STATE OF THE FIELD

Findings from the 2018 National Survey of Postsecondary Competency-Based Education (NSPCBE)

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EXECUTIVE SUMMARY

This report is based on data obtained from the 2018 National Survey of Postsecondary Competency-Based Education (NSPCBE). It represents a collaborative effort between the American Institutes for Research (AIR) and Eduventures®, the research division of ACT™ | NRCCUA™. It includes findings based on responses by more than 500 colleges and universities—the largest institutional sample to date—about their interest in, or activity related to, competency-based education (CBE). It also compares findings to those of Eduventures' 2016 CBE study, Deconstructing CBE.

The goal of the 2018 NSPCBE is to provide a comprehensive and detailed assessment of the state of postsecondary CBE. It includes data and findings that are relevant to a range of institutional stakeholders, policymakers, researchers, and educators. It includes six key findings, based on 2018 data, and, wherever possible, comparisons to the 2016 data from prior Eduventures' research. These findings include the following:

1. *Motivations for adopting CBE:* Institutions see CBE as a way to serve nontraditional students and improve workforce readiness.
2. *Scope of CBE adoption:* Many institutions' adoption activities fall short of full CBE programming.
3. *Scale of enrollment in CBE programs:* Most CBE programs currently serve relatively small numbers of students.
4. *Role of faculty in CBE programs:* Faculty are still fulfilling a broad range of roles in active CBE programs.
5. *Barriers to CBE implementation:* Perceived barriers to CBE implementation represent both internal and external factors.
6. *Future of CBE:* Most institutions are optimistic about the future of CBE.

Each finding includes a detailed analysis of the available data and explores the implications for both schools with active CBE programs as well as those in the planning stage. Collectively, these findings suggest that although CBE remains a compelling and valuable innovation, further growth and scalable impact are hampered by a range of barriers. These barriers stem from both the federal policies and the external regulatory climate as well as those that are internal to the operations and governance of many institutions of higher education.

This 2018 NSPCBE report concludes with critical questions for postsecondary CBE implementation and scale, followed by a set of recommendations for program leaders, institutional leaders, and policymakers.

Future editions of the NSPCBE, currently planned for 2019 and 2020, will continue to address these questions and track the evolution of the field over time.

INTRODUCTION

Study Background and Rationale

Competency-based education (CBE) is a nontraditional, but not necessarily new, approach to postsecondary education. In the last decade, it has attracted considerable attention from a wide variety of stakeholders, policymakers, and institution leaders. Although exact definitions of CBE vary, several components distinguish CBE from traditional models of postsecondary education:

- Curricula are designed around specific competencies,
- Advancement focuses on demonstration of competency, and
- The time it takes to demonstrate a competency is typically allowed to vary.

Proponents of CBE argue that its "learner-centered" logic is compelling: By measuring students' learning rather than a traditional program's credit hours and grades, CBE has the potential to improve quality of learning, expand access for "nontraditional" students,[1] and lower costs for students.

But compelling logic alone is insufficient: Institutional leaders interested in CBE need to know whether their peers are adopting it, how, and what the path ahead might look like. Similarly, policymakers want to know whether CBE is expanding across institution types and what barriers are inhibiting growth as they consider whether and how to design policies that support or inhibit CBE expansion.

This report summarizes findings from a survey of college and university leaders that sought to better understand whether, how, when, why, and for whom institutions in the United States are using CBE. This survey, a partnership of the American Institutes for Research (AIR) and Eduventures, a division of ACT | NRCCUA,[2] was conducted in 2018. It builds upon and updates Eduventures' Deconstructing CBE report, a study of 251 institutions supported by Ellucian.[3] The 2018 NSPCBE begins a 3-year study, supported by Lumina Foundation, to better understand CBE scale and adoption. Together with Eduventures' 2016–17 research, it provides an essential baseline for further inquiry into the future of postsecondary CBE.

In 2016, Eduventures found that although interest in CBE was high, outside of a few large and established schools where CBE was the dominant mode of instruction, implementation remained relatively fragmented, small in scale, and generally designed to meet the needs of working adult learners. Since 2016, a variety of factors have affected both expectations for broader CBE growth as well as the pace and scale of actual implementation. These factors include improved knowledge about CBE through hubs such as the

[1] This report uses "nontraditional" students to refer broadly to student populations that are older than students coming directly from high school (typically age 25 or older), in line with the description provided by the National Center for Education Statistics: https://nces.ed.gov/pubs/web/97578e.asp. These populations are referred to as "new traditional" or "today's students" as well.

[2] The National Research Center for College and University Admissions

[3] Garrett, R., & Lurie, H. (2016). *Deconstructing CBE: An assessment of institutional activity, goals, and challenges in higher education.* Boston, MA: Eduventures.

Competency-Based Education Network (C-BEN), the continued growth of prominent CBE exemplars, more specific guidance from accreditors, and inconsistent messages from the federal government regarding the use of Title IV funding in certain CBE models.[4] Given the evolving nature of the field—and to begin tracking developments in the field longitudinally—the 2018 NSPCBE reexamines the state of postsecondary CBE with the most comprehensive study to date about implementation of CBE.

Broadly, this survey shows that although the learner-centric logic of CBE remains compelling across institution types and that more than 500 programs have been launched and are operating, significant barriers to implementation and scale remain. These barriers are often related to core functions of the higher education enterprise and lead many institutions to adopt CBE on a relatively small scale or to engage in partial efforts to implement programs. There is, however, evidence that a majority of respondents believe CBE will grow nationally.

This report highlights six key findings:

1. *Motivations for adopting CBE:* Institutions see CBE as a way to serve nontraditional students and improve workforce readiness.
2. *Scope of CBE adoption:* Many institutions' adoption activities fall short of full CBE programming.
3. *Scale of enrollment in CBE programs:* Most CBE programs currently serve relatively small numbers of students.
4. *Role of faculty in CBE programs:* Faculty are still fulfilling a broad range of roles in active CBE programs.
5. *Barriers to CBE implementation:* Perceived barriers to CBE implementation represent both internal and external factors.
6. *Future of CBE:* Most institutions are optimistic about the future of CBE.

Appendix A includes descriptive statistics about responses to key survey questions, many of which shed further light on patterns of implementation among those who are implementing CBE. It is important to note that this study is based on a survey of institutions, so findings are based on self-reported data from institution leaders. Although this survey does not include an evaluation of student outcomes and does not incorporate the perspectives of students, employers, or other stakeholders, we recognize the importance of that information and encourage continued research in those areas.

[4] Signals from the federal government include a positive emphasis on CBE in legislative proposals, such as the PROSPER Act, as well as the 2017 findings from regulatory enforcement regarding Western Governors University, a well-known CBE model.
U.S. House of Representatives Committee on Education and the Workforce. (2017). *PROSPER Act: Promoting Real Opportunity, Success, and Prosperity through Education Reform (PROSPER) Act.* Washington, DC. Retrieved from https://edworkforce.house.gov/prosper/
U.S. Department of Education, Office of Inspector General. (2017). *Western Governors University was not eligible to participate in the Title IV programs: Final audit report.* Washington, DC. Retrieved from https://www2.ed.gov/about/offices/list/oig/auditreports/fy2017/a05m0009.pdf

Methodology

SURVEY DEVELOPMENT

To best capture longitudinal data while collecting new relevant information, AIR and Eduventures designed the 2018 NSPCBE survey instrument to build on Eduventures' 2016 Deconstructing CBE survey. This approach was guided and vetted by an advisory board of key leaders and experts involved in leading or studying CBE; the advisory board provided insight about what questions to maintain and what questions might need to change based on developments in the field.[5] Many questions on the 2018 survey instrument are consistent with those on the 2016 instrument—particularly those related to the elements associated with CBE, the path toward implementation, and details about implementation. Changes in the 2018 instrument were primarily to solicit additional details, add clarity or updated terminology to existing questions, or remove questions from 2016 that did not yield much variation.[6]

SAMPLE

The 2018 NSPCBE was sent to 3,043 institutions, representing a census of 2- and 4-year institutions listed in the Integrated Postsecondary Education Data System (IPEDS).[7] For most recipients, the survey invitation went to provosts and institutional research contacts with a request that the recipient forward it to the most appropriate contact on campus, which may vary by campus. C-BEN member institutions (as of 2017–18) were an exception; they provided preferred contact information for their institutions directly in advance.

Of the 3,043 institutions, 501 provided a response, representing the largest survey to date of institutions about CBE and an overall institutional response rate of 16%. Of that 501, 54% were from public institutions, 41% were from private nonprofit institutions, and 5% were from private for-profit institutions (see Figure 1). The majority—69%—were from 4-year institutions, with 31% from 2-year institutions (see Figure 2).

