ON THE PATH TO SUCCESS

Early Evidence About the Efficacy of Postsecondary Competency-Based Education Programs

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CONTENTS

INTRODUCTION

Competency-based education, or CBE, has received considerable attention and interest among college and university leaders, policymakers, philanthropists, and many students in recent years. Although CBE programs have existed since the 1970s, they have garnered new interest as a promising innovation to address some of higher education's most important challenges: cost, quality, access, and success. In a 2015 survey conducted by Public Agenda, more than 500 CBE programs are either in the planning or implementation phase at institutions of all types and all levels.[1] Policymakers regularly point to CBE as a promising strategy for improving attainment rates and helping students to earn their degrees.

At its core, CBE involves two key features: (1) curricula designed around specific competencies, and (2) a model in which the time it takes to demonstrate those competencies varies while the expectations for learning—or demonstration of competency—is held constant.[2] Once the competencies have been identified, programs rely on strong assessments to measure competence or mastery and to document competencies attained. This model is held up as a contrast to traditional programs in which students spend a standard amount of time in classes, defined by credit hours, and earn grades that indicate different levels of performance in the courses rather than mastery of specific competencies.

Proponents of CBE assert that emphasizing learning rather than time spent in a classroom allows CBE to address challenges at the heart of higher education:

> **Quality:** Programs are designed around a set of competencies, and students must demonstrate competency through rigorous learning assessments. Proponents assert that this feature improves the transparency of learning by documenting that students master each competency. This transparency is considered a central quality feature because it provides a better sense of the student's learning than a traditional transcript might, both to students themselves and to prospective employers. Specifically, a grade point average reflects only the average performance of a student over the course of a program rather than documenting demonstration of an articulated set of competencies.

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[1] Public Agenda. (2015, December). *A research brief on the Survey of the Shared Design Elements & Emerging Practices of Competency-Based Education Programs.* New York, NY: Author. Retrieved from http://www.publicagenda.org/files/SurveyOfSharedDesignElementsAndEmergingPracticesOfCBEPrograms_PublicAgenda_2015.pdf

[2] Competency-Based Education Network. (n.d.). What is competency-based education? [Webpage]. Retrieved from http://www.cbenetwork.org/competency-based-education/

Price/Cost to Students: CBE programs often allow students to move at their own pace, with some restrictions. If students have the option of accelerating, they could, in theory, spend less time earning the credential. This acceleration could reduce students' direct tuition expenses, their opportunity cost for time spent in the program, and, possibly, the amount of federal and state aid expended per degree earned.

Access and Success: Programs that allow students increased flexibility are thought to be attractive pathways to a credential for students not on a "traditional" pathway, particularly for returning adults who already have some college credits but no degree. Students might be more likely to enroll, and, given the option of completing coursework or participating in labs at times that are convenient for them—as well as the option of accelerating through what they already know—they might be more likely to complete their degree.

However, despite the popularity of CBE and its compelling narrative, we lack a good understanding of who is enrolling in CBE programs and whether these programs are resulting in improved student outcomes. Recently, American Enterprise Institute (AEI) researchers highlighted the dearth of evidence about CBE and called for more research and evaluation on the demographics of students in CBE programs and the success rates of students in these programs, particularly compared with students in traditional programs.[3] Prior efforts to understand CBE program characteristics and student characteristics have used publicly available data, meaning that the early findings were largely limited to institutions that offer only CBE programs.[4] Other work has investigated student progression or mastery, but has been limited to an individual program or course within an institution, and has not used a comparison group of traditional instructional programs.[5] Existing research also has focused on asking students to self-report their perceptions of learning and competency rather than studying the impact of CBE programs on observable student-level outcomes, such as performance on assessments or progression and completion.

Better evidence about student outcomes in CBE and how they compare with outcomes in traditional programs is important as institutions and policymakers consider investing in CBE programs. To launch CBE programs, institutions may need to invest heavily in start-up costs and can take years

[3] Kelly, A. P., & Columbus, R. (2016, June). *Innovate and evaluate: Expanding the research base for competency-based education.* Washington, DC: American Enterprise Institute. Retrieved from http://www.aei.org/publication/innovate-and-evaluate-expanding-the-research-base-for-competency-based-education

[4] Kelchen, R. (2015, January). *The landscape of competency-based education: Enrollments, demographics, and affordability.* Washington, DC: American Enterprise Institute. Retrieved from https://www.luminafoundation.org/files/resources/competency-based-education-landscape.pdf

[5] See, for example: Diegelman-Parente, A. (2011). The use of mastery learning with competency-based grading in an organic chemistry course. *Journal of College Science Teaching, 40*(5), 50–58.

to break even on their investment.[6] To justify that investment, institutional leaders might desire better evidence that CBE programs will work. Similarly, federal and state policymakers considering opportunities to remove policy barriers to make it easier for CBE programs to develop and operate need additional evidence that facilitating public investment aligns with state and national goals for improving educational attainment of credentials of value. Program leaders need further evidence to support decisions about which models and features of CBE programs make the most sense for their student populations and their institution's goals.

