohort B—their course sections were dropped from the pool of potential matches in all analysis years.

[3] For a detailed explanation of CEM, see Iacus et al. (2008) and Icarus et al. (2012).

Second, because Cohort C consisted of faculty who began an ACUE course in the 2019-2020 academic year—the year after Cohort B earned an ACUE credential—their course sections were dropped from the pool of potential matches in 2019-2020. Third, any faculty who began the ACUE course in Cohort B but did not complete the course with Cohort B—either because they finished with a later cohort or never completed—had course sections that were dropped from the pool of potential matches in both the 2018-2019 and 2019-2020 academic years. These restrictions were necessary to ensure that the pool of match course sections only included course sections taught by non-credentialed faculty. Finally, course sections with fewer than 5 students enrolled were dropped.

When implementing CEM, variables are temporarily "coarsened" (i.e., collapsed) to substantively meaningful categories and exact matches are made on the coarsened data.[4] Given our emphasis in matching on course sections taught, individual ACUE faculty course sections could be matched with course sections taught by multiple non-ACUE faculty (one-to-many), and were not always matched with courses taught by the same faculty across semesters. To compensate for the differential strata sizes, the CEM returned the original, uncoarsened values with normalized weights in a sample of matched course sections taught by ACUE and non-ACUE faculty. These weights were used in subsequent analyses.

Of the 502 course sections taught by the 29 ACUE faculty, our CEM model matched 424 course sections taught by 27 ACUE faculty to 997 course sections taught by 151 non-ACUE faculty.[5] Table 1 shows the breakdown of course section counts and student enrollments by faculty type and time period. The final analytic sample consisted of 1,421 course-section records representing 32,719 non-unique student enrollments (see Table 1 for the breakdown by year and faculty type).

[4] In our preferred CEM, course name and academic term were included based on their original construction. However, given a relatively high dimensionality in course number and faculty rank across course sections, the two variables were temporarily coarsened. Consistent with PNW's course level categorizations (e.g., where graduate level courses are 50000 and 60000), our CEM model recategorized course numbers into 10000-point bins. Similarly, faculty ranks were recategorized into four groups: Group 1 (graduate students), Group 2 (limited term lecturers, continuing lecturers, visiting instructors, visiting assistant professors, and visiting professors), Group 3 (visiting clinical instructors, clinical assistant professors, clinical instructors, clinical associate professors, and clinical professors), and Group 4 (assistant professors, associate professors, and professors).

[5] The CEM model matched 84% of the total course sections taught by ACUE faculty. There was a total of 15 Cohort B faculty for whom at least one course section could not be matched. Because two of these faculty never taught a course section with an available match, they were dropped from the analysis sample.

Table 1

Number of Student Enrollments and Course Sections by Faculty Type and Time Period for Cohort B

	Faculty type					
	ACUE			Non-ACUE		
Time Period	Non-unique student enrollments	Course sections	Number of faculty	Non-unique student enrollments	Course sections	Number of faculty
Baseline	3,208	135	26	8,346	357	109
During ACUE	3,360	139	26	7,551	347	104
Post-ACUE	3,631	150	26	6,623	293	99

Because our primary goal with CEM is to achieve common empirical support, differences may exist between ACUE and non-ACUE faculty in uncoarsened variables as well as variables not included in the CEM model. Demographic data reveals that there was a marginally significant difference between ACUE faculty and non-ACUE faculty in their uncoarsened rank (continuing lecturer, assistant professor, associated professor, and professor), $\chi^2(3, N = 178) = 7.51$, $p = .057$, and a significant difference in total years of experience at PNW, $F(1, 176) = 6.84$, $p = .010$—ACUE faculty had significantly fewer years of experience, ($M = 8.47$, $SD = 6.93$), than non-ACUE faculty, ($M = 12.41$, $SD = 7.26$). There was, however, no evidence of a difference in faculty gender, $\chi^2(1, N = 168) = 2.34$, $p = .126$. Because of the potential for remaining differences post-matching, these variables were included as statistical controls in weighted matched analyses.