Figure 1. Respondents by Sector

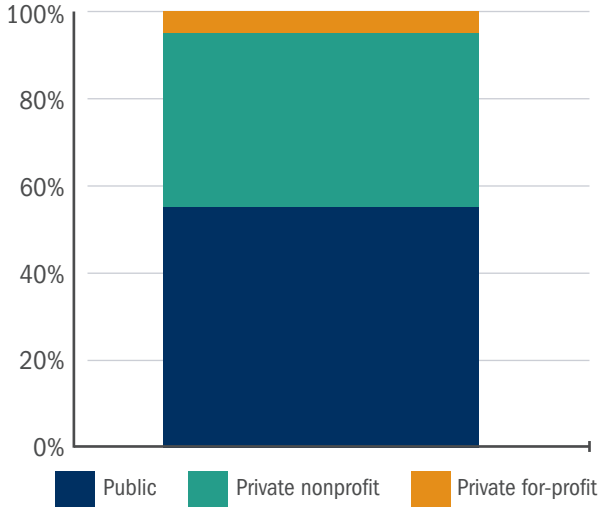
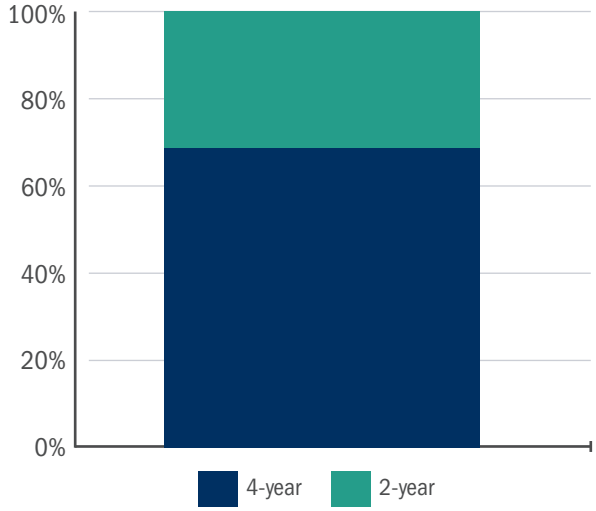


Figure 2. Respondents by Level



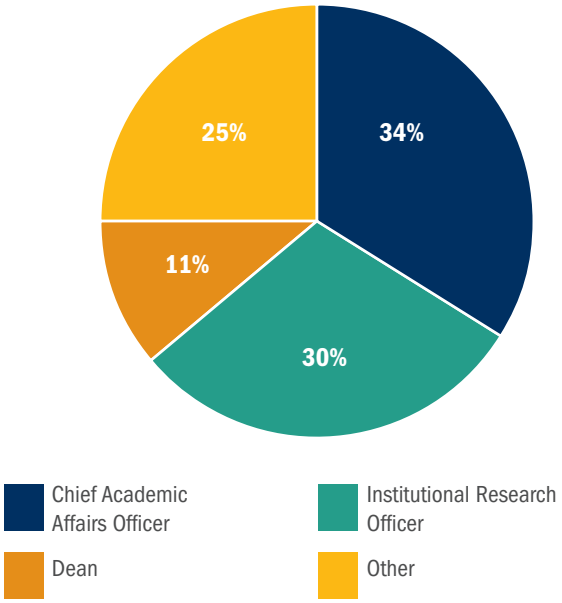
[5] For a list of board members, please see the AIR CBE Research website: https://cberesearch.org/about-us#board

[6] For example, edits improved wording, narrowed response options related to types of students served, and eliminated questions about implementation details (including questions about how technology is used and details about roles; Eduventures and AIR determined that those are valuable but more feasible for interview approaches).

[7] Recipient institutions represented those in the IPEDS universe for which we could obtain contact information from the Higher Education Directory. For more information about the sample, see Appendix B.

The survey asked respondents to identify their role to clarify their perspective on CBE. Thirty-four percent identified as a chief academic affairs officer (provost or vice president of learning), 30% identified as the institutional research officer, and 11% identified as a dean. The remaining 25% of respondents identified as presidents/chancellors, vice provost/provost's office staff, department chairs, faculty members, or other (see Figure 3).

Figure 3. Respondents' Roles on Campus



Eighty-one percent of respondents indicated that they had "institutionwide" knowledge about competency-based approaches compared with 11% who noted that their scope of knowledge was limited to a single academic unit.

Because institutions that were adopting or interested in adopting CBE may be more likely to respond than those without interest, sample bias is possible. To mitigate this possible sample bias, weights were assigned to each survey respondent based on how likely comparable institutions were to respond to the survey. Although these weights ***do not*** affect counts (including the number of institutions and programs listed throughout this Methodology section), they ***are*** used to calculate percentages in the Key Findings section of this report and its appendices. For a more detailed description of the survey weights and overall methodological approach, see Appendix B.

DEFINING CBE

To define CBE while acknowledging variation within CBE programs, survey respondents were asked to answer a series of questions regarding their ***adoption*** of or ***interest*** in several elements associated with competency-based approaches.[8] Next, the survey asked those who had *adopted* those elements whether they had adopted those approaches at the course level or for entire programs of study.

For the purposes of this study, the threshold for classification as a CBE program was whether an ***entire program*** *contained at least* ***one*** *of the following characteristics:*

1. Learning is *measured* in competencies, and either quantified without reference to seat time or mapped to measures of seat time;
2. Students advance from the course or complete the program based on mastering all required competencies; or
3. Courses or programs can be substantially "self-paced"[9] by students.

[8] Respondents were grouped into categories based on their adoption and interest, including (1) adopted or adoption in-progress, (2) interested but not adopting, and (3) not interested in CBE.

[9] The authors acknowledge that "self-paced" can be defined differently by different respondents, and that some in the CBE field use different terminology, such as "flexible" or "personalized" pacing. For the purposes of this survey, "self-paced" was meant to encompass any situation where expectations for learning are held constant while time is allowed to vary to some degree.

These criteria were selected with input from the NSPCBE advisory board, which sought to balance (1) accounting for the key components of widely recognized definitions in the field,[10] and (2) capturing the variety of program types that exist at this point in the evolution of CBE.[11]

The survey also sought to capture information about institutions that were implementing competency-based elements, but that fell short of the CBE definition threshold. This approach allows for analysis of adoption that falls short of a full CBE program, but may signal future activity. The prevalence of all elements, as well as activity at the *course* level rather than the program level, is discussed in the Key Findings section of this report.

This survey does not, however, attempt to include the *full* set of related approaches, termed "competency-based learning" (CBL) approaches. CBL may include structured and unstructured opportunities for learning and/or the assessment of learning, both self-created and those designed by employers, education institutions, and training providers, which are aligned to competencies and may lead to a recognized education credential. These approaches may include military training, apprenticeships and workforce development programs, and other related opportunities.[12]

KEY INDICATORS

STATE OF THE FIELD

Four hundred thirty of the 501 respondents reported being either interested in adopting CBE or in the process of adopting; 71 expressed no interest in CBE. Fifty-seven institutions reported currently operating at least one full CBE program; together, those 57 institutions reported offering a total of 512 CBE programs: 427 undergraduate programs and 85 graduate programs. The highest concentration of programs reported were in nursing and computer sciences.

[10] See, for example, the Competency-Based Education Network's definition of CBE: https://www.cbenetwork.org/competency-based-education/
[11] For example, this threshold allows analyses to include implementation of both direct assessment and nondirect assessment CBE programs.
[12] For a more complete description of the distinction between CBL and CBE, see https://cberesearch.org/about-us

KEY FINDINGS

This report features six key findings from the 2018 NSPCBE. Descriptive statistics from other sections of the survey also are included in Appendix A.

1. Motivations for Adopting CBE

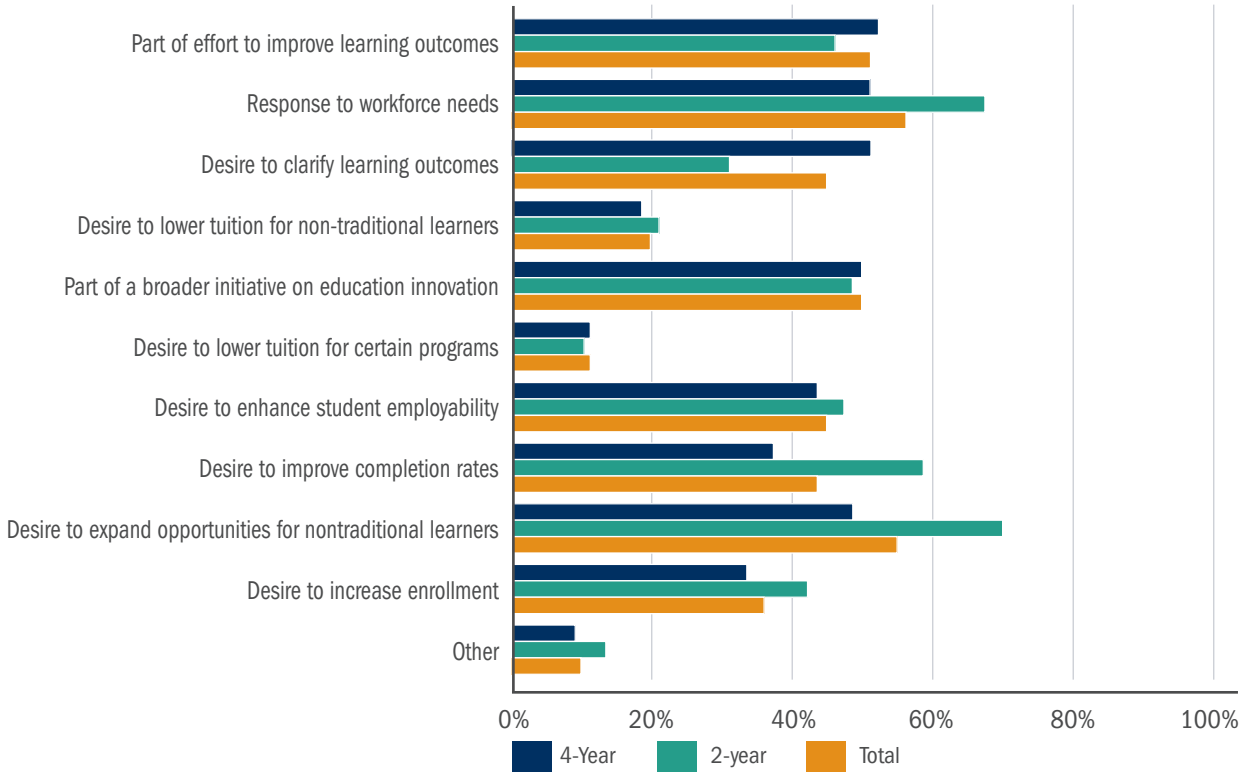
Key finding: Institutions see CBE as a way to serve nontraditional students and improve workforce readiness.