To address this gap in evidence, American Institutes for Research (AIR) partnered with CBE program leaders and institutional research staff at six institutions offering at least one CBE program. These partners included one 2-year public community college and five 4-year institutions, including three private nonprofit institutions and two private for-profit institutions. Together, we considered questions key to advancing the field of research on CBE:

- **Who** is enrolling in CBE programs?
- **What outcomes** did those students achieve, and how did they compare with students in traditional programs?
- **What data** were being used, when gaps existed, and what else would be needed to better address these questions?

Broadly, we find that CBE programs are on the path to success in fulfilling their value propositions of broadening access, offering paths to credentials, and improving cost and quality. In this paper, we present our early findings and outline the key challenges related to data and measurement in CBE contexts.

In this project, we aimed to take the first step toward understanding the main effects of CBE programs. Our goal was to understand, on average and across models, whether CBE programs appear to be working. The implementation of CBE varies across these institutions. Although each program fits a broad definition of CBE, all of the programs differed in key features, ranging from how they price courses to whether (and to what extent) students are allowed to accelerate or decelerate within the program. The field currently supports a variety of CBE models, and we considered it important to understand whether results appear to be robust across models in terms of main effects. Each CBE program design involves many moving parts, and an important focus for research should involve teasing out the relationship of different features with student outcomes, a point we address more deeply in the *Discussion* section.

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[6] Desrochers, D. M., & Staisloff, R. L. (Forthcoming). *Competency-based education: A study of four new models and their implications for bending the higher education cost curve.* Annapolis, MD: rpkGROUP.

To address basic questions about the efficacy of CBE and its success in fulfilling its promise for improving access, cost, and quality, our collaborative effort identified five core research questions that could be addressed through this work, as shown in Table 1.

Table 1. Research Questions and Their Relationship to CBE Value Propositions

Research Question	Relevance to CBE Value Propositions
1. What are the characteristics of programs being offered?	Access, Cost, Quality
2. What are the demographic characteristics and educational goals of enrollees?	Access
3. What do the data tell us about student outcomes in CBE, in contrast to students in traditional programs?	Access/Success, Cost, Quality
4. What data are used to track student performance and improve programs?	Access/Success, Cost, Quality
5. What data gaps concerning these questions remain?	Access/Success, Cost, Quality

Not only are these the kinds of questions in which policymakers are interested, but also they are questions that institutions want to answer as they consider their own approach to improving and refining their programs. They also identify challenges related to data and measurement in CBE contexts, which can provide a starting point for future research efforts to improve CBE measurement.

Together with our partner institutions, we jointly defined these research questions and then worked to identify necessary data elements, including program characteristics, student demographics, progression and completion, affordability, student satisfaction, and postgraduation outcomes (research questions 1, 2, and 3). We borrowed many of these metrics from typical student outcome measures used in higher education. Although many of these measures might not be ideal for CBE, they are well-established measures that hold common definitions; thus, institutions are able to calculate them for both their CBE programs and traditional internal comparison programs. In early research, the partner institutions agreed that CBE programs must employ measures used by traditional programs when they are being compared to traditional programs, while continuing to develop new measures that better capture what access and success mean in CBE programs.

An important feature of this project is that, unlike prior research, our work used comparison groups of students in traditional instructional programs. This approach helps us understand the effect of CBE programs in contrast to traditional programs, moving beyond studies focused on understanding the kinds of students who are enrolled. Each institution, in consultation with AIR, identified the best available comparison group, typically finding students who were as similar as possible to the CBE students in observed characteristics. Partner institutions achieved this objective in a variety of ways, ranging from methods that were comparatively more rigorous, such as propensity score matching, to those that were less rigorous, such as rough balancing on key characteristics (e.g., enrollment intensity, age, and field of study). This focus on identifying some kind of comparison group allows us to understand student outcomes in contrast to other students who, in the judgment of the institutions, were most like the students in the CBE program except that they chose to enroll in a traditional program rather than a CBE program. One factor that we cannot observe and account for through this approach, however, is students' motivation or goals for enrolling in CBE programs; we delve more deeply into potential solutions in the *Discussion* section.

Next, we present our key findings related to each research question.

AN EARLY LOOK AT STUDENT OUTCOMES IN CBE PROGRAMS

To address some of the unanswered research questions related to CBE, this section provides an overview of the themes that emerged through the analysis of student outcomes in CBE programs at the participating institutions. We first describe characteristics of both the CBE programs and the demographic characteristics and educational goals of the students who participate in these programs. We then turn to a discussion of how the student outcomes in CBE programs compare with outcomes for students in traditional programs. This section concludes by considering the data that are currently in use and data gaps that remain.

What are the characteristics of CBE programs?

There was considerable variety in the six CBE programs analyzed by the institutions in this study, particularly with regard to degree award level and topic of study. Degrees offered by CBE programs in this study ranged from short-term workforce credentials to professional master's degrees. With respect to the program of study, there was a tendency toward areas of study with workforce licensure requirements or specialized accreditation programs, perhaps because these areas of study often have established competencies that are required of graduates in each field. This was not true in all cases, however: One program of study was a bachelor's degree curriculum focused on liberal arts.

