MATHEMATICA Policy Research

EXECUTIVE SUMMARY

Implementation and Outcomes of Competency-Based Education in Three Community Colleges

Findings from the Comprehensive Evaluation of a TAACCCT Grant

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Between 2011 and 2014, the U.S. Department of Labor (DOL), Employment and Training Administration (ETA) awarded nearly $500 million per year to individual community colleges and consortia of institutions working together, through the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program. In October 2012, under Round 2 of the program, DOL awarded a $12 million grant to a consortium led by Sinclair Community College (SCC) in Dayton, Ohio, to fund a three-year project titled "Adapting and Adopting Competency-Based IT Instruction to Accelerate Learning for TAA-Eligible, Veterans, and Other Adult Learners."[1] Under the grant, lead college SCC and co-grantees Broward College (BC) in Fort Lauderdale, Florida, and Austin Community College (ACC) in Austin, Texas, implemented programs that "adapted and adopted" the Western Governors University (WGU) model of competency-based education (CBE) in four information technology (IT) programs: programming at ACC, technical support at BC, and networking and software development at SCC. WGU served as a consultant to the colleges and Mathematica Policy Research acted as the external evaluator for the grant-funded project.

This executive summary draws on information from three implementation and outcomes evaluation reports produced by Mathematica (Person, Goble, and Bruch 2014; Person, Goble, Bruch, and Mazeika 2015; and Person, Thomas, and Bruch 2016). It outlines the consortium colleges' CBE models (Section I), summarizes the implementation and outcomes evaluation designs (Section II), discusses implementation and outcomes study findings (Sections III and IV), and concludes with discussion of overarching lessons and implications from the evaluation findings (Section V).

I. Overview of the consortium colleges' CBE program models

Competency-based approaches are not new in U.S. higher education but have received increasing attention in recent years as policymakers and college administrators have struggled to find ways to ensure high quality education while containing costs, potentially by leveraging new technologies (Ford 2014; Johnstone and Soares 2014; Steele et al. 2014).

Evidence and motivation for the CBE approach

Despite growing interest in CBE, little is known about the influence of these models on student outcomes, particularly at the postsecondary level. Several studies published in the 1970s and 1980s examined mastery-based curricula in K–12 and postsecondary settings and found positive effects on student achievement outcomes, but program design and implementation were highly variable (Guskey and Gates 1985, 1986; Kulik et al. 1979; Slavin 1984).

More recent evidence on CBE models has been mixed. A rigorous study of K–12 CBE models found heterogeneous effects on achievement (Steele et al. 2014). At the postsecondary level, another recent study synthesized quasi-experimental evaluations of "adaptive learning technologies"—which use software to customize instructional pace and sequencing according to

[1]The period of performance for Round 2 TAACCCT grantees was originally scheduled for three years, October 1, 2012, through September 30, 2015. In late 2014, DOL extended the period in which Round 2 grantees could offer grant-funded program services through March 31, 2016. The evaluation period for the grants continued as originally scheduled, through September 30, 2016.

student performance—and found moderate positive impacts on learning at some sites, but no effects on course grades or course completion at most sites (Yarnall et al. 2016).

When consortium college leaders developed their TAACCCT grant proposal, CBE models had not been widely applied in community colleges. However, WGU had established itself as a leading CBE provider in higher education (Klein-Collins 2012), and consortium leaders believed the WGU model could be successfully adapted to community college contexts. They also viewed CBE as a way to meet student demand for flexible programs and course schedules with the possibility of acceleration. At the same time, they hoped this approach could help meet employer demand for qualified individuals with appropriate skills and credentials. Finally, college leaders viewed CBE as a promising approach to improve course and program completion rates, especially in online and distance learning programs.

