

Modality and Student Success

A Comparison of Competency-Based and Face-to-Face Course Sections

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Introduction

Competency-based education (CBE), broadly defined, awards college credit to students based on demonstrated knowledge rather than clock hours spent in a classroom (Rasmussen, Northrup, & Colson, 2017). In response to growing calls for educational innovation, over 500 colleges and universities have launched competency-based programs and courses. An additional 400 institutions report being either interested in adopting competency-based education or in the process of creating a CBE program (Lurie, Mason, & Parsons, 2019). Many view CBE as a “compelling, learning-centric way of reaching people who’ve been left behind by higher education” (Fain, 2019).

Unfortunately, much of the research on CBE has focused on program development and administrative processes (Uranis & Bibbs, 2017). Research on student success in CBE is limited (American Institutes for Research, 2020). In this third of three research briefs, I discuss findings from a study comparing the academic success of students in CBE courses with students in traditional face-to-face courses. This project was completed in partnership with the [National Research Collaborative on Competency-Based Education and Learning](#).

Study Context and Methodology

Data used in this study came from a community college district (hereafter called the district) in the southern region of the United States. The district contains 16 colleges across a wide geographic area and enrolls over 100,000 students. CBE courses in this district are traditional community college courses redesigned in a competency-based learning framework. Each course has up to five modules that students must pass. Each module begins with a pretest to measure a student’s prior knowledge of the module materials. Students who demonstrate mastery in the pretest can progress directly to the posttest and earn credit for the module. Students who do not pass the pretest proceed through assignments and assessments at their own pace until they have demonstrated mastery of course content.

CBE courses in the district are asynchronous, online, and self-paced. The courses are typically facilitated by full-time faculty, and students are provided with CBE success coaches who can assist them with issues they might have in the course. CBE courses in the district also offer students flexible enrollment options. Students have the option of starting a CBE course each Monday for the first ten weeks of the semester. As a result, students can complete a course in anywhere from 6 to 15 weeks.

For many courses in the district, students have options with regard to the modality they use to complete a course. For example, students taking Math 101 (a hypothetical course) may have the option to complete the course in a traditional face-to-face format, a synchronous non-self-

paced online format, a hybrid format, or a CBE format. I exploited this unique aspect of courses in the district to examine if students taking CBE formatted courses had similar success (as measured by final course grade) to students taking the same course in a face-to-face format. To do this, I obtained data for all first-time students in the district during the 2018-2019 academic year enrolled in a course offered with both face-to-face and CBE sections. The dataset contained several student demographic and enrollment characteristics commonly used to predict student success in college courses, such as race, academic preparation, and Pell Grant status. The dataset also contained student final letter grades for courses. Grades ranged from A to F and included grades of W for students who voluntarily withdrew from a course.

I then identified the courses with the largest enrollment of CBE students. The five courses with the largest CBE enrollment were the focus of this study. Those courses were Introduction to Computers, Human Anatomy and Physiology, Academic Writing, General Psychology, and College Reading. I provide information on the student enrollment modality distribution for each of these courses in the next section of this report.

After identifying the courses that would be the focus of this study, I used inverse propensity weighting to create covariate balance between students enrolled in face-to-face and CBE sections of the same course. I used eight covariates to create a predicted probability of student enrollment in either face-to-face or CBE sections of a given course. Table 1 describes the eight variables used in the model. After creating weights to balance groups of students in face-to-face and CBE sections, I used OLS regression to estimate the relationship between course modality and final student grades after controlling for the variables listed in Table 1¹. I also estimated logistic regression models to explore the relationship between course enrollment modality and the odds of students voluntarily withdrawing from the course².

Table 1: Variable Names and Descriptions

Variable Name	Description
Enrollment status	Indicator of whether students were enrolled full-time or part-time during the semester in which they took a CBE course
Race	Student self-reported race coded as nonunderrepresented (white & Asian) or underrepresented minority (Black, American Indian, Hispanic, Non-residents, two or more races, race unknown) ³
Previous college credit	Measure of whether students had some or no previous college credit before enrolling in the district
Sex	Student self-identified sex coded as male or female. Students with unknown sex were dropped from the analysis

Academic preparation	District-developed measure of student college readiness based on high school GPA and exam scores coded as unprepared, prepared, or no preparedness indicator
Academic program	Measure of whether students majored in transfer or occupational/technical curriculum
Pell Grant	Total amount of federal Pell Grant money received by a student (ranging from 0 to \$8,381)
Supporting college	Indicator of whether a student’s home college is one of six CBE Charter Colleges within the district

Findings

Introduction to Computers

Introduction to Computers offers students in the district an overview of computer hardware and software, file management, green computing security, and computer ethics. In the 2018-2019 academic year, 5,243 first-time students enrolled in this course. Of those, 1,484 students enrolled in a face-to-face section of the course, while 118 students enrolled in a CBE section of the course. The remaining students enrolled in traditional online sections or hybrid sections and were excluded from this analysis. After dropping students who did not report their biological sex, students with a grade of W, and students with course section enrollment predicted probabilities outside the common support criteria, the final sample contained 1,318 face-to-face students and 104 CBE students. Regression analysis with inverse propensity score weights found very little difference in the final grades of students in face-to-face and CBE sections of the course ($\beta = -.024$, $SE = .252$). This small difference was not statistically significant.