There also was substantial variability in program design features related to pacing and pricing, both of which are likely to bear upon the student outcomes that we considered. In some programs, students could adjust their pace substantially within the constraints placed on them by their participation in federal student financial aid programs; in others, students could only accelerate by "loading up" on additional courses or competencies during a particular term, much like students in traditional programs. Some of these features were related to the programs' pricing models: Two used some form of a subscription fee model, in which students could take as many courses or competencies as they could fit during a set period of time, whereas others charged students per competency or course, which might result in lower incentives for students to accelerate. Noting these differences across programs is key to understanding and interpreting any results,

PROGRAMS AT A GLANCE

The six CBE programs featured in this study:

- operate within public, private non-profit, and private for-profit institutions;
- offer certificates and associate's, bachelor's, and master's degrees;
- use online and hybrid delivery; and
- include technical and liberal arts programs.

particularly concerning the total cost to students, progression, and time to degree completion.

Other aspects of the programs and how they were situated within institutions varied widely. Some programs were a prominent offering of the institution and received considerable institutional support; others were housed in a separate "arm" of the institution focused entirely on CBE. Some had been created "from scratch" based on a holistic reconsideration of the competencies required by the program, whereas at least one transitioned course by course from a traditional program to CBE. Each program used a mix of standardized and authentic assessments to an extent, although we observed a preference for authentic assessments (performance-based assessments focused on application of knowledge and skills) in certain programs. Three programs offered CBE courses only online, one offered a hybrid of online and in-person courses, and one program considered each course to be a hybrid of online and in-person features. Even among a small number of programs, it is evident that there is no single way to offer CBE; each program was unique to its institutional contexts and origins of program development.

What are the demographic characteristics and educational goals of enrollees?

The demographic data provided by the six participating institutions revealed that CBE programs appear to be drawing larger numbers of nontraditional students than traditional instructional programs. Specifically, we found that the share of adult students in CBE programs ranges from 68% to 99%, and students with prior college experience make up at least 70% of the student population in four of the CBE programs at participating institutions. Furthermore, three of the undergraduate CBE programs serve student populations in which at least 30% of students receive federal Pell Grants, which range from being on par with the institutions' general population to about 10 percentage points higher than the percentage of students in the rest of the population. Although we hoped to investigate the share of students who were currently employed, those data are not collected systematically by most programs; therefore, we were unable to make any meaningful comparisons. In most CBE programs, females were the majority (ranging from 50% to 84%). With respect to enrollment by race and ethnicity, programs varied widely; that variation, along with substantial proportion of "race/ethnicity unknown" students, confounds our ability to identify any relevant trends about racial demographics. Proponents argue that CBE is a good option for adults with some college experience but no degree, and our findings offer some evidence that adult learners are enrolling in these programs, as are students with previous college credit but no degree.

KEY FINDINGS: Who Enrolls?

- **Adult learners** make up **68% to 99%** of CBE program populations.
- **Students with prior college experience** make up at least **70%** of CBE program populations.
- **Female students** make up **50% to 84%** of CBE program populations.
- Gaps in data limit our ability to measure what proportion of CBE enrollees were currently employed.

What can we learn about student outcomes in CBE, in contrast to student outcomes in traditional programs?

Our work with institutions indicates that, on leading indicators and key outcome measures, CBE student outcomes appear to be on par with, or slightly better than, the outcomes of students in comparison groups who were enrolled in traditional programs. The following metrics were calculated based on a cohort of students entering during a 12-month period; in four cases, programs were able to use retrospective cohorts for which "100% of expected program length" had elapsed (i.e., 4 years for bachelor's degrees and 2 years for associate's and master's degrees).

Completion rates. Because many programs are still relatively new, and because the "program length" expectation that exists for traditional programs may not be as useful for CBE programs, completion rates can be difficult to measure. For this project, we collected three metrics: (1) the share of students in the cohort who had completed their program by the time we collected data, (2) the share of completers who completed each year following their year of entrance (in an effort to uncover how quickly students completed), and (3) the share of students who either had completed or were still enrolled in the program and making progress toward completion.

For our first metric, the share of students who had completed the program at the time of data collection ranged from 15% to 80%, which was consistently higher than completion rates in the traditional comparison groups (ranging from 2 to 10 percentage points higher than the comparison groups). Related to our second metric, completers of CBE programs completed them at least as quickly, but often faster, than students in the comparison groups. Finally, the measure of the share of students who had either completed, or were still making progress toward, their degree at the time of data collection ranged from 41% to 55%.[7] All of these rates were higher than those of their respective comparison groups, with the difference ranging from 1 percentage point to 19 percentage points higher.

Retention and progression. For reasons discussed in the next section, traditional progression metrics do not necessarily work well in CBE contexts. CBE programs are explicitly moving away from the time-based concepts that currently underlie common progression measures, including credit hours, expected program lengths, and standard-term start dates. In CBE programs, time becomes an important variable rather than an indicator of progress.

KEY FINDINGS: How do students fare?

- **Completion rates** of students in CBE programs ranged from **15% to 80%,** which is **2 to 10 percentage points higher** than their comparison groups.
- **Retention rates** of CBE students ranged from **68% to 83%,** which ranges from **13 percentage points lower to 16 percentage points higher** than their comparison groups.
- **The average pace** of students in CBE programs ranged from completing **3% fewer** units per term to completing **42% more** units per term than their comparison groups.

[7] The highest share of students who completed or were still enrolled in a CBE program is lower than the highest graduation rate because one institution provided graduation rates but not the share of students who completed or were still enrolled in a program.