Grant-funded CBE program components

The consortium colleges developed and implemented their programs during the first year of the grant, offering CBE courses for the first time in fall 2013. Although there is variation in how institutions of higher education implement CBE, the consortium colleges embraced some basic attributes common to most models, including WGU's:

- **Definition of relevant and measureable competencies.** CBE models require that all learning outcomes (the essential competencies) be precisely defined, objectively measurable, and reflect skills needed for a given position or field. Although the definition, measurement, and relevance of learning outcomes are standard components of sound instructional design (Gagné et al. 2004), and especially important for distance learning (Bourdeau and Bates 1996), CBE incorporates these elements more explicitly than most traditional higher education models. Most CBE programs focus on preparation for specific jobs from which the competencies are derived, but such focus is not necessary in all cases (for example, general education courses or programs). The consortium used state and industry standards to articulate required competencies for the grant-funded IT programs.
- **Demonstration of competency through valid assessment.** Before advancing through a CBE course or program, students must demonstrate mastery of each competency. Assessments must be clearly linked to required competencies in order to accurately measure mastery. Some models allow students to skip content if they demonstrate mastery on an assessment. The consortium required minimum proficiency, typically corresponding to a B grade on key assessments, and all colleges offered "test out" options with potential tuition savings for students.
- **Potential acceleration through the educational program.** Unlike traditional educational models that hold "time (semesters or quarters) constant and [allow] the level of mastery (as reflected in grades) to vary" (Johnstone and Soares 2014), CBE models allow time to vary but hold constant the minimum level of mastery. As a result, students can move through material at a flexible pace, allowing acceleration, especially for students who can draw on prior education or work experience. The consortium colleges did set guidelines for recommended pace to facilitate students' timely progress through course and program materials.

- **High-quality curricular materials and timely support.** Because CBE models strongly emphasize content mastery and allow students to move through material outside of traditional academic term schedules, the quality and availability of learning resources are paramount and need to be continuously monitored. For independent learning to be effective, students must be able access adequate help when they need it. The consortium used instructional designers to help develop high quality materials, and coaches to provide targeted learner supports from enrollment through completion.

Components of each college's program evolved throughout the grant period, but these overarching features remained more or less constant.

III. Evaluation design summary

The evaluation had two major goals: (1) to understand program implementation, to support interpretation of outcomes and inform program replication and scaling; and (2) to assess the extent to which the TAACCCT-funded curricula improved student learning and employment outcomes, compared with traditional programs. To support both of these goals, the evaluation team worked with the colleges to develop data collection and analysis procedures for performance reporting and continuous improvement efforts.

Implementation study design

The implementation study had two phases, each culminating in a major report. The first phase occurred early in the grant period, between summer 2013 and early 2014. Findings were presented in the interim report (Person et al. 2014), which described the consortium colleges' CBE models at baseline when grant-funded courses were first offered. The second phase occurred near the end of the grant period, between spring and fall 2015, with comprehensive findings presented in the year 3 implementation report (Person et al. 2015).

Implementation research questions. The full implementation study addressed a number of questions related to program strategy and design, operations, delivery, and participation (Table 1). The questions were adapted from the TAACCCT solicitation (DOL 2012) and enhanced with input from consortium leaders.