For course-section level covariates, balance tests found significant differences in student enrollments, $F(1, 1419) = 6.51$, $p = .011$, where ACUE faculty had slightly larger student enrollments, ($M = 24.05$, $SD = 16.37$), than non-ACUE faculty, ($M = 22.59$, $SD = 17.51$). Because student enrollment was also significantly correlated with each outcome of interest, $p < .001$, it was included as a covariate in all subsequent analyses.

Measures

The course outcomes assessed included average course grades, passing rates, and completion rates. Students who dropped a course before the end of the add/drop period were excluded. To measure average course grades, final grades in each section were converted from an alphabetic scale to a numeric equivalent (A = 4, B = 3, C = 2, D = 1, F = 0), and then averaged for all students in the section. Since only A through F letter grades can be calculated on this scale, students who withdrew from a course before receiving a final grade or had marks with no numeric equivalent were excluded when using average grades as an outcome.[6] Congruently, sections that were taken strictly as Pass/Fail were dropped from these analyses. To measure passing rates, the number of students receiving a passing grade (i.e., A, B, C, D, and P) was divided by the number of students enrolled in the section.[7] A passing or non-passing grade could be identified for all students and in all sections. To measure completion rates, the number of students completing a section with any mark excluding a W (withdrawal) was divided by the number of students enrolled in the section.

Results

Data Analysis Plan

To mitigate biases resulting from omitted factors, such as unobserved changes at PNW that occur contemporaneously with the analysis years, we estimated the impact of ACUE-faculty led course sections on course outcomes using a difference-in-differences (DID) approach. The approach allows for the comparison of changes in outcomes between course sections taught by ACUE and non-ACUE faculty. Regression equations were estimated using ordinary least squares and included normalized weights extracted from the CEM.[8]

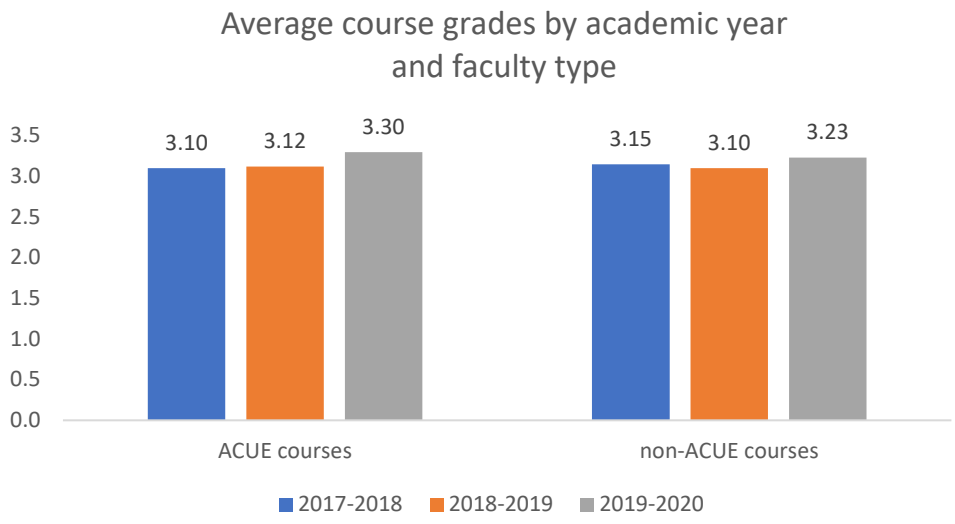
[6] Non-convertible grades included: I (incomplete), N (no pass, i.e., fail), P (pass), and W (withdrawn).
[7] Failing or no grades included: F (fail), I (incomplete), N (no pass, i.e., fail), and W (withdrawn). For more information on how PNW interprets grades, visit: https://catalog.pnw.edu/content.php?catoid=1&navoid=11&hl=attendance
[8] Because we allow course sections taught by ACUE faculty to be matched to multiple course sections taught by non-ACUE faculty, there is an imbalance between the number of observations within each strata of matches. This variance in distribution must be normalized using CEM Weights. For information on how CEM weights are calculated, see: https://docs.google.com/document/d/1xQwyLt_6EXdNpA685LjmhjO20y5pZDZYwe2qeNoI5dE/edit

Regression equations also included course-section level covariates (student enrollment counts and coarsened course number) and faculty demographic covariates (faculty rank, gender, years of teaching experience).[9] Faculty rank was converted to several binary variables. Associate professors taught more course sections on average than other faculty ranks and were, therefore, used as the reference group. Similarly, when controlling for gender, faculty who identified as male were used as the reference group relative to female faculty, who taught fewer course sections in the sample.