This difference makes measuring progression particularly difficult when seeking to contrast CBE programs with a comparison group of students in traditional instructional programs.

For the purposes of comparison, this set of partner institutions agreed on two progression metrics: (1) first-to-second term retention, and (2) the pace at which students moved through the program. Despite the caveats noted previously, both of these metrics were possible to measure for both CBE students and the comparison group, and both were useful in this context.

First-to-second term retention rates are fairly comparable between CBE and comparison groups. The retention rate for CBE programs ranges from 68% to 83% for the program cohorts in this study. The difference between the CBE program and the comparison group retention rates ranged from 13 percentage points lower (than the comparison group) to 16 percentage points higher.[8] Of the four programs for which retention rates were available, two CBE programs had lower retention rates than their comparison group; the program with the retention rate 13 percentage points lower than its comparison group maintained an 82% rate overall, which is among the highest. These findings are mixed; overall, it appears that retention rates for students in these CBE programs are roughly on par with those of the comparison groups, and all of these rates are on par with, or above, the national average for institutional retention rates.[9]

Pace, at least in some program models, also varies between CBE and non-CBE students. The difference between the average pace of CBE students and their comparison group counterparts ranged from completing 3% fewer units per term to completing 42% more units per term. This variation in differences appears to be based on program design, particularly whether or not students have the option of accelerating or increasing their "load" of courses or competencies each term.

An important consideration for progression and retention is that our institutions identified multiple student "profiles" of progression, or different ways in which students chose to move through the CBE programs. CBE is often designed to be more "student-centered" through its increased flexibility, an important feature that might allow students both to accelerate and, when necessary, to move more slowly. These profiles, however, might be obscured by the overall averages; we delve into this issue more deeply in the *Discussion* section.

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[8] Data from one institution compared CBE and traditional students on retention across two different cohorts, one year apart. Institutional data show, however, that the retention rates in the traditional program have remained stable, making this a useful comparison.

[9] The average retention rate of 2- and 4-year institutions reporting to the Integrated Postsecondary Education Data System (IPEDS) was 73.8% (full-time students only) for the fall 2010 entering cohort, the most recent data available. The figure for part-time students was 44.2%. For more information, see U.S. Department of Education, National Center for Education Statistics. IPEDS, Spring 2012, Fall Enrollment component. Retrieved from http://nces.ed.gov/ipeds/datacenter/

Student satisfaction. To understand students' satisfaction within their programs, the group agreed to report students' responses to their existing student satisfaction surveys, using the items that were either identical, or nearly identical, across their CBE program and their comparison group. In most cases, institutions asked students in each program the same general satisfaction question measured on a 5-point Likert scale; for example, "Please rate your overall satisfaction with the program" or "The value of my degree outweighs the cost." In CBE programs, student satisfaction appears to be on par with, or potentially better than, student satisfaction in traditional programs. On institutions' primary student satisfaction measure, the difference between the programs ranges from 0.2 points to 0.5 points higher (each measured on 5-point Likert scales). This finding should, however, be taken with the caveat that student satisfaction surveys can be challenging to administer and that response rates are low in some cases. Further investigation into gauging student satisfaction and engagement in CBE programs would augment these positive early findings.

Price to students. Overall price to students is particularly difficult to investigate because the most meaningful metric—average cumulative tuition paid by students for their degree—can only be observed after students have completed the program. Furthermore, this metric depends on the pricing structure for the program; if a program charges students per course or competency, students might not realize any savings, no matter how quickly they accelerate. If, however, the program uses a subscription model (a set price for a certain period, during which students can take as many courses as they would like for the same price), students who accelerate might realize substantial savings. Although early results indicated that the cumulative tuition paid by students was substantially lower in CBE programs—in some cases, by nearly 50%—we caution that these results are based almost entirely on those who accelerated through their degrees or brought in substantial transfer credits, and does not yet include those who have taken more time to complete and are still enrolled.

Are CBE programs fulfilling their value propositions?

Background

CBE proponents argue that the way in which CBE programs emphasize *learning* and *mastery of competencies,* rather than traditional *seat time,* can improve quality, access, and cost.

1 To evaluate this question, a group of leading CBE programs, with assistance from AIR, collected data about who is enrolling in their programs and how they fare, particularly in comparison to students in traditional programs.

2 Together, we explored CBE learner characteristics, measures of progression in CBE programs, and completion.

Who enrolls in CBE programs?

>68% Adult learners make up **68%** to **99%** of CBE program populations.

>70% Students with prior college experience make up at least **70%** of CBE program populations.

How do students in CBE programs fare?

68%–83% Retention rates ranged from **68%** to **83%.** → These rates range from **13** percentage points **lower** to **15** percentage points higher than the comparison groups.

15%–80% Completion rates ranged from **15%** to **80%.** → These rates range from **2** to **10** percentage points **higher** than the comparison groups.

The average pace of students in CBE programs ranged from completing **3% fewer** units per term to completing **42% more** units per term than students in the comparison groups.