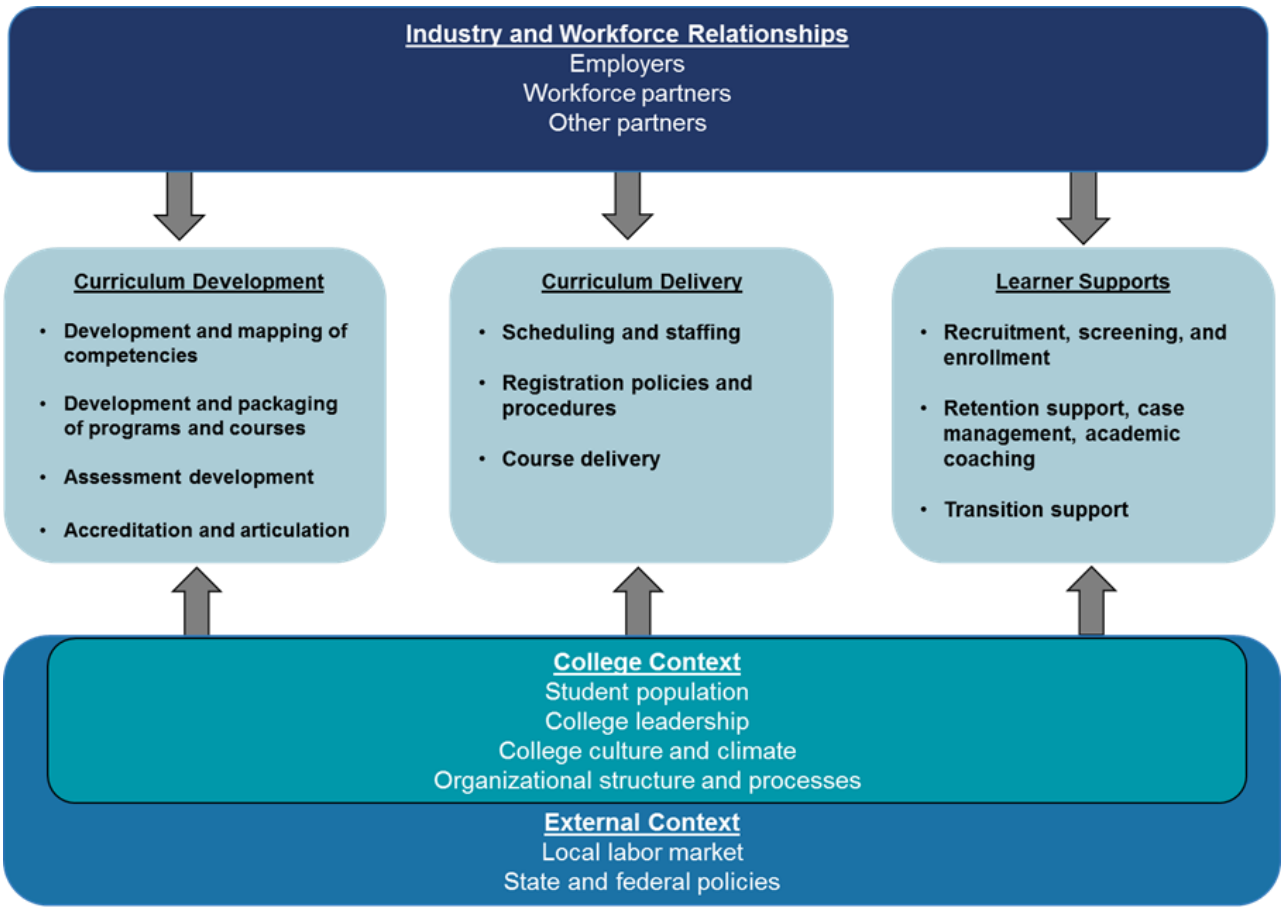
Table 1. Implementation study research questions

Program strategy and design
• What is the rationale for adopting the model?
• How do colleges understand the competency-based approach?
• Why do colleges believe the model is best for their students?
• How do programs operationalize the program components?
Program operations
• What services were offered?
• What role did partner organizations play?
Program delivery
• How were services delivered?
• What administrative structures were put in place to deliver services?

Program participation
• How were students recruited into programs? • How were students entering the program assessed? • How were student assessments used?

Analyzing the development and implementation of CBE programs required attention to several processes that unfolded simultaneously in the first three years of the grant period. The conceptual framework (Figure 1) lists the individuals and processes involved in curriculum development, delivery, and learner supports; emphasizes the industry and workforce relationships that informed and strengthened the programs; and highlights the contextual influences that shaped each college's approach. Using the implementation research questions presented in Table 1 as a guide, the research team applied this conceptual model as an organizing principle for data collection and analysis.

Figure 1. Conceptual framework for analysis of college CBE models



Implementation data and analysis methods. The implementation study drew on the following primary data sources:

- **Notes and materials from webinars** in which each college presented its CBE model were the leading source of data for the interim report (Person et al. 2014). Webinars occurred in summer 2013, just before the colleges launched their programs.
- **Site visits**, completed at all three colleges during late March and early April 2015, were the leading data source for the year 3 implementation report (Person et al. 2015). During these two-day visits, research staff conducted semi-structured interviews and focus groups with 62 individuals in key roles across the colleges, including program leadership and support staff, college leadership, faculty, employers, and students.
- **Administrative data**—from the consortium's implementation database and the colleges' student information systems—informed both implementation reports. The implementation database tracked colleges' progress on key inputs, activities, milestones, and outcomes for all project deliverables and recorded change management activities and capacity building progress. To assess consortium progress toward student enrollment targets, the evaluation team collected and analyzed data from the colleges' student information systems and program intake databases.
- **Extant documents** related to the colleges' implementation activities informed both implementation reports. Documents included program descriptions, meeting minutes, and presentations on topics such as curriculum development and learner supports.