To better understand which aspects of CBE were most appealing to institutions that were adopting CBE or interested in adoption, the NSPCBE asked respondents to identify the top motivations behind program adoption or interest.

For institutions with existing CBE programs and those that have begun adopting programs, the rationale for adopting CBE focused on expanding access to certificate or degree programs and preparing students for the workforce (see Figure 4):

- Fifty-five percent reported that they considered CBE as a means to expand opportunities for nontraditional students, and
- Fifty-six percent seek to better prepare their students for the workforce.

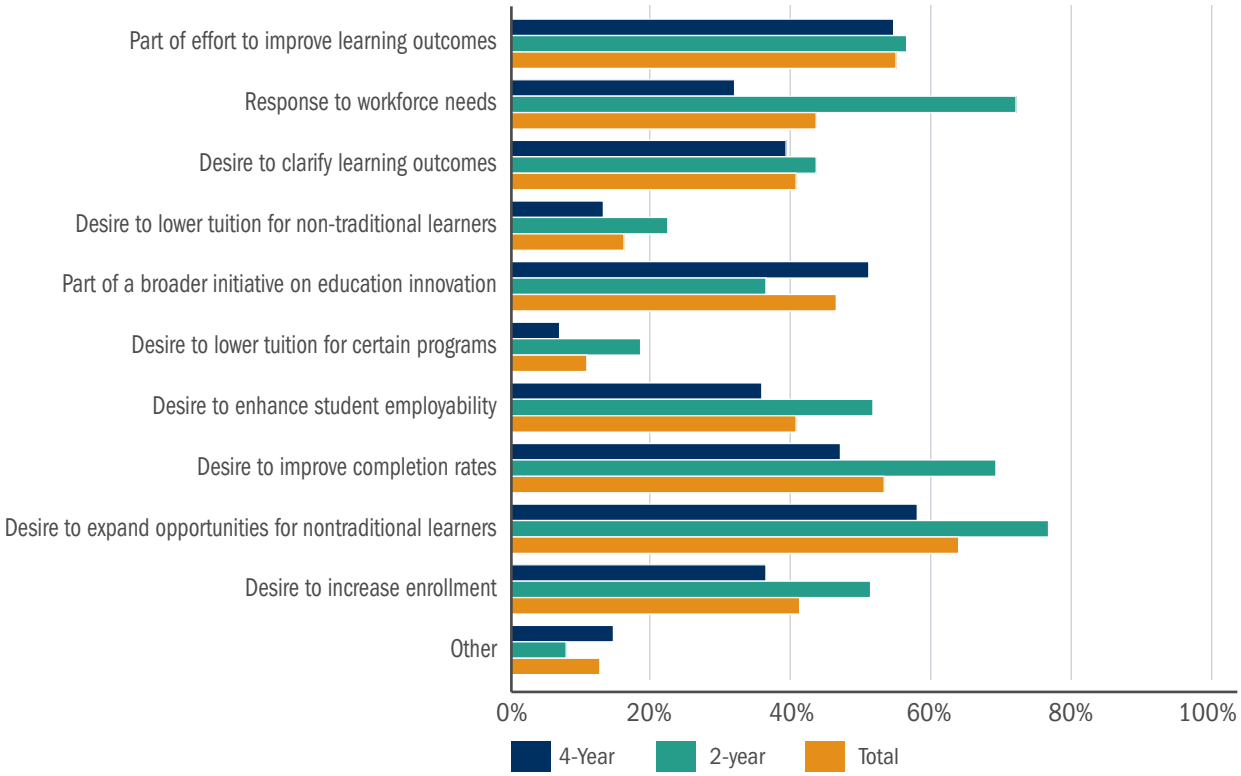
Figure 4. Motivation for CBE: Institutions With a Program or Currently Adopting



Among institutions with only interest (but no program to date) in CBE, expanding opportunities for nontraditional students and improving learning outcomes were among the top responses (see Figure 5):

- Sixty-three percent reported that CBE's potential to expand opportunities for nontraditional students was a key factor, and
- Fifty-five percent reported that interest in CBE was part of an effort to improve learning outcomes for students.

Figure 5. Motivation for CBE: Institutions With Interest in Adopting



Boosting overall enrollment was not a top priority for either group of institutions; the share reporting this as a goal was at or below 40% for both groups.

Although these priorities are largely consistent between 2-year and 4-year institutions, there are some notable differences. The focus on workforce preparation is more pronounced for 2-year institutions, likely reflecting their traditional mission of providing workplace-focused credentials.[13]

Another key difference rests in a focus on completion: A greater share of 2-year institutions reported valuing CBE for its potential to improve completion rates compared with their 4-year counterparts. This reflects the priority that many 2-year institutions have related to improving completion rates, and suggests that many may see CBE as a model that could help boost completion.

[13] This difference is statistically significant.

In addition to comparing 2- and 4-year institutions, these trends were consistent across sector and institutional size.

Comparison to 2016: These themes are consistent with 2016 findings; the focus on access for nontraditional learners and workforce relevance were among the top reasons cited in 2016, with improving completion rates near the top of the list as well. The desire to lower tuition was similarly the least common rationale in 2016. The consistent focus on supporting nontraditional students also may reflect increasing interest among more schools to improve their programming and support systems for working adults.

2. Scope of CBE Adoption

Key finding: Many institutions' adoption activities fall short of full CBE programming.

Two key takeaways from Eduventures' 2016 report were that (1) CBE is not a well-defined model, and many institutions were using a variety of elements commonly associated with CBE even if they were not fully adopting a program; and (2) most CBE activity remained aspirational, still at the planning or course-level implementation stage.

The 2018 NSPCBE was designed to explore how the CBE landscape may have evolved since 2016 and whether or not more institutions had moved to full programs with key components of CBE in place. To that end, respondents were asked about activity that may not meet the definition of a full CBE program, but may be close on two dimensions: (1) implementation of specific elements related to CBE and (2) CBE implementation at the course level or still in the planning phase. Overall, the trend is still similar to 2016: Much of the activity remains short of a full CBE program on at least one of those two dimensions. This section describes the activity underlying that overarching trend.

ADOPTION BY ELEMENTS

Just over half of institutions reported having adopted—or planning to adopt—at least one of the elements that would meet the minimum threshold for CBE in this survey:

1. Measuring learning in competencies, *either* quantified without reference to seat time *or* mapped to measures of seat time;
2. Requiring mastery of all required competencies for advancement between unit to unit or for program completion; and
3. Allowing students to substantially "self-pace" (or "personalize the pace" of) courses or programs.

Each of those individual elements was adopted by less than half of respondents, though, indicating that many institutions are not implementing all of the above (see Figure 6); rather, they appear to be selectively implementing certain elements.