Gaps in what we know

- **It's too early to understand whether students save money in CBE programs.**
- **The structures are not yet in place to draw cross-program conclusions about quality or postcompletion outcomes.**

Takeaway

CBE programs appear to be **on the path to fulfilling their value propositions.**

The contents of this infographic are based on research on the programs that participated in this study. Recommended citation: Parsons, K., Mason, J., & Soldner, M. (2016, September). *On the path to success: Early evidence about the efficacy of postsecondary competency-based education programs.* Washington, DC: American Institutes for Research.

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What data are used to track student performance and improve programs? What data gaps remain?

Using data to measure and track student enrollment and outcomes can be complicated in CBE contexts. Institutions involved in CBE are innovating and creating new ways to measure students' engagement and progression, but there are many familiar—and some new—data and measurement challenges.

Conceptual challenges. Because of the variation in program design and features of CBE models in general, some measures, such as quality, progression, and enrollment intensity, are rather difficult to conceptualize in a way that is measurable and comparable across institutions.

The concept of quality, particularly as it relates to learning, is understood quite differently in traditional and CBE programs. That difference makes comparing quality across CBE and non-CBE programs particularly challenging. A final grade in a traditional program reflects a student's average performance across multiple assessments. It is possible, for example, to earn a passing grade in a traditional course by doing very poorly on one assessment but performing very well on another. In contrast, mastery of a competency in CBE is usually a bright line—students either can or cannot demonstrate what they knows and can do—and each competency must be demonstrated to earn the credential.

Comparison across CBE programs is similarly difficult, and is strictly possible only if each program uses the same standardized assessments. The best hope for these kinds of comparisons is a common cross-institution measure, such as standardized assessments or common rubrics for assessing student learning through work products or portfolios.[10] These scores would allow programs to understand whether their students are mastering competencies or content, and would enable them to compare students' performance against those in other programs, both CBE and traditional.

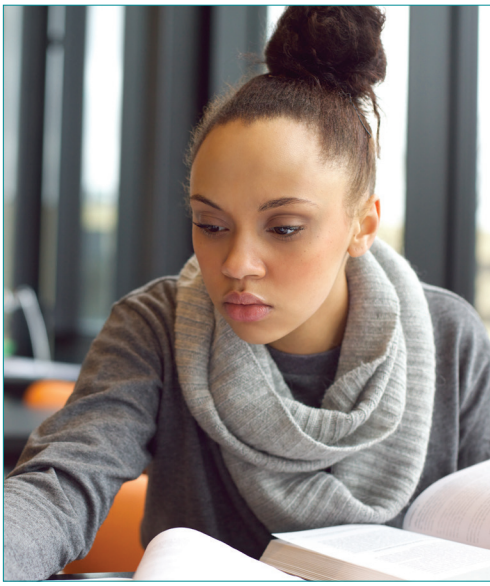
Existing standardized tests, however, are not well suited for this task. Licensure and certification exams are typically content based, rather than competence or performance based. As a result, passing these examinations does not guarantee a student's ability to apply knowledge to real-world tasks. Despite this misalignment, certification exam scores are an increasingly popular way to measure learning in the limited number of fields that include such an exam. Common rubrics for evaluating portfolios, billed as a better way to assess performance, are not yet widely used. Without further development in this area of better measuring learning and performance, the

[10] For an example of using a common rubric, see VALUE/Multi-state collaborative to advance learning outcomes assessment: Pilot year study findings and summary. Washington, DC: Association of American Colleges & Universities and Boulder, CO: State Higher Education Executive Officers Association. Retrieved from https://www.aacu.org/node/15699

field may continue to use less-than-ideal proxies, such as postcompletion wages, employer satisfaction, and, when available, licensure exam pass rates or scores.

Progression and enrollment intensity, measures that are based on notions of time in traditional programs, including the credit hour and a term structure, are also difficult to reconcile with the experience of students in CBE programs.

In traditional programs, time-based progression measures are important for understanding whether students are "on track" toward earning their degree. We use the passage of time and notions of academic terms, standardized "expected program length," and credit hours to calculate how much of the program a student has completed; for instance, students attending full time who complete 30 credits in their first year are considered "on track" to finish in 4 years.



The same is not necessarily true for CBE programs. Not only do CBE programs offer students flexibility in terms of how long they take to complete each competency, but competencies also are not designed to be a standardized unit. Simply counting the number of competencies that the student has completed out of the total number of competencies in the program would ignore the fact that, even within programs, discrete competencies vary in depth and the level of learning expected. Progression is not described in traditional programs by counting classes because different numbers of credit hours can be assigned to classes to acknowledge that not all of them are created equally. To date, CBE does not have an alternative unit to serve this function—no standard "unit of competence" or "unit of learning" exists yet. Differences in how competencies are packaged—as discrete competencies, combined into courselike packages, or built over several courses (typically foundational competencies)—further complicate any effort to use competencies as units of progression. Currently, CBE programs map to credit-hour equivalencies so that students can continue to receive federal student aid, but this interim solution is not a useful way to understand students' progress.

Developing appropriate ways of understanding whether or not students are "on track" toward earning a degree in CBE environments is an important challenge for the field. Policymakers and institutional leaders share a goal of helping more students earn a credential, and are interested in ensuring that those students do not spend more money and time than necessary in earning that degree. Understanding whether or not students are "on track" is important for uncovering issues in policies or structures that might hinder those goals.