DOL requirements for third-party evaluations of the TAACCCT grants, set forth in the Round 2 grant solicitation (DOL 2012), shaped the analytic approach for the implementation study. Data collection protocols reflected key themes and questions articulated by DOL and refined by the evaluation team in collaboration with consortium leaders. The team organized primary data by theme to facilitate systematic analysis across sources.

Summative outcomes study design

In line with DOL requirements, the outcomes study assessed participant education and employment outcomes, using a comparison group design to assess CBE program impacts.

Research questions. The outcomes study addressed four key research questions, building on the requirements in the Round 2 grant solicitation:

1. What are the cumulative education and employment outcomes of TAACCCT participants?
2. What factors are associated with TAACCCT participants' outcomes?
3. Do education outcomes differ for participants exposed to different course modalities or different levels of student support?
4. How do TAACCCT participants' education outcomes compare to those of nonparticipants?

In examining student outcomes, the evaluation focused on the education and employment outcomes DOL highlighted in the grant solicitation and included in grantees' annual performance reports (for example, program and credential completion, employment entry and retention; Table 3 summarizes these outcomes). Given the short evaluation period, the research team also examined some near-term education outcomes of interest to the consortium colleges and other audiences (for example, gatekeeper course completion).

Outcomes data and analysis methods. The outcomes study drew on two key administrative data sources:

- College administrative data (program intake data, student transcripts, course history data, and self-reported student characteristics available through student records)
- State wage record data (employment and wage data from state workforce agencies)

Using these data, the research team conducted descriptive and correlational analyses for research questions 1 through 3. For research question 4, the team used multivariate regression and propensity score matching methods to compare outcomes of participants and similar nonparticipants.