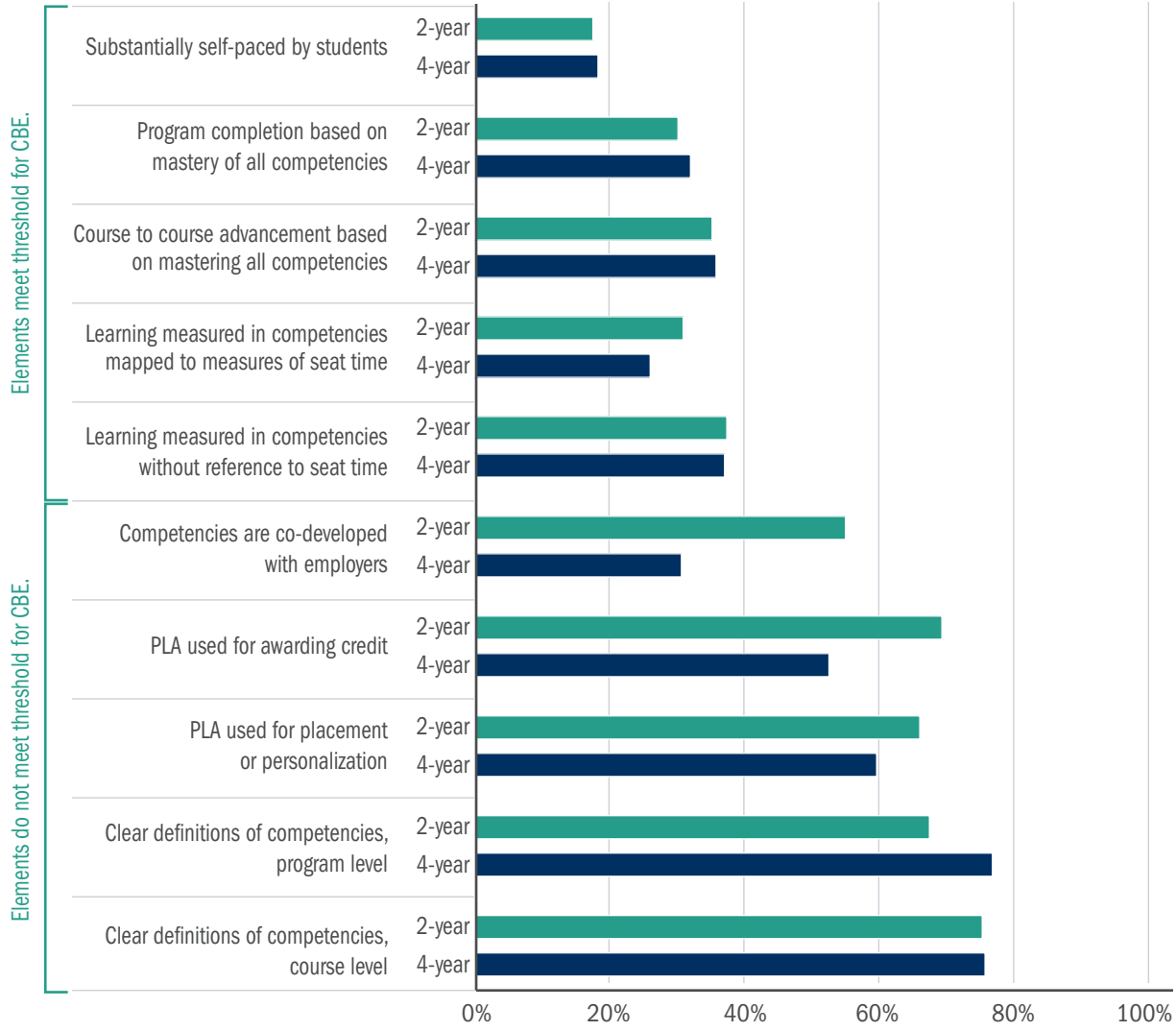
In contrast, elements ***related to CBE but not independently meeting the threshold*** for definition as CBE were typically more prevalent. These elements are often associated with CBE or may represent early steps toward adoption. These elements include:

1. Writing clear definitions of competencies at both the course and program levels (an activity often related to accreditation);

2. Using prior learning assessments (PLA) for both awarding credit and for placement or personalization purposes for incoming students; and

3. Codeveloping competencies with employers.

Figure 6. Adoption Activity by Element (Adopted or In Progress)



The only element that had a statistically significant difference in adoption between 2-year and 4-year institutions was the codevelopment of competencies with employers or other third parties. Two-year institutions reported significantly higher adoption than 4-year institutions, potentially reflecting the traditional distinctions in employer engagement between the two segments.

Comparison to 2016: Eduventures' 2016 survey showed that institutions were selectively adopting certain elements associated with CBE. In particular, in 2016, defining learning outcomes at the course and program levels were the most commonly adopted elements, followed by options related to using PLAs.[14] One difference

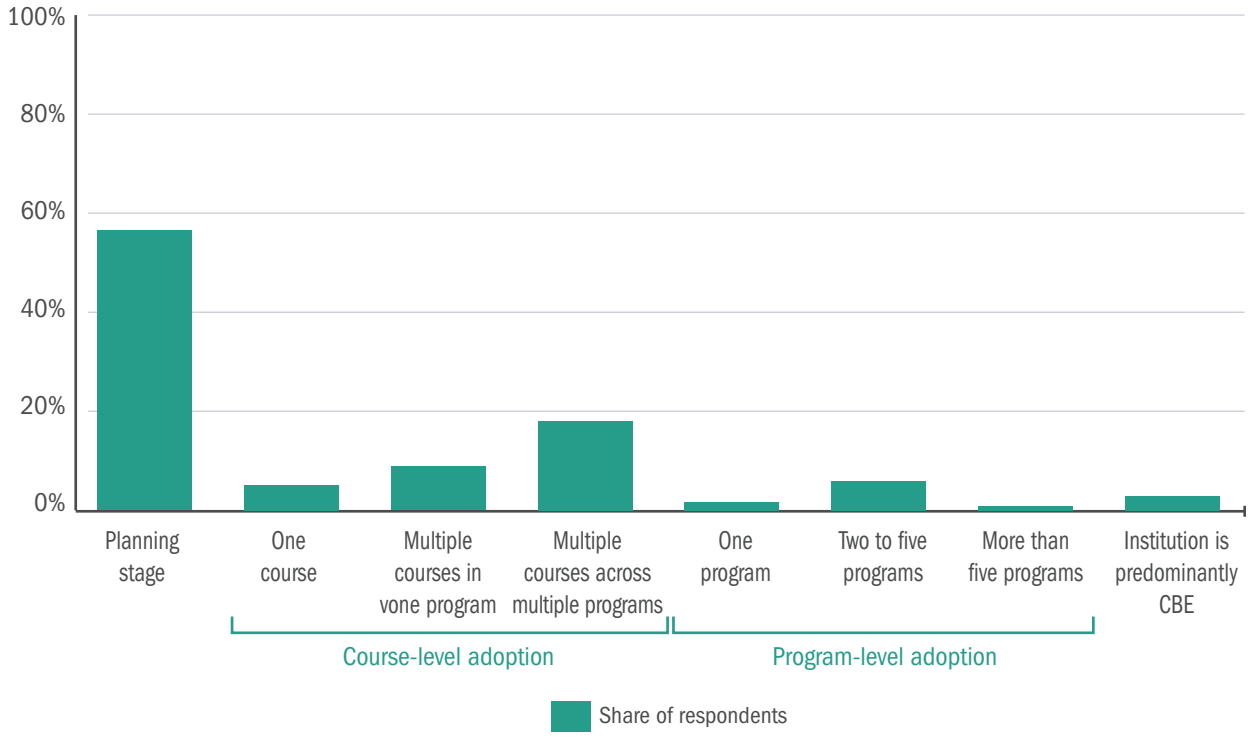
[14] Elements included in the 2016 and 2018 surveys differed slightly. The 2016 survey did not ask about mastery as the basis for advancement in this section. The 2018 survey did not include adaptive learning or learning outcomes at the subcourse level, and it collapsed three PLA options (placement, personalization, and credit) into two (placement/personalization and credit).

is that the use of direct assessment (measuring learning and quantifying it without reference to a measure of seat time) was among the most commonly reported adopted or adoption-in-progress elements in 2016; in 2018, however, it was one of the least commonly reported elements. This difference may be due, in part, to the different set of institutions responding to the 2018 survey.

STAGE OF ADOPTION

The 2018 NSPCBE also asked institutions that indicated current or in-process adoption of elements that met the threshold of CBE to clarify their current stage of implementation. It sought to distinguish whether institutions were still at the planning stage ("adoption in progress"), implementing elements in individual courses, or implementing full programs. As shown in Figure 7, the majority—57%—report that they were still in the planning stage. Thirty-two percent reported activity at the course level (one course or multiple), while only 11% reported having one or more full programs. Of those with at least one full program, having two to five programs was the most common category—with fewer institutions reporting that CBE was the "predominant" approach at their institution.

Figure 7. Stage of Adoption



Comparison to 2016: These findings are consistent with the overall results from Eduventures' 2016 study, which found that 38% were at the planning stage and 37% were only active at the course level. Although these broad trends are not longitudinal data about the same institutions and how they have changed over time, they generally show the prevalence of course-level activity rather than full program(s) in both 2016 and 2018 as well as the concentration of institutions still in the planning phase.