On a more granular level, reconciling the concepts of enrollment intensity and progression with CBE environments is also important because these concepts are used for legal and regulatory purposes. Students' enrollment intensity during their first term, for example, is used to determine whether and how they are included in various federal data collections, such as the Integrated Postsecondary Education Data System (IPEDS). Students' enrollment intensity in each term is used to calculate the amount and types of federal financial aid for which they are eligible, and they are required to maintain satisfactory academic progress (SAP), defined by grades and credit hours, to continue receiving aid. Creative solutions will be needed to address this issue and to design better CBE-relevant progression measures, which we explore further in the *Discussion* section.

Structural challenges. The structure of an institution and the way the institution manages data ownership and sharing internally can limit the ability of CBE programs to measure other outcomes, including the total cost of a student's degree, wages, and other postcompletion outcomes. At some institutions, CBE program offerings are limited to a few specific programs, or they exist within a special "arm" of the institution. This particular structural feature of some CBE programs may allow programs to be flexible, but it often means that institutions have financial aid practices and institutional research practices that are not organized around, or optimized for, a CBE program environment. Metrics that may be tracked by other departments (e.g., total cost, which is tracked by financial aid data owners) may not be available and regularly tracked for the specific CBE programs. In addition, other important quality measures, such as wages, licensure and certification pass rates, employer satisfaction, and other postcompletion outcomes, are subject to the same structural limitations as traditional programs. Tracking students into the workforce, especially in the absence of access to an agile state longitudinal data system, can be expensive and difficult.

Technological challenges. Almost every element of a student's enrollment can be difficult to track effectively when data systems are not optimized for CBE environments. Many institutions struggle to find data systems that fit their CBE model because many data systems are still optimized for traditional programs, or, when new systems exist that might better accommodate CBE programs, the systems within an institution often do not interface seamlessly.[11] Some programs use spreadsheets to track student enrollment, progression, and formative assessment performance because their data systems do not allow them to track these fields in ways that support their program operation or performance analysis.

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[11] Knepler, E. (2015, December). A research brief on the Survey of the Shared Design Elements & Emerging Practices of Competency-Based Education Programs. New York, NY: Public Agenda. Retrieved from http://www.publicagenda.org/files/SurveyOfSharedDesignElementsAndEmergingPracticesOfCBEPrograms_PublicAgenda_2015.pdf

Key lessons learned

CBE proponents argue that the way in which CBE programs emphasize learning and mastery of competencies, rather than traditional seat time, can improve quality, access, and cost. In this section, we outline our key findings and our confidence in those findings.

We have reasonable confidence that, on average, CBE programs are increasing student access, especially for adult students, those with prior college credits, and Pell Grant-eligible students. These programs also appear to be at least on par with, or better than, traditional programs in terms of student success; on average, students seem to progress through CBE programs at a similar or a faster pace than students in traditional programs, and they appear to complete the programs at similar or higher rates. Clearly, there is a set of students who accelerate through programs when those programs allow, which means that some students are able to shorten their time to degree completion and reduce their opportunity cost of enrolling in the program. It also appears that students are at least as satisfied with their experience in CBE programs as their peers in traditional programs.

We have limited confidence that CBE programs cost students less money. As previously outlined, the cost to the student depends on the pricing structure of the program and the time that students take to complete the program; at this point, only some institutions have moved to a subscription model that would allow accelerating students to save money. The currently available data about the tuition paid by completers includes those who completed a program in a "typical" amount of time or accelerated to complete a program more quickly; therefore, the averages do not yet include those who take more time to complete a program and who may end up paying more than a student in a traditional program. Under certain pricing structures, the potential for students to save money exists—as does the potential for some students to spend more money if they take longer—but the full range of results is not yet evident.

At this time, we are unable to draw any conclusions about quality or postcompletion outcomes because the structures are not yet in place and not enough time has elapsed to gain meaningful postcompletion data.

CHARTING A COURSE FOR INVESTIGATING KEY CHALLENGES IN CBE RESEARCH

As this project has shown, student outcomes in CBE programs is an area ripe for research and exploration; however, early findings suggest that the CBE programs we studied are on the path to fulfilling their promise. At the same time, however, our findings highlight several key areas that merit further attention. This section describes the exploratory work that AIR and its partner institutions performed on those key areas:

1. Unpacking and understanding the key components of CBE programs that might affect outcomes
2. Understanding students' intentions and educational goals when they enroll in CBE
3. Identifying new, CBE-relevant student success metrics
4. Establishing valid comparison groups

Unpacking and understanding the key components of CBE programs

A critical question for future research concerning student success in CBE programs is identifying the key components of CBE as the "treatment" and relating how variation in program design affects outcomes. The working group of institutions identified this question in the early stages of study design, recognizing that each institution operated a slightly different CBE model. Although institutions are testing a variety of models under the CBE umbrella, the differences across models are important because they shape the behaviors in which students can engage. For instance, if the program does not allow acceleration, we should not expect to see faster progression or decreased time to degree, or, depending on the program's pricing model, we should not expect to see lower direct tuition costs to students, even if students can accelerate and reduce their opportunity cost of time spent taking courses.