When propensity score weights were calculated including students who voluntarily withdrew from the course, the final sample (after excluding students who failed to report biological sex and students outside the common support criteria) included 1,470 students in face-to-face sections and 118 students in CBE sections of Introduction to Computers. Logistic regression found no statistically significant difference in the odds of students withdrawing from a course based on the modality by which the course was taken (Odds Ratio = .741, $SE = .252$).

Human Anatomy and Physiology

The district offers human anatomy and physiology as a course designed to introduce students to the human body’s structure and function. A total of 2,358 first-time students in the district

enrolled in anatomy and physiology during the 2018-2019 academic year. One thousand seven hundred and seventy-two (1,772) took the course face-to-face, while 110 took the course in a CBE format (the remaining students took the course online or hybrid). After dropping students who did not report their biological sex, students with a grade of W, and students with section enrollment predicted probabilities outside the common support criteria, the final sample contained 1,133 face-to-face students and 63 CBE students. Findings from the regression model with inverse propensity score weights showed that while students in CBE sections of anatomy and physiology were predicted to have lower grades than students in face-to-face sections, that beta coefficient was not statistically significant ($\beta = -.3048$, $SE = .265$)

After recalculating course enrollment predicted probabilities without dropping students with a grade of W (but still excluding students who failed to report biological sex and students outside the common support criteria), I was left with a final sample of 1,394 face-to-face students and 108 CBE students in human anatomy and physiology. Logistic regression with inverse propensity score weights using these data revealed that the odds of withdrawing from anatomy and physiology were 4.64 times higher for students in CBE sections of the course. This estimate was statically significant at the 99% confidence level.

Academic Writing

Academic Writing is a course that provides instruction on using essays to express ideas in standard English. The course teaches students how to think logically, respond to texts, address specific audiences, and document sources. This course is very popular in the district, enrolling 7,434 first-time students. Of those, 4,509 enrolled in face-to-face sections of the course, while 53 enrolled in CBE sections of the course (all other students enrolled in online or hybrid sections). After dropping students who did not report their biological sex, students with a grade of W, and students with course section enrollment predicted probabilities outside the common support criteria, the final sample contained 1,734 face-to-face students and 41 CBE students. Regression analysis with inverse propensity score weights found a large, statistically significant difference in the final grades of students in face-to-face and CBE sections of the course. Students in CBE sections of Academic Writing scored the equivalent of two letter grades lower than students in face-to-face sections of the course ($\beta = -1.98$, $SE = .223$).

When I calculated propensity score weights without excluding students who voluntarily withdrew from the course (but still excluding students who failed to report biological sex and those outside the common support criteria), the final sample included 3,182 students in face-to-face sections and 53 students in CBE sections of Academic Writing. Logistic regression found no statistically significant difference in the odds of students withdrawing from the course based on the modality by which the course was taken (Odds Ratio=1.40, $SE = .542$).

General Psychology

General Psychology teaches students the history, methods, and content of modern psychology. In 2018-2019, the course enrolled 4,656 first-time students in the district. Two thousand three hundred and sixty-eight (2,368) students took the course face-to-face, while 48 took the course in a CBE format (the remaining students took the course online or hybrid). After dropping students who did not report their biological sex, students with a grade of W, and students with course section enrollment predicted probabilities outside the common support criteria, the final sample contained 1,147 face-to-face students and 42 CBE students. Findings from the regression model with inverse propensity score weights showed that students in CBE sections of General Psychology earned significantly lower final grades than students in face-to-face sections of the course ($\beta=-1.16$, $SE=.271$). This beta coefficient is equivalent to just over a one letter grade lower score for CBE students.

When propensity score weights were calculated including students who voluntarily withdrew from the course, the final sample (after excluding students who failed to report biological sex and students outside the common support criteria) included 1,219 students in face-to-face sections and 48 students in CBE sections of General Psychology. Logistic regression found no statistically significant difference in the odds of students withdrawing from a course based on the modality (Odds Ratio=1.10, $SE=.600$).