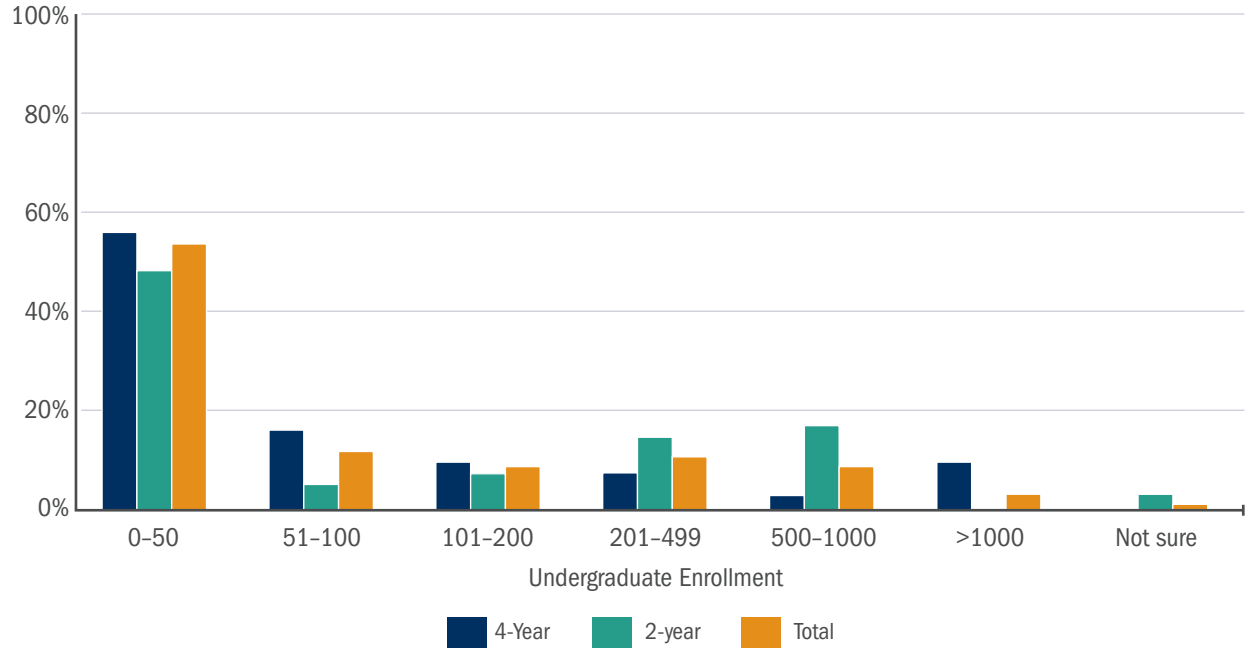
3. Scale of Enrollment in CBE Programs

Key finding: Most CBE programs currently serve relatively small numbers of students.

For those institutions offering full CBE programs, a key indicator of scale and potential impact of implementation is student enrollment. To better understand the scale of enrollment, the survey asked institutions with existing CBE programs to provide recent estimates of student enrollment.

Institutions with undergraduate CBE programs reported relatively small enrollments in those programs. In the last academic year, 53% of those reporting undergraduate enrollment in CBE programs reported fewer than 50 students per program (see Figure 8). In comparison, just 4.0% enrolled more than 1,000 undergraduate students in CBE programs. When disaggregating findings by institution level, there is a somewhat similar pattern, with approximately half of programs at both the 2- and 4-year levels enrolling fewer than 50 students.

Figure 8. Reported Undergraduate Enrollment in Active CBE Programs: Share of Institutions in Enrollment Size Categories



The prevalence of small programs in the 2018 survey suggests that, except for a small set of institutions with large programs, CBE at most institutions has not yet achieved large-scale implementation. Some of the reported barriers to adoption, detailed in the finding summarizing barriers, may explain this phenomenon, or this finding may represent early stage programs that institutions are piloting at a small scale.

Comparison to 2016: Although data limitations[15] make comparisons with 2016 challenging, data collected in 2016 show a similar concentration of programs with enrollment below 100 students. This was consistent among both undergraduate and graduate programs reported in the 2016 survey.

[15] This finding is difficult to compare because a relatively small share of respondents have operating programs and report enrollment sizes, so estimates are based on smaller sample sizes, and the enrollment size ranges were slightly different.

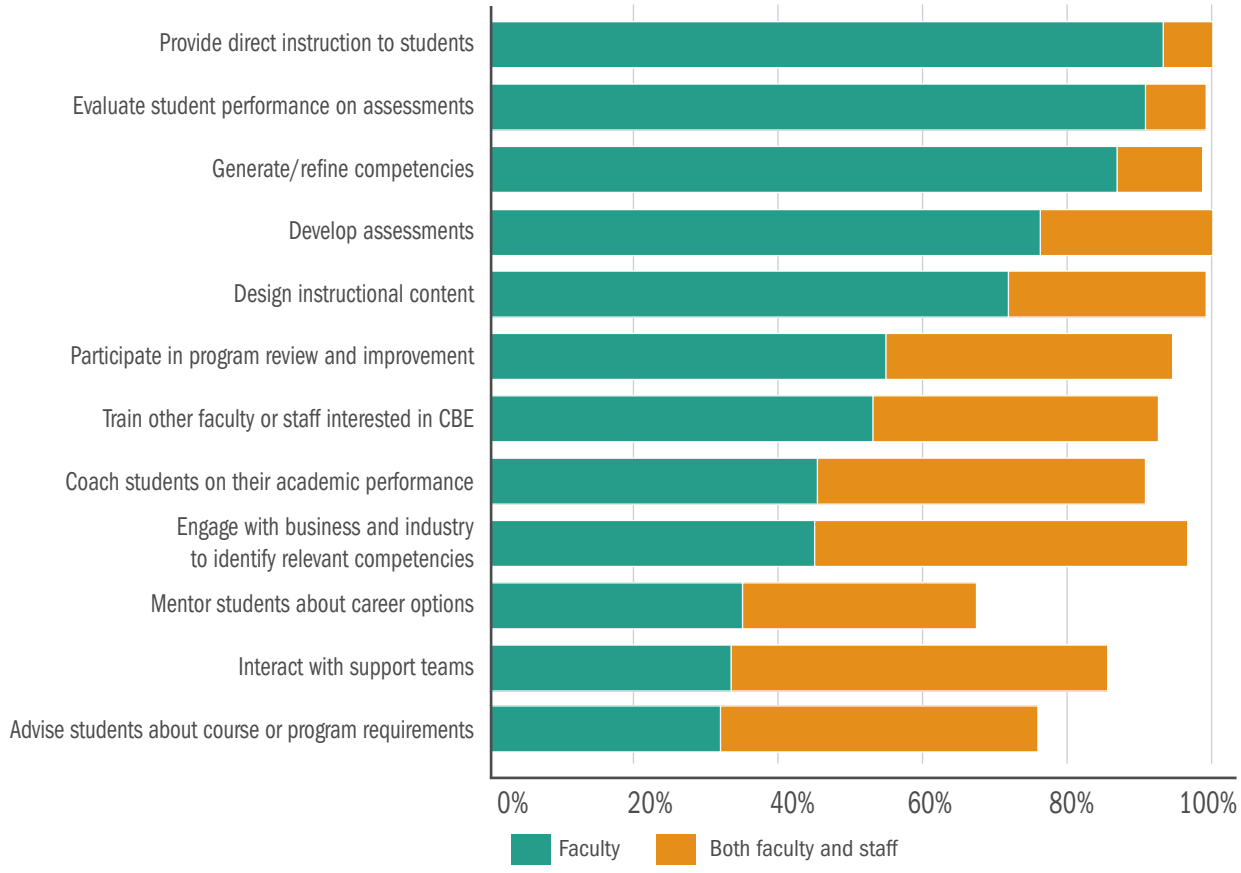
4. Role of Faculty in CBE Programs

Key finding: Faculty are still fulfilling a broad range of roles in active CBE programs.

Because CBE often departs from traditional models of teaching and learning, CBE programs frequently involve restructuring typical faculty roles.[16] The identification of optimal ways to structure faculty roles for successfully supporting student learning has been a key implementation challenge in many CBE programs. In addition, monitoring contact between faculty and students continues to be a core focus of the Education Department through the existing "regular and substantive" regulation.[17] To better understand what faculty roles look like in 2018, the NSPCBE included questions about the types of roles that faculty and staff filled in operating CBE programs.

Generally, responses support the notion that faculty continue to fulfill a broad range of roles across CBE programs, with the majority reporting that faculty members provide direct instruction to students, evaluate student performance on assessments, define competencies, develop assessments, and design instructional content (see Figure 9). Roles less commonly fulfilled by faculty include participating in program review, training other faculty or staff, engaging with third parties to identify competencies, coaching/mentoring students, and interacting with support teams; institutions typically reported that these roles were fulfilled by nonfaculty staff. These findings suggest that faculty in CBE programs fulfill content-driven roles but are likely to rely upon the contributions of nonfaculty staff to provide advising and related student support services.