Even though we know that these features matter, no common language or method exists for talking about the dimensions on which programs can vary and what those variations might look like. To better understand and name

these differences, we developed a descriptive rubric that identifies critical features of CBE programs and delineates a series of facets that further describe how those features might be evidenced in specific programs.[12] The rubric is not intended to judge whether or not a program is a "pure" CBE model, but, rather, to identify different design choices built into programs. Program leaders can select the facets that best describe their program, allowing researchers to improve their interpretation of the data. AIR and its partner institutions hope that by identifying and describing these differences, and eventually investigating whether certain features seem to have a relationship to student outcomes, we can advance the conversation about the key elements—and important differences—across programs. Some partner institutions began piloting this rubric, and we expect to continue to refine it through future evaluation activities.

Understanding students' intentions and educational goals when they enroll in CBE

As previously noted, our partners report that, at least anecdotally, they see different "profiles" of students moving through programs in different ways and at different paces, and they hypothesize that these profiles are related to students' intentions and goals for enrolling in the program. These profiles include:

- **Sprinters,** who take advantage of the opportunity to accelerate through the program
- **Flexers,** who take advantage of the flexibility and self-paced nature of the program to work at their own pace
- **Frequent flyers,** who enroll, complete a few courses or competencies, stop out for an extended period, and then reenroll in more competencies
- **Consistent enrollers,** who make steady progress without stopping out

Understanding these different profiles, and the variety of students' goals and intentions for moving through the program, is an important area for future research. If certain goals align with particular progression profiles, this understanding might help program leaders predict how students move through the program. Building on that knowledge, some program leaders are interested in how understanding these student profiles might improve their advising and coaching services to students based on how other students with similar goals and intentions have progressed through the program.

[12] The rubric is available at www.air.org/resource/postsecondary-CBE-rubric

To this end, several institutions, in collaboration with AIR, developed a survey designed to measure students' intentions and educational goals when they enroll in CBE programs. The survey asks students to identify their goals for enrolling in the program by asking them to rank their main goals from a series of options, including the following: to help them advance in their current position, to help them change their career or profession, to get a job, and to gain the satisfaction of earning a college degree. Because more important background factors may affect students' decisions to enroll in a CBE program, the survey also asks students about their work situation and family circumstances, including whether or not they are currently employed, how many hours they currently work per week, and whether or not they have children (and, if so, how many). Finally, several questions attempt to uncover whether students would otherwise not enroll in higher education if not for a CBE option. Three institutions have plans to pilot this survey to explore whether the survey is effective in shedding light on how students might progress through their programs. In the future, these institutions might consider segmenting students in different categories for analysis, particularly when exploring time to degree completion, unique predictors of completion, and other measures in an effort to better understand students' enrollment patterns and to improve advising and other services.

Identifying new, CBE-relevant progression metrics

Many institutions leading the development of CBE programs are working to identify new metrics more relevant to how students engage in CBE programs. As we have outlined, the focus on learning rather than time means that most traditional progression metrics are less relevant than for traditional programs. As previously described, no "unit of competence" or "unit of learning" exists yet to measure progression in comparable ways across CBE programs, and such a unit would not address the challenges of comparing progression in CBE programs and traditional programs. Furthermore, as noted previously, our partner institutions recognized that it is particularly important to consider new progression metrics because student progression seems to occur differently, and along different patterns, in CBE programs. In particular, the preponderance of "sprinters" and "flexers" lead many CBE program leaders to believe that any progression measure might have a bimodal distribution and, therefore, might benefit from more granular measurement than an average or median.

With all these challenges in mind, our partner institutions considered a set of progression metrics to include in this analysis. For the purposes of this project, the institutions settled on two metrics that could be readily adopted. In Table 2, we outline the key progression metrics that we considered as well as key considerations that affect their feasibility and usefulness in a CBE context.

Table 2. Progression Options Considered for CBE Measurement

Metric/ Leading Indicator Concept	General Specification	Considerations
	Adopted Metrics	
Retention/ Reenrollment	Share of students still enrolled in the program during the second period	▪ Based on the traditional retention metric.
Pace	Average number of units completed per period	▪ Applicable for within-institution comparisons; institutions can compare like units (courses, credit-hour equivalencies, competencies). ▪ Difficult in cross-institutional contexts without a standardized unit (course lengths might vary).
	Metrics Considered but Not Adopted	
Time to Completion	Average calendar time to completion for CBE completers	▪ Beneficial retrospectively only; does not track progression as it occurs. Might be bimodal ("sprinters" versus "flexers"); thus, centiles, rather than averages, may be more useful.
Time to Complete 50% of the Program	Average calendar time for students to complete 50% of their program	▪ High potential for cross-institutional comparisons because it does not require a standardized unit. Requires considering how to handle students with transfer credits, identify the halfway point, and determine whether or not programs are of similar "length."
Unit Completion Pace	Average time to complete a unit	▪ Requires units (courses, competencies) to be a standardized "length." Does not work well in contexts without such standardization.
	Metrics Considered but Not Adopted	
Pass Benchmark Course	Share of students who pass the benchmark course within a specific time frame	▪ Requires a specific benchmarking course to be identified as the key predictor of success. Appears to be valuable internally, but is not as useful in cross-institutional comparisons.
Course Engagement/ Activity	Time between submissions/activity	▪ Some institutions are developing novel indicators of student progression that leverage student activity within a course (e.g., time between submissions) to describe progression differently. Not currently feasible for a cross-institutional context or for comparison with traditional delivery programs.