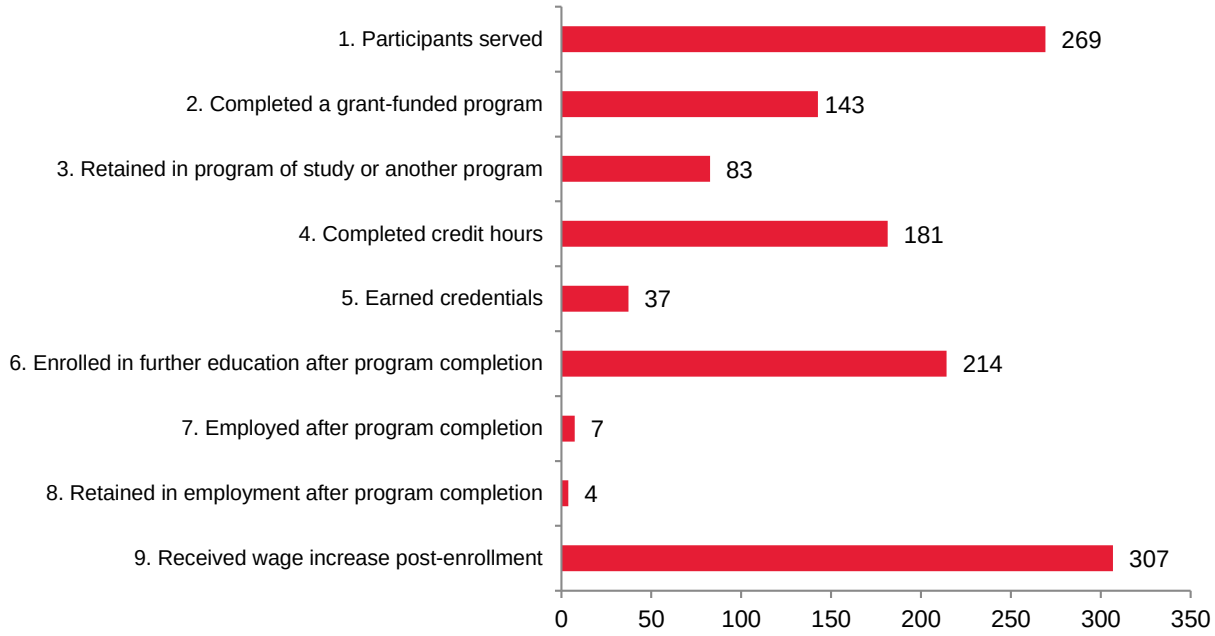
III. Implementation study findings

The consortium colleges successfully implemented their CBE models as planned, with few exceptions. Teams at all three colleges completed a majority of their project milestones on time, as articulated and tracked in the implementation database. To the extent that the colleges deviated from their planned approaches, they typically did so to enhance or expand CBE offerings. The colleges all added courses and/or programs beyond their original implementation plan, generally in response to perceived needs and opportunities. BC experienced some implementation delays attributed to staff turnover and technical infrastructure issues.

The colleges drew on the WGU model, but diverged from it in important ways. All three colleges adopted a collaborative curriculum development process and a learner support model, with academic coaching at its center. Also like WGU, they targeted mature, academically prepared students for their CBE programs. In contrast to the WGU model, the colleges only partially unbundled faculty roles (that is, course and assessment development, teaching, grading, mentoring, and coaching), mostly due to the constraints of using existing full-time, sometimes unionized faculty. None adopted the WGU subscription model for tuition.

The consortium exceeded most performance targets specified in the grant agreement. DOL worked with the consortium to specify targets on nine performance measures, which were then incorporated into the grant agreement. The consortium exceeded targets on five of these measures (Figure 2). In particular, the colleges enrolled nearly three times as many participants as planned and, of these, more than three times as many as planned received a wage increase after enrollment. The consortium also exceeded the program completion target by almost half. They did not meet the credential completion target, but there are at least two countervailing factors. First, programs were offered for three academic years, but most students entered in the second and third years of the grant, allowing less time for credential completion (Person et al. 2016). Second, programs were designed to prepare students for college certificates and degrees, as well as industry certifications, but the latter credential is extended by third-party industry organizations, so data for these credentials were not available. Additionally, the consortium faced challenges meeting the two employment-related outcomes for participants not employed at program entry, largely because most participants were incumbent workers (Person et al. 2016).

Figure 2. Consortium performance targets, percentage achieved



Source: College administrative and state wage record data; figures as of September 30, 2016

Note: The full list of performance measures follows (targets in parentheses): 1. Total unique participants served (2,325); 2. Total number of participants completing a grant-funded program of study (1,193); 3. Total number of participants retained in program of study or other grant-funded program (1,645; the figure cited here reflects the non-cumulative count from the 2016 report year); 4. Total number of participants completing credit hours (2,250); 5. Total number of participants earning credentials (1,420; the figure cited here may include duplicate counts of students earning both a certificate and a degree); 6. Total number of participants enrolled in further education after grant-funded program completion (386; the figure cited includes only participants with continued enrollment at grantee colleges); 7. Total number of participants employed after grant-funded program completion (803); 8. Total number of participants retained in employment after program completion (769); 9. Total number of participants employed at enrollment receiving wage increase post-enrollment (1,066).

Explicit attention to capacity building and change management advanced program scale and sustainability. Consortium leaders knew they would have to engage in proactive change management to achieve the grant's ambitious goals. Toward that end, they created the implementation database as a management tool and advanced an aggressive CBE program implementation plan. With the grant's emphasis on capacity building, program components continued to evolve well into the final year of the grant period. However, the colleges ultimately scaled up and will sustain their programs. Some specific examples include:

- At SCC, the computer information systems (CIS) faculty chose to adopt the grant-funded CBE curriculum department-wide, which program leaders considered a major victory and helped scale up parts of the curriculum to reach all CIS students.
- ACC and SCC were able to expand offerings into additional areas not planned under the grant, including visual communications and software testing.

- All three colleges planned to continue their CBE programs after the grant period, and had secured college funding and institutional homes—in the college's Accelerator lab at ACC, the online campus at BC, and in the CIS department and online campus at SCC.

Table 2 summarizes additional findings for each area in the evaluation's conceptual framework.