Main effects were included for faculty type (dummy coded 1 for ACUE faculty and 0 for non-ACUE faculty) and time period (2017-2018 versus 2018-2019 versus 2019-2020). Time periods corresponded to the baseline, during ACUE, and post-ACUE years, respectively. The parameters of interest were the two-way interactions between faculty type and time period, which capture the change over time in average student outcomes in course sections taught by ACUE faculty relative to course sections taught by non-ACUE faculty. Finally, when the interactions between faculty type and time period were significant, follow-up analyses were conducted to examine the main effect of time among course sections taught by ACUE faculty and separately among course sections taught by non-ACUE faculty.

The results interpreted below focus on the parameters of interest in each model and use the baseline time period as the reference group such that time period effects and interactions indicate a change from baseline.

Figure 1



Note: In Figure 1, the baseline period is 2017-2018, the during period is 2018-2019, and post period is 2019-2020.

[9] There was no significant difference in coarsened course numbers between courses taught by ACUE and non-ACUE faculty. The covariate was included in analyses, however, to increase the precision of estimates.

Average Grades. The DID estimates for average course grades showed a marginally significant interaction between faculty type and the during-ACUE time period, b = .12, SE = .07, 95% CI [-0.01, 0.25], β = .06, p = .074, compared to the baseline time period. Furthermore, there was a significant interaction between faculty type and the post-ACUE time period, b = .16, SE = .07, 95% CI [0.03, 0.28], β = .08, p = .016, compared to the baseline time period (see Figure 1). Follow-up analyses explore the interaction between faculty type and the during-ACUE time period as well as faculty type and the post-ACUE time period.

Follow-up analyses examining course sections of ACUE faculty and course sections of non-ACUE faculty separately showed that course sections taught by non-ACUE faculty experienced a marginally significant decline in average grades in the during-ACUE time period, b = -.06, SE = .04, β = -.05, 95% CI [-0.13, 0.00], p = .082, while for course sections taught by ACUE faculty there was no evidence of a significant change in average grades in the during-ACUE time period, b = .06, SE = .06, β = .05, 95% CI [-0.06, 0.17], p = .324, compared to the baseline time period.

Conversely, there was improvement in average grades in course sections taught by ACUE faculty, b = .25, SE = .06, 95% CI [0.14, 0.37], β = .21, p < .001, as well as in course sections taught by non-ACUE faculty, b = .07, SE = .03, 95% CI [0.01, 0.15], β = .07, p = .024, in the post-ACUE time period compared to the baseline time period. Consistent with the DID estimate, the improvement that occurred in course sections taught by ACUE faculty was larger than in course sections taught by non-ACUE faculty.

Passing Grades. The DID estimates for the fraction of students receiving a passing grade showed no significant interaction between faculty type and the during-ACUE time period, b = .01, SE = .30, 95% CI [-0.01, 0.04], β = .04, p = .304, or faculty type and the post-ACUE time period, b = .00, SE = .01, β = .01, 95% CI [-0.02, 0.03], p = .806, compared to the baseline time period.

Course Completion. The DID estimates for the completion rates showed no significant interaction between faculty type and the during-ACUE time period, b = .01, SE = .01, β = .04, 95% CI [-0.01, 0.03], p = .308, or between faculty type and the post-ACUE time period, b = -.01, SE = .01, β = -.02, 95% CI [-0.03, 0.02], p = .643, compared to the baseline time period.