Progression is an important leading indicator of student success, but more consideration of these, or other, metrics is necessary to describe student progression in CBE contexts. None of these options sufficiently addresses the issue of "progression profiles" that we raised previously, but, as noted under "time to completion," one part of the solution might be to present information about the distribution of progression behaviors, not simply averages or medians. Our partner institutions hope that, by outlining options and challenges associated with progression metrics in CBE, we can provide starting points for continued research and discussion about progression in CBE programs.

Establishing valid comparison groups

Constructing valid comparison groups of students in traditional programs is an important measurement challenge in CBE programs. These groups are important for analysis because they allow us to understand how the outcomes observed in CBE programs compare with student outcomes in traditional, non-CBE programs. For the reasons highlighted in this early study, constructing comparison groups that are similar enough to their CBE program counterparts to provide valid comparisons is challenging. First, because CBE programs are often designed to appeal to different groups of students—for instance, working adults—even matching on student characteristics, such as demographic information and previous college experience, can prove to be difficult, depending on the institution and its other offerings. Second, even when matching on covariates is possible, finding common outcome metrics on which to compare the matched groups, without waiting for completion or postcompletion outcomes, can be difficult. Third, unobserved differences in students' intentions and goals for enrolling in the programs complicate the development of valid comparison groups because they might include important reasons that students select CBE programs or traditional programs, thus rendering the groups less comparable. Therefore, despite similarities on observed baseline characteristics, these students might differ in important, yet unobserved, ways from their counterparts in traditional programs.

Our partner institutions hoped to explore this problem and provide some early information to prompt future work, but the resolution remains elusive. Although we anticipate that the survey of student intentions might provide a starting point for answering the question about students' goals and intentions, the other questions are difficult to address directly. Some of our partner institutions considered ways of understanding whether students in CBE programs might otherwise not enroll in postsecondary education, including investigating whether students who tried CBE courses, but did not complete them, switched back to traditional courses only or dropped out

entirely. This early, imperfect measure of whether students might otherwise not enroll in higher education suggests that students dropped out rather than moving back to traditional programs; however, much more research should be done to help us gain a better understanding of this dynamic. Some programs also experienced difficulty in constructing their comparison groups because many students from traditional programs who matched the background characteristics of students in CBE programs eventually transferred into CBE programs, meaning that they could no longer serve as a comparison. Future research into the appropriateness and validity of comparison groups will be important for continuing to improve our understanding of how CBE programs compare with traditional programs.

MOVING FORWARD: CONTINUING TO BUILD EVIDENCE ABOUT CBE PROGRAMS

In this project, we offer early evidence that the CBE programs we studied are on the path to fulfilling their value propositions. We find that, on average, students in CBE programs are achieving outcomes on par with, or better than, students in traditional programs in terms of progression, completion, and student satisfaction. Measurement challenges unique to CBE, as well as challenges that have long plagued traditional higher education programs, remain a barrier for comprehensively measuring learning and cost, in particular.

Going forward, the development of programs that fulfill the value proposition of CBE will hinge on an increased focus on, and capacity to, build evidence in two domains: the kinds of outcomes that students achieve in CBE programs and what program features affect those outcomes.

What are students' outcomes in CBE, and how do they compare to those of traditional programs?

Educators and policymakers stand to benefit from continued investigation into the outcomes that CBE students achieve, compared to their peers in traditional programs. Efforts to build on this work and continue to evaluate student outcomes such as completion, total cost to students, and employment outcomes with increased rigor will be important in informing policy conversations and resource decisions at the program, institutional, state, and federal levels. In addition to the kinds of outcomes we included in this paper, evaluating CBE students' learning outcomes—and how those outcomes compare to those of students in traditional programs—would yield fundamental information about these programs' efficacy that could inform both policy conversations and continuous program improvement efforts.

What is it about program design that affects CBE students' experiences and outcomes?

Because this project sought to build directional, rather than definitive, evidence about CBE programs, it included programs that had been implemented in a variety of novel ways. As research in this field advances, it will be increasingly important to attempt to understand how the assumptions, practices, and policies that define a specific program affect student outcomes, either singly or in combination. At this early stage, we see these components as encompassing three layers. The most foundational layer surrounds

the structure of individual competencies—how they are identified, how granular or broad they are, and how they are arranged to form a coherent competency architecture that describes what students should know and be able to do. Above these assumptions rests a layer of tactics that support learning, including strategies for proactive and personalized engagement with students to support learning and contemporary pedagogies appropriate to that program's delivery method. Finally, at the highest layer of design, organizational structures and institutional, state, and federal policies shape the ways in which educational programs can be implemented. We have no doubt that many of these assumptions, practices, and policies are as relevant to traditional programs as they are to programs rooted in competency-based models. As a result, findings from additional research here stand to benefit all students.

To support this research agenda, we will continue to investigate these questions and, along the way, share tools, lessons learned, and measurement insights with the field. With more and better evidence in hand, we hope these programs will be better equipped to serve the students they seek to benefit, providing students opportunities to earn high-quality college credentials that prepare them for fulfilling lives and rewarding careers.

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