Table 2. Implementation study findings by conceptual domain

Curriculum development and delivery
• CBE curriculum development was more collaborative and more standardized than traditional models and relied heavily on instructional designers and tools to support standardization. • CBE course delivery was primarily online, using common templates to reduce students' learning curve. • Timely instructor responses were emphasized; student discussion forums were de-emphasized. • More strategic "chunking" of content was used to improve student progress. • Assessments were not entirely online; test out options (with financial incentives) supported acceleration. • "Unbundling" of the faculty role was sometimes limited by full-time and/or union faculty contracts.
Learner supports
• Student "fit" with CBE models was perceived as critical for success, so colleges were strategic in recruiting and enrolling students, using "high-tech/high-touch" intake processes, which included screening, assessments, and personal interviews. • Coaching models were originally different, but evolved to be similar across colleges; tools supported coaches' work (for example, student data reports, pace charts). • Career and transition supports evolved differently, but all relied on college career services; other activities included resume prep, mock interviews, job fairs, internships, and job placement.
Industry/workforce engagement
• Industry partners informed curriculum development, including current and future competencies; ACC and SCC developed new programs of study in response to employer input. • Partnerships addressed local and regional economic conditions and often built on existing relationships. • There was less engagement than expected with workforce agencies (especially at ACC and BC), but engagement goals were largely similar (recruitment and career supports).
Internal and external contextual influences
• High-level and consistent project leadership facilitated implementation; turnover in BC leadership resulted in implementation challenges. • Institutional culture, climate, and processes posed both supports and barriers to CBE implementation. • Continuous improvement required the right data, strong research capacity, and structured inquiry processes; the colleges varied in their access to these resources. • State and federal laws or regulations were not major influences, but colleges were keenly aware of policymakers' interest in CBE and sometimes engaged with policymakers.

Source: Person et al. 2015.

IV. Summative outcomes study findings

Three of the four research questions examined in the outcomes study pertained to program participants; the fourth question centered on a comparison of participants and nonparticipants.

Participant outcomes. Table 3 summarizes findings for the first research question: *What are the cumulative education and employment outcomes of TAACCCT participants?* The outcomes correspond to those set forth in the grant solicitation and grantee agreements, and largely reflect those reported in grantees' annual performance reports.

Table 3. CBE participants' cumulative education and employment outcomes

Participant outcomes	ACC	BC	SCC	Consortium
Number of participants	814	509	4,233	5,556
Total number who have completed a grant-funded program of study	453	93	1,084	1,630
Total number who completed a program of study and are still enrolled at the college	239	41	726	1,006
Total number of students completing credit hours	709	282	3,457	4,448
Total number of students earning certificates	205	12	317	534
Total number of students earning degrees	52	53	308	413
Total number employed after program of study completion	342	92	966	1,400
Total number retained in employment after program completion	283	78	270	631
Total number of those employed at enrollment who received a wage increase post-enrollment	497	210	1,187	1,894

Source: College administrative and state wage record data.

Additional analyses shed further light on key participant outcomes:

- **A large proportion of participants completed a program of study**, including industry certification preparatory courses, college certificates, or degrees. Consortium-wide, 35 percent of participants completed any grant-funded program of study. Most commonly, 28 percent of all participants completed industry certification preparatory courses. Fewer earned certificates (10 percent) or degrees (7 percent).
- **On average, participants completed programs quickly**. Program completers took approximately two terms from the time they entered the grant-funded program to complete their first program of study. Industry certification preparatory courses took the least amount of time to complete (less than two terms after initial program enrollment), followed by certificate programs and associate's degrees (both taking approximately four terms after initial enrollment).
- **Employment rates started and remained high, and wages for employed participants increased after program enrollment.** Consortium-wide, about two-thirds of participants were employed at the time they entered the CBE programs, and about the same proportion were employed at the end of the study period. Across the colleges, the average quarterly wage for employed participants increased from $6,654 in the initial enrollment term to $7,498 at the end of the study period (a 13 percent increase).[2] The increase compares favorably with national wage growth over the same period (about 7 percent; calculated from Bureau of Labor Statistics data).

[2]The end of the outcomes study period corresponds to Q1 2016 (for ACC and SCC) or Q4 2015 (for BC).