Academic Disruptions during COVID-19

Due to the COVID-19 pandemic, PNW announced on March 16, 2020 that courses would operate remotely for the remainder of the semester.[10] Considering the post-ACUE period overlaps with the onset of the pandemic during spring 2020, we conducted follow-up analysis on average course grades treating fall 2019 and spring 2020 separately as the post-ACUE period.

When examining average course grades, follow-up analyses using only fall 2019 as the post-ACUE period showed a marginally significant interaction between faculty type and the post-ACUE period, b = .13, SE = .08, 95% CI [-0.02, 0.29], p = .097. Moreover, follow-up analyses that use only spring 2020 as the post-ACUE period showed a significant interaction between faculty type and the post-ACUE period, b = .18, SE = .08, 95% CI [0.03, 0.33], p = .021. The observed patterns when separating the post-period terms are the same as described when considering the terms together and provide evidence that the impact of ACUE on average course grades was persistent in spite of the academic disruption caused by COVID-19.

Discussion

There was a significant improvement in average course grades in sections taught by both ACUE and non-ACUE faculty between the baseline time period and the post-ACUE time period. However, the improvement was significantly larger in course sections taught by ACUE faculty, providing evidence of a positive effect of ACUE in the year after Cohort B faculty earned an ACUE credential.

The coefficients from the regression equation were used along with demographics of the ACUE faculty and course-section characteristics in the post-ACUE time period to estimate the regression-adjusted improvement in average grades due to the ACUE course. The calculations indicate that, in course sections taught by ACUE faculty, average grades were 0.16 grade points higher in 2019-2020 than would have been otherwise (i.e., 3.30 instead of 3.14 on a 4.0 scale).

Improvements in average course grades complement prior evidence demonstrating faculty development courses can result in improved student outcomes, including student success rates (Lawner & Snow, 2018), average grades (Lawner & Snow, 2019a; Pippins et al., 2021), and passing rates (Lawner & Snow, 2020). The findings also extend previous research in important ways. They provide evidence of the continued impact of ACUE courses on faculty effectiveness in the year

[10] To view the announcement from PNW's chancellor, visit: https://www.pnw.edu/covid-19-update-from-chancellor-keon-spring-and-summer-2020/

after participation. There are multiple reasons why the ACUE course leads to increased grades, including broadly stronger instruction by ACUE faculty that leads to better student learning.

Of interest is the continued positive effect of faculty development training on grades during academic disruptions, specifically COVID-19. ACUE's content around engaging students, active learning, and emphasis on clarity in grading and expectations might have been particularly important throughout a period of disruption in students' lives during COVID-19, leading students to better demonstrate their knowledge. Future research should seek to understand the impact of ACUE credentialing during the COVID-19 pandemic and how faculty development functions as a driver of student success in times of transition at an institution.

Examining other outcomes, we find no evidence of a differential change in passing rates or completion rates between courses taught by ACUE and non-ACUE faculty over time. This finding may in part be attributed to high baseline course completion rates, which were approximately 95 percent at PNW in the 2017-2018 academic year. Results on completion rates may therefore be attenuated by a ceiling effect, such that room for improvement may be narrow for students in subsequent years. Given a two-percentage point decline in overall completion rates that occurred at PNW in Spring 2020 (in part attributable to the COVID-19 pandemic), future analyses may be better able to estimate the effect of ACUE on completion rates in academic terms that succeed the pandemic.

One limitation of the current study is that the analyses do not account for clustering of outcomes, such as within sections, courses, or faculty. This non-independence of observations can affect the standard errors and thus statistical significance. However, given that faculty teach multiple courses and sections, and those courses include some sections taught by ACUE faculty and others taught by non-ACUE faculty, it is unclear whether sections should be considered nested within faculty or vice versa. Choosing a method of clustering is additionally complicated because students are not unique to courses; rather, they may be 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 groups are more similar to each other. 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.

A final limitation is that, because the data is not student level, we cannot examine any differences across student demographics nor control for any such differences that might exist. Future research should consider heterogeneous effects across student demographics. It should also explore why impacts on course outcomes sometimes occur while faculty are taking the ACUE course and at other times after faculty have earned their credential.

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