College Reading

College reading is designed to improve critical reading, thinking, and writing at the college level. The course is part of the district's reading placement curriculum and is offered to students who score below a certain cutoff on placement exams. In the 2018-2019 academic year, 479 first-time students enrolled in this course. Of those, 215 students enrolled in a face-to-face section of the course, while 47 enrolled in a CBE section of the course (the remaining students took the course online). After dropping students who did not report their biological sex, students with a grade of W, and students with course section enrollment predicted probabilities outside the common support criteria, the final sample contained 140 face-to-face students and 41 CBE students. Regression analysis with inverse propensity score weights found a large, statistically significant difference in the final grades of students in face-to-face and CBE sections of the course. Students in CBE sections of College Reading scored the equivalent of nearly two letter grades lower than students in face-to-face sections of the course ($\beta=-1.88$, $SE=.343$).

When I calculated propensity score weights without excluding students who voluntarily withdrew from the course (but still excluding students who failed to report biological sex and those outside the common support criteria), the final sample included 159 students in face-to-face sections and 45 students in CBE sections of College Reading. Logistic regression found no

statistically significant difference in the odds of students withdrawing from the course based on the modality by which the course was taken (Odds Ratio=.54, SE=.523).

Discussion and Conclusion

For CBE to reach its full potential as a transformative educational innovation, the higher education community must better understand student outcomes in CBE classes and programs. Previous research has explored variation in program completion rates (Parsons, Mason, & Soldner, 2016) and program satisfaction (Rivers & Sebesta, 2017) among CBE Students. This study adds to our understanding of CBE student success by exploring the final grades of CBE students relative to non-CBE students enrolled in the same course.

Under ideal experimental conditions, I would randomly assign students enrolled in the same course into face-to-face and CBE sections. Then, at the end of a semester, I could examine final grades to determine if course modality had a causal impact on student course success. Unfortunately, my data did not allow for this type of experiment. While I did attempt to mitigate the effects of selection bias in this study by using propensity score weights, there are undoubtedly many unmeasured or unmeasurable student characteristics that correlate with both course modality selection and final student grades. Because of this, I cannot make causal claims about the findings presented in this research brief. However, this study does offer compelling evidence about student success in CBE courses.

In only one of the five courses examined were outcomes for face-to-face and CBE students the same (Introduction to Computers). In the other four courses, CBE students experienced less optimal final course outcomes. In one course (human anatomy and physiology), students in CBE sections were more likely to withdraw than students in face-to-face sections. In three courses (Academic Writing, General Psychology, and College Reading), students in CBE sections earned significantly lower final grades than students in face-to-face sections. For advocates of CBE, these findings are problematic. The structure and flexibility of CBE can certainly increase access to higher education. However, we must also create conditions where students in CBE courses can be as successful as students in traditional college courses. The findings presented here suggest colleges and universities can do more in this regard.

Work to improve course outcomes for CBE students begins by identifying discrepancies. Colleges and universities with CBE courses and programs should monitor student grades to determine whether CBE and face-to-face students perform differently. If performance differences are found, like they were in this study, work should be done to understand why these differences exist. Findings presented in this research brief point to the existence of grade differences based on course modality. I cannot, based on these findings, make claims about why these differences exist. Future research should ask students about their CBE experiences and how those experiences promote or hinder in-class success.

Once colleges and universities can identify the factors leading to lower CBE student success, they can create targeted interventions. These student support interventions might include

mentoring, flexible academic tutoring, and increasing the number of CBE coaches working with students. These support initiatives should be targeted and active. Because many CBE students have other demands on their time (Rasmussen et al., 2017), administrators cannot wait on students to come to them. CBE administrators must proactively seek opportunities to support students.

Final course grades are not the only measure of student success. Indeed, college success is a multifaceted and complex construct (Wang, 2017). It is possible that while student final course grades differed for CBE and face-to-face students, student learning across the two modalities did not differ. For this specific empirical study, due to data availability, I defined student success in terms of final course grades. Future studies should consider conceptualizing student success in different ways, such as student satisfaction or student success in subsequent courses.

I hope this research brief motivates increased conversation around CBE student success. CBE students should not be forced to choose between course flexibility and structures that fail to facilitate student success. Avoiding this means properly supporting students along their CBE journey.

Want More Information?

AIR is active in the CBE research community and is committed to building partnerships to gather evidence regarding the effectiveness of CBE programs. Please send any questions about this research brief to Willis A. Jones, Associate Professor of Higher Education and Student Affairs, at jonesw150@usf.edu.

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Footnotes

¹ In regression models, course grades were treated as discrete variables with F assigned a value of 0, D assigned a value of 1, C assigned a value of 2, B assigned a value of 3, and A assigned a value of 4.

² In models estimating student final grades, only students who earned a final grade in the course were included in the propensity score match and regression. In models estimating student withdrawal, all students were used in the propensity score match and regression.

³ This definition comes directly from the district's definition of underrepresented minority.

⁴ Detail descriptions of study findings are available upon request.

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