Further analyses addressed the second and third research questions: *What factors are associated with TAACCCT participants' outcomes? Do outcomes differ for participants exposed to different course modalities or different levels of student support?* Key findings include:

- **Credential completers tended to be older, experienced students; many were enrolled full-time.** Most participants who completed a certificate or degree were age 25 or older (about two-thirds across all three colleges), and a large majority of those who completed credentials had prior postsecondary experience (86 percent consortium-wide). A substantial proportion (35 percent) had already completed a postsecondary credential, ranging from 21 percent at SCC to 63 percent at ACC. Across the consortium, 53 percent of participants who completed credentials enrolled full-time on initial entry into the program, ranging from 37 percent at ACC to 94 percent at BC.
- **CBE programs may help level the playing field for older participants, but other predictors of program and credential completion varied.** We examined the relationship between a host of participant characteristics and program and credential completion, using both bivariate and multivariate approaches. Characteristics included age, gender, race/ethnicity, English language status, Pell grant eligibility, expected family contribution, high school GPA, developmental course history, prior postsecondary experience, prior postsecondary credential, initial enrollment status (full- versus part-time), incumbent worker status, veteran status, and TAA eligibility. Results consistently showed that age and full-time enrollment status were positively and significantly related to program and credential completion, but results for other participant characteristics were inconsistent.
- **Credential completion rates were higher for participants who completed gatekeeper courses.** To explore whether gatekeeper course completion predicted educational success, we examined whether credential completion rates were higher for participants who completed gatekeeper courses, compared to those who attempted but did not complete. The pattern across the three colleges was clear: credential completion rates were higher for participants who completed gatekeeper courses.
- **Participants with access to fully online, flexibly paced CBE courses and the most enhanced academic coaching achieved higher program and credential completion rates.** SCC offered different combinations of course modality and learner supports to different groups of participants, presenting a unique opportunity to examine the relationships between these program features and educational outcomes. Multivariate analysis showed the group with access to the fully online, flexibly paced CBE courses and the most enhanced academic coaching included the highest proportion of program and credential completers. It is important to note, however, that this analysis did not account for the extent to which participants actually took part in a particular modality or took up corresponding supports.

Comparison of participants' and nonparticipants' outcomes. The final set of outcome analyses used a series of methods to examine the fourth research question: *How do TAACCCT participants' outcomes compare to those of nonparticipants?* Because wage record data were not available for nonparticipants, these analyses focused on educational outcomes, in particular, gatekeeper course completion (which had been shown to predict credential completion) and credential completion. For each outcome, the research team conducted three analyses:

1. We compared average outcomes for participants and nonparticipants at each college and consortium-wide using unadjusted means and mean differences.
2. We compared average outcomes using adjusted means and mean differences to account for existing differences between participant and comparison groups. To calculate the adjusted means and mean differences, we used logit regressions of each outcome on a participant status indicator and key characteristics of participants and comparison students measured at baseline (that is, on initial program enrollment).
3. We compared outcomes using a propensity score matching method that involved the selection of one or more comparison students who were similar to each participant in terms of key baseline characteristics. We then estimated the relationship between program participation and outcomes by comparing outcomes for the matched groups.

Tables 4 and 5 present major findings of the comparison group analyses.[3] In sum:

- Gatekeeper course completion rates were slightly lower for participants than for comparison students.
- Differences in participants' and nonparticipants' credential completion rates varied by college and may reflect unobservable differences between the groups.

Table 4. Adjusted and unadjusted differences between gatekeeper course completion rates for participants and comparison students

Mean differences	ACC	N	BC	N	SCC	N	Consortium	N
Unmatched samples								
Analysis 1 (unadjusted)[a]	3.9	2,548	-27.7*	197	-4.5*	6,715	-3.4*	9,460
Analysis 2 (adjusted)[a]	-2.8	2,548	-23.8*	197	-6.3*	6,715	-7.0*	9,460
Matched samples								
Analysis 3[b]	-7.3	1,218	-13.1	274	-3.4*	10,354	-4.6*	11,792

Source: College administrative data.

Note: Table presents differences between gatekeeper course completion rates for participants and comparison students from three analyses.

[a] These analyses used imputed data.

[b] This analyses used propensity score matching, in which each participant student was matched to one or more similar comparison students.

* Significantly different from zero at the 0.05 level, two-tailed test.