Figure 9. Faculty Roles in CBE



[16] Navarre Cleary, M. (2015). *Faculty and staff roles and responsibilities in the design and delivery of competency-based education programs: A C-BEN snapshot.* Franklin, TN: Competency-Based Education Network. Retrieved from http://works.bepress.com/navarrecleary/14/

[17] Mehaffie, L. B. (2014, December 19). *Competency-based education programs—Questions and answers.* Washington, DC: U.S. Department of Education, Federal Student Aid. Retrieved from https://ifap.ed.gov/dpcletters/GEN1423.html

Comparison to 2016: The 2018 findings are broadly consistent with 2016, with a few notable exceptions. Areas of consistency include the development and evaluation of assessments and the creation of instructional content. In 2018, however, institutions more commonly reported that faculty were involved in additional areas, including direct instruction activities, developing and refining competencies, and training other faculty or staff (though, generally, this was much less common than the first two roles). Faculty involvement in other areas, including program evaluation and interaction with student support teams, was generally less common than in 2016. Most notable is the lower prevalence of institutions reporting that faculty are directly involved in coaching, mentoring, and advising students on a range of topics; this finding may be due in part to the evolving ways in which CBE programs are framing and structuring this role or splitting some elements between faculty and staff roles.[18]

It is clear from both the 2016 and 2018 surveys that CBE programs use faculty in a broad range of roles. A key consideration, though, is that responses do not distinguish how and whether programs have arranged "unbundled" or "reassembled" faculty models, which would involve having specific faculty fulfill one or two roles while other faculty members specialize in another role (e.g., instructional faculty separate from faculty evaluating performance on assessments).[19] Institutions may be reporting that faculty fulfill many roles, but it may be that *different* faculty fulfill different types of roles. Given the potential importance of this finding, questions about this approach will be included in future years of the survey.

5. Barriers to CBE Implementation

Key finding: Perceived barriers to CBE implementation represent both internal and external factors.

Because CBE may be a less familiar approach to teaching and learning, program leaders may encounter local barriers to implementation on their campuses, ranging from institutional processes and infrastructure to stakeholder buy-in. External factors, such as accreditation and financial aid regulations, also may affect an institution's decision to implement CBE. Given the broad range of potential barriers, the NSPCBE asked respondents to share their perceptions of what barriers exist to implementing CBE on their campuses.

Across institution types and levels of program adoption, responses indicated several key barriers to CBE implementation. More than 50% of institutions responding cited three key barriers, regardless of whether the institution had adopted CBE. These included:

1. Federal student aid regulations
2. Institutional business processes
3. Costs associated with program start-up

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[18] Navarre Cleary, M. (2015). *Faculty and staff roles and responsibilities in the design and delivery of competency-based education programs: A C-BEN snapshot.* Franklin, TN: Competency-Based Education Network. Retrieved from http://works.bepress.com/navarrecleary/14/. Page 9 contains discussion of new ways to conceptualize the coaching, advising, and mentoring roles.

[19] Bushway, D., Dodge, L., & Long, C. (2018). *A leader's guide to competency-based education: From inception to implementation* (p. 88). Sterling, VA: Stylus Publishing.

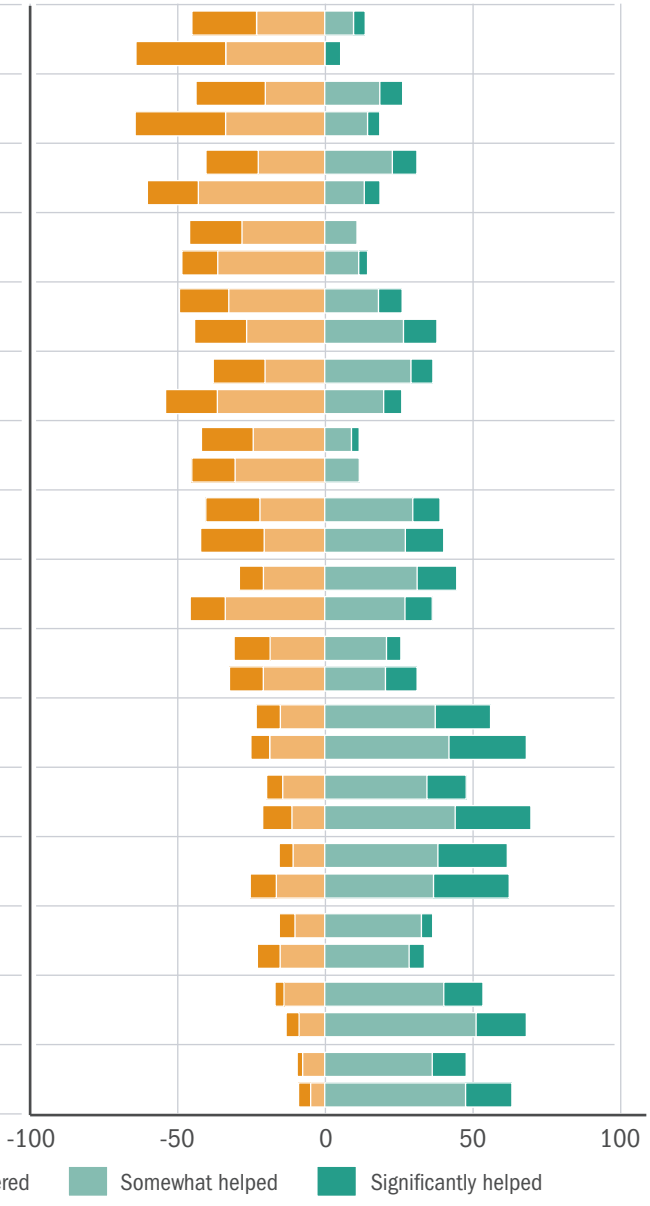
Among institutions that have existing programs or have begun building them, there were some differences between 2-year and 4-year institutions (see Figure 10). Of the 4-year institutions that responded, the top barriers to implementation included:

1. Faculty perceptions of CBE on campus
2. Start-up costs for CBE program
3. Federal student aid regulations

In contrast, 2-year institutions reported (1) institutional business processes, (2) federal student aid regulations, and (3) competing priority initiatives on campus as key barriers. Still, none of these differences were statistically significant.

Figure 10. To what extent is the adoption of CBE at your institution helped or hindered by the following factors?

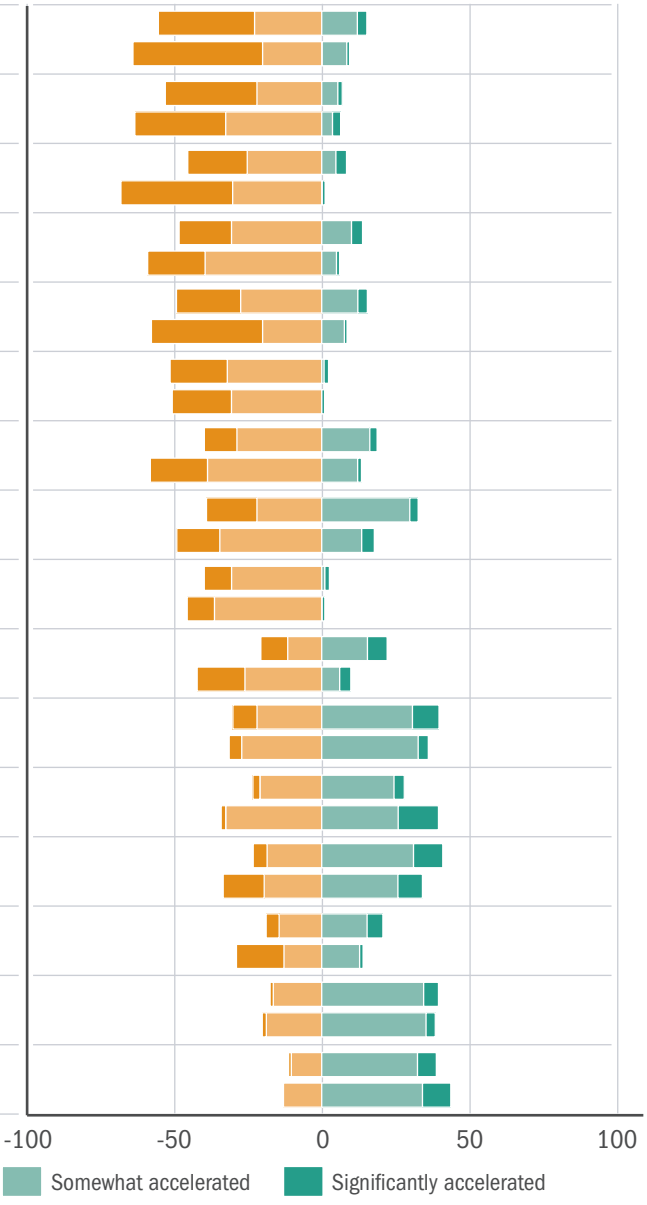
Factors	IPEDS Level	% Don't Know
Federal Student Aid regulations and processes	4-year	42
	2-year	31
Your institution's business systems and processes that support CBE	4-year	30
	2-year	18
Other priority initiatives at the institution	4-year	29
	2-year	21
CBE program start-up costs	4-year	44
	2-year	38
Faculty members' perception of CBE programs	4-year	24
	2-year	17
Accreditors' regulations and processes	4-year	26
	2-year	21
Non-federal student aid regulations and processes of the U.S. Department of Education	4-year	48
	2-year	44
On-campus expertise for developing CBE programs	4-year	21
	2-year	18
Your institution's educational technology resources	4-year	21
	2-year	18
Program's financial sustainability	4-year	44
	2-year	37
Senior administrators' perceptions of whether CBE is a "fit" for your institution	4-year	21
	2-year	7
Your ability to align industry standards to programs' competencies	4-year	32
	2-year	1
The support of your institution's leadership	4-year	23
	2-year	13
Demand from students	4-year	49
	2-year	44
Evidence about CBE programs' potential to improve outcomes for students like yours	4-year	30
	2-year	19
Evidence about CBE programs' potential to reduce cost for students like yours	4-year	43
	2-year	28



Although many of the trends were similar for institutions that were interested in CBE but had not yet begun building a program, there is one notable difference: 57% cited a lack of on- campus expertise to be a key barrier to implementation (see Figure 11) compared with 40% of institutions with a CBE program or in the process of adopting a program.