[3] Because a large majority of participants were enrolled at SCC, the consortium-level results largely reflect results at that college.

Table 5. Adjusted and unadjusted differences between credential completion rates for participants and comparison students

Mean differences	ACC	N	BC	N	SCC	N	Consortium	N
Unmatched samples								
Analysis 1 (unadjusted)[a]	16.3*	8,362	-10.1*	684	-4.2*	10,208	0.2	19,265
Analysis 2 (adjusted)[a]	10.8*	8,362	-14.4*	684	-6.0*	10,208	-3.0*	19,265
Matched samples								
Analysis 3[b]	22.3*	3,882	7.6*	706	-5.4*	15,354	-2.6*	19,998

Source: College administrative data.

Note: Table presents differences between gatekeeper course completion rates for participants and comparison students from three analyses.

[a] These analyses used imputed data.

[b] This analysis used propensity score matching, in which each participant was matched to one or more similar comparison students.

* Significantly different from zero at the 0.05 level, two-tailed test.

Study limitations

There are several important limitations to the outcomes analysis. First, the small number of variables that could be measured on or prior to enrollment for both participant and nonparticipant groups explained very little of the variation in the outcome measures—less than 8 percent consortium-wide. This low coefficient of variation, coupled with the inconsistency of the results in Table 5, suggests that the differences in credential completion rates may reflect unobserved differences between participants and nonparticipants. Further, lack of wage record data for nonparticipants and lack of industry certification data for all study subjects precluded full analysis of some potentially important outcomes. Finally, the period covered by the evaluation (2.5 years) was too short to allow adequate time for observation of many participants' outcomes, especially those for individuals who entered programs in the latter years.

At SCC, adoption of the grant-funded CBE curriculum by the entire CIS department resulted in less contrast between program participants and the comparison group, making it difficult to detect program effects.

V. Conclusions and implications

A few overarching lessons emerged from the consortium colleges' implementation of CBE programs under the TAACCCT grant. The following may inform the ongoing public conversation around CBE, especially its application in community college contexts:

- **There is no single "right" way to design or implement a CBE program**, but curriculum development requires a high degree of collaboration and standardization, which may be unusual for some colleges. Colleges tried different approaches to learner supports and, although the analysis of SCC's different support models was not conclusive, enhancing supports may be key for students working through academic programs independently and often remotely.

- **Colleges should proactively address cultural, procedural, and structural issues,** because CBE programs may be at odds with the normal way of doing business. This is particularly true for many back-end processes—such as populating course sections or calculating faculty payloads. It could also apply to cultural issues—such as determining who is responsible for reaching out to students when they fall behind. Attention to change management may help address these challenges and support program sustainability.
- **Predictors of program and credential completion in CBE programs may vary, depending on institutional and other factors.** Most completers had prior postsecondary experience and many had completed a prior postsecondary credential. Furthermore, most were older than 25 and many were enrolled full-time at CBE program entry. These findings align with program leaders' emphasis on the importance of maturity, academic preparation, and motivation for success in CBE programs and, indeed, program intake procedures helped ensure participants had such characteristics. However, multivariate analyses revealed few clear, systematic associations between these characteristics and program or credential completion, suggesting that the predictors of CBE program and credential completion may vary depending on institutional and other factors.
- **CBE models should be one of multiple options available to college students** because these models may not be appropriate for all students. Intensive intake processes can help determine the best fit and start students on the right path, while enhanced learner supports may help students move independently through CBE courses and programs.

Although the study findings are mixed, they suggest potential benefits of CBE programs for some students. Further research, especially on mature CBE programs, can promote deeper understanding. In particular, experimental evaluation is required for a credible estimation of the impacts of CBE programs on participants' outcomes. At the same time, the poor predictive power of the analytic models presented here suggests that more research is needed to determine what student, institution, and contextual factors might matter most for success in CBE programs. It would be especially helpful for research to follow subjects for a longer period to determine whether CBE approaches support job success and career advancement, as their proponents maintain they should and findings on participants' wages suggest. Descriptive research could shed light on support services that might best be combined with self-directed, flexibly paced CBE curricular models. Finally, with CBE sometimes touted as a way for both students and postsecondary education systems to save money, future research should address cost-effectiveness.

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