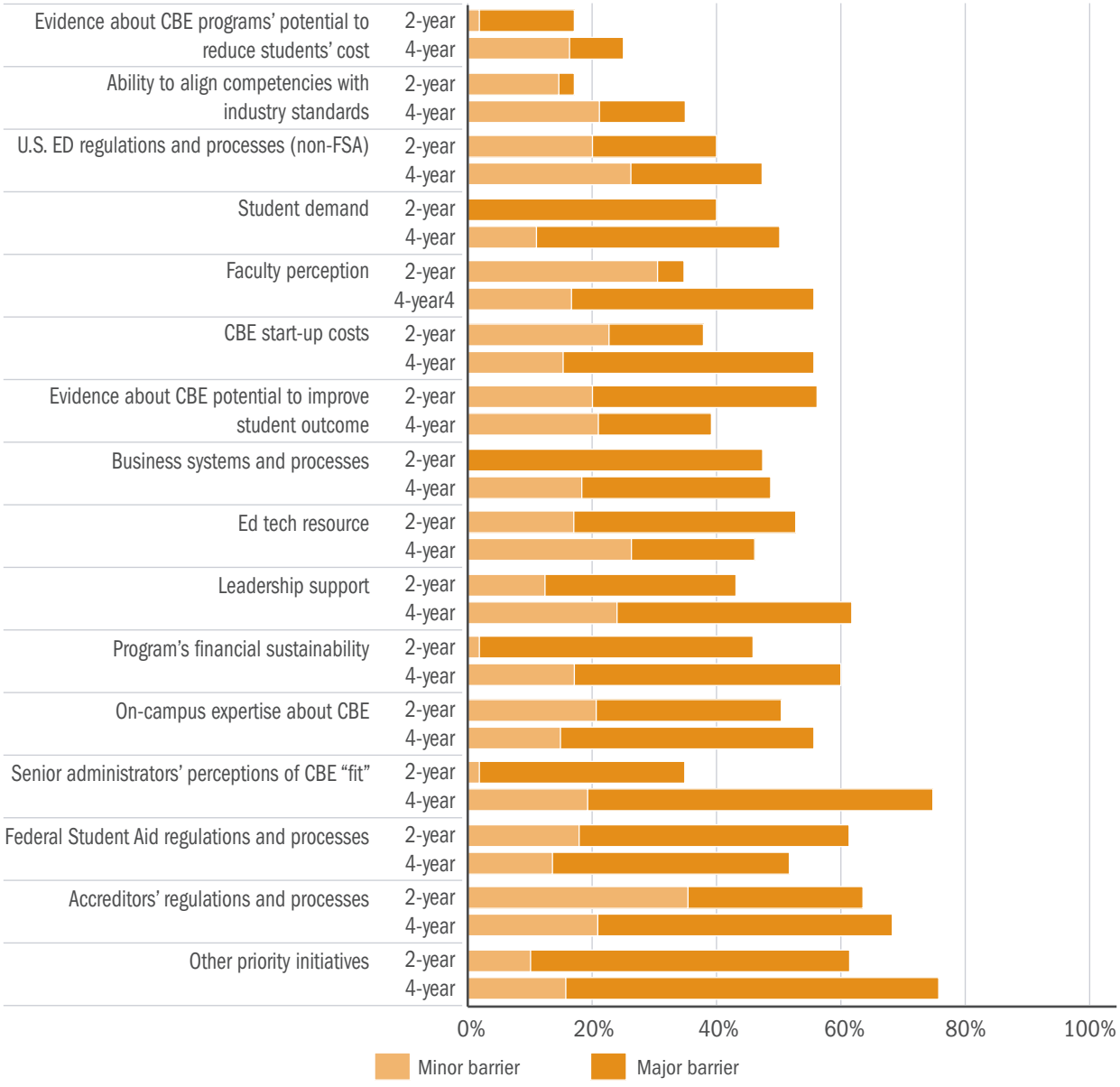
Figure 11. To what extent is interest in the adoption of CBE at your institution accelerated or slowed by the following factors?

Factors	IPEDS Level	% Don't Know
On-campus expertise for developing CBE programs	4-year	30
	2-year	28
Your institution's business systems and processes that support CBE	4-year	41
	2-year	30
Federal Student Aid regulations and processes	4-year	47
	2-year	32
Faculty members' perception of CBE programs	4-year	38
	2-year	36
Other priority initiatives at the institution	4-year	36
	2-year	34
CBE program start-up costs	4-year	47
	2-year	50
Accreditors' regulations and processes	4-year	42
	2-year	29
Your institution's educational technology resources	4-year	29
	2-year	34
Non-Federal Student Aid regulations and processes of the U.S. Department of Education	4-year	58
	2-year	55
Program's financial sustainability	4-year	58
	2-year	49
Senior administrators' perceptions of whether CBE is a "fit" for your institution	4-year	30
	2-year	33
Your ability to align industry standards to programs' competencies	4-year	49
	2-year	27
The support of your institution's leadership	4-year	36
	2-year	33
Demand from students	4-year	61
	2-year	57
Evidence about CBE programs potential to improve outcomes fro students like yours	4-year	43
	2-year	42
Evidence about CBE programs' potential to reduce cost for students like yours	4-year	51
	2-year	44



Of those institutions that had no interest in adopting CBE (see Figure 12), federal student aid and accreditation regulations remained at the top of the list, but senior administrators' perception of fit was higher than the other groups. It appears to be a greater barrier for 4-year institutions (74% citing it as a barrier) than for 2-year institutions (34%). This distinction may be important because those adopting and interested (above) cited senior administrators' perception of fit to be among the top factors supporting implementation or interest. Ultimately, this may reinforce the notion that institutional factors, particularly those outside of academic units or departments, are an important part of supporting CBE implementation.

Figure 12. Among Institutions Not Interested in CBE: Minor and Major Barriers to Interest



Comparison to 2016: The broad trends are consistent with the 2016 survey findings; more than 75% of institutions reported that federal student aid processes and CBE program start-up costs were either a significant barrier or somewhat of a barrier to CBE implementation. Faculty perceptions (or skepticism) of CBE and resource constraints (including constraints due to competing priorities) also were among the top-reported barriers in 2016.

6. Future of CBE

Key finding: Most institutions are optimistic about the future of CBE.

The future of CBE is likely to be influenced by the regulatory climate and the ability of schools and vendors to remove or bypass persistent obstacles to implementation. However, the willingness of institutions to expand existing CBE programs or develop new ones plays an equally important role in CBE's growth over time. To better understand this, the 2018 NSPCBE survey sought to gauge expectations among responding institutions over whether CBE would grow nationally and at their own institution. Overall, 75% of institutions reported that they expect the number of CBE programs nationally to increase in the next 5 years, 24% expected there to be no change in the number of CBE programs nationally, and just 1% reported that they expect a decrease in CBE programs nationally (see Figure 13). The findings are similar across institution type, where 80% of 2-year institutions expect the number of programs to increase compared with 73% of 4-year institutions.

Responses suggest that an institution's interest in CBE is related to its perceptions about the future of CBE.[20] Among institutions adopting CBE or interested in doing so, expectations were relatively similar. Among both institutions with CBE programs or those in the process of adopting CBE, 80% expected CBE to increase and 20% believed the number of programs would be unchanged (see Figure 14). Furthermore, of institutions with CBE programs, 83% reported expecting that CBE programs at *their institution* would increase in the next 5 years. Of those institutions interested in adopting, 76% expected the number of programs to increase, 23% expected no change, and 1% expected the number of programs to decrease. However, among those institutions that were not interested in adopting CBE, 58% expected CBE to grow in the next 5 years, 38% expected no change, and 4% believed the number of CBE programs will decrease.

Comparison to 2016: Data from 2016 revealed a similar set of attitudes toward the prospects for further CBE growth. Among institutions with existing programs, 33% reported that they expected CBE to continue to play a major role in their institution's strategic plan. Among this same cohort, however, only 16% envisioned CBE becoming part of the higher education "mainstream." Among schools that reported to be in the planning stage, only 5% anticipated mainstream potential for CBE; 32% expected CBE to useful in specialized programs or through the use of specific component parts. Not surprisingly, these 2016 data suggested that institutions with first-hand experience in operating a CBE program were more likely to anticipate further growth. Institutions that had yet to implement a program remained slightly less sure of continued growth.

These data suggest that despite significant and varied barriers to CBE program growth, most institutions remain optimistic about the prospects for further CBE expansion. Although there is evidence that optimism is higher among those with direct experience in developing and managing a CBE program, the sense that CBE will grow going forward cuts across key categories of respondents. This positive outlook is consistent with the 2016 findings, and may even be interpreted as an increased sense of optimism.

[20] These differences are statistically significant.

Figure 13. Expectations About the Future of CBE, by Adoption

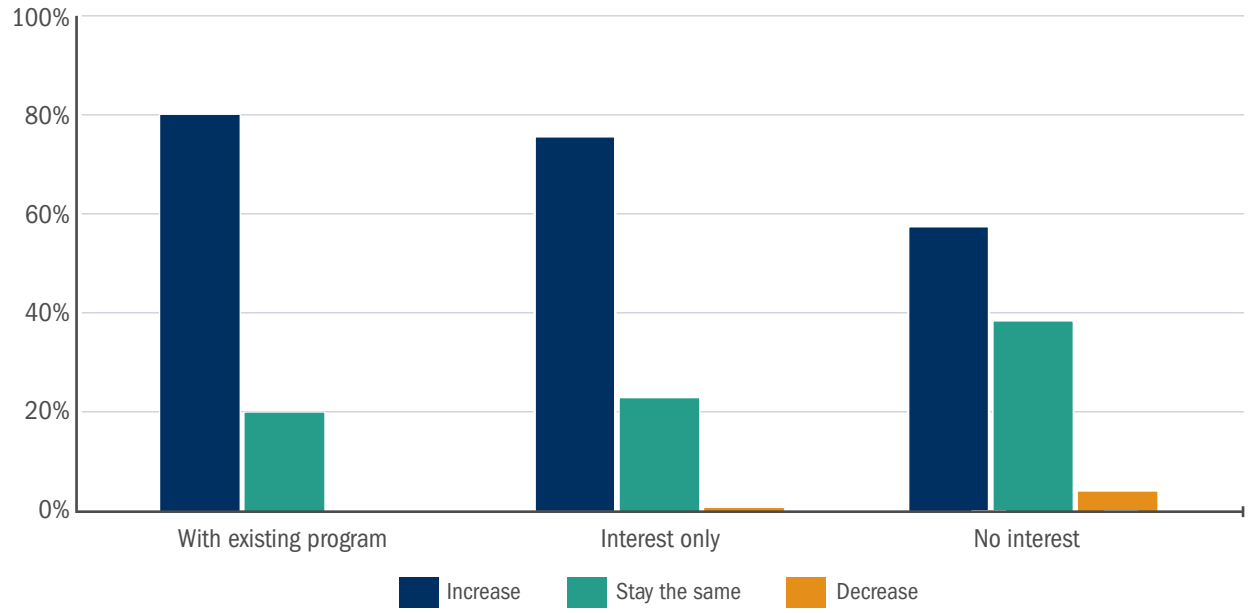
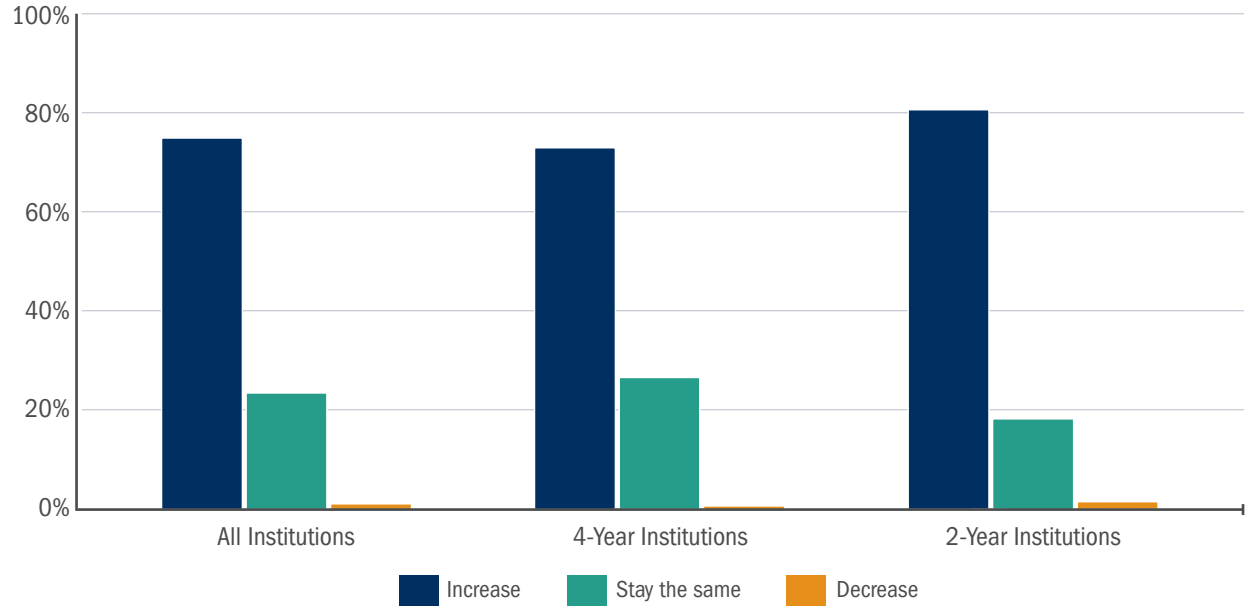


Figure 14. Expectations About the Future of CBE, by Institution Level



CRITICAL QUESTIONS FACING THE FIELD: CBE IN 2018

Findings from the 2018 NSPCBE confirm that the learner-centric logic for CBE remains compelling for many institutions. Indeed, 57% have implemented CBE or are in the process, and 27% are interested—in sum, 84% are either implementing or interested in implementing CBE. A small subset of institutions account for the most program activity.

A critical question is whether CBE can expand in scale and have an impact in traditional institutional contexts and in the current regulatory and policy environment. The findings from this survey suggest that building full CBE programs requires overcoming significant barriers, particularly those outside the purview of any individual academic unit looking to implement CBE, including federal financial aid regulations or institutionwide business processes.

Ultimately, these barriers may explain why many institutions initially use only some CBE elements without adopting a full set or opt for course-level activity rather than full programs. However, CBE's potential to address institutions' learner-centric goals rests in providing its perceived benefits *throughout a student's experience*—or for a full program rather than in one or two courses—and it is not yet clear whether that logic can help institutions overcome the barriers.

Despite the current small scale of CBE and barriers to its implementation, the majority of institutions responding to the survey remain optimistic about the growth of CBE. This trend may reflect widespread acknowledgment of the commonly touted, systemic challenges to providing affordable, accessible, and high-quality postsecondary experiences. Or it may signal a deep reservoir of commitment to CBE as *the best solution* to these problems, perhaps leading more institutions to implement CBE in the years ahead despite the barriers. The NSPCBE will continue to track the level of optimism and implementation in the coming years to better understand that evolution, the decisions that institutions make, and the students they serve.

THE ROAD AHEAD

When considering how to support the sustainable and responsible implementation of CBE programs, CBE stakeholders could benefit from assessing several critical challenges:

- **Program leaders and department chairs** considering CBE should weigh the relative benefits and costs of starting with specific CBE elements versus going "all in" on implementing a full CBE program to understand which components will allow them to best navigate potential barriers. In addition, program leaders with operating programs can consider and evaluate whether their program designs indeed achieve the goals or benefits they intended, including serving nontraditional students and supporting equitable outcomes for all students.
- **Institutional leaders** should assess whether CBE represents enough of a strategic priority that it is worth marshaling institutionwide resources to remove important barriers identified in this survey, including technology services and platforms, business processes, financial aid, and institutional research.
- **Policymakers** must figure out how to balance efforts to remove regulatory barriers to innovation—as cited by many in this survey—with maintaining important consumer protections. The survey data do not provide sufficient detail to cite individual regulations nor do they provide evidence of the efficacy needed to help inform a path forward, but those barriers continue to be perceived by both institutions who have navigated the barriers and implemented a program *and* by those who have not yet started.

Given the prevalence of barriers to CBE implementation, it will be critical that future research continues to seek a better understanding of the experience of CBE implementation and how it is serving students. Future years of the NSPCBE will focus on broadening the field's understanding of where CBE is and is not being successfully implemented, what barriers and accelerators affect implementation, and how faculty and staff roles are structured. The survey also will have a deeper focus on cost to students in CBE programs, a topic that was not well captured by the existing questions. In addition, given early indications that these programs indeed serve sizable populations of older students and students of color, the survey will probe more deeply about how programs are designing approaches with these students in mind, including whether and how program leaders incorporate equity into their design and operations. With an eye toward change over time, the NSPCBE also will track trends in the field and question whether and how changes in the field are related to external factors, such as policy or regulatory changes.

ACKNOWLEDGMENTS

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APPENDICES

Appendix A: Survey Descriptive Statistics

The following tables provide details on responses to questions related to program implementation. Please note that these responses are based on respondents who indicated that they had a CBE program, which is a subset of the overall respondents.

Table A–1. How long has your institution offered competency-based courses?

Less than one year	6%
1–2 years	19%
3–4 years	26%
5–7 years	7%
More than 7 years	29%
Don't know	14%

Table A–2. How long has your institution offered entire programs that are exclusively CBE?

Less than one year	13%
1–2 years	12%
3–4 years	24%
5–7 years	10%
More than 7 years	11%
Don't know	30%

Table A–3. Do your CBE programs…

	Don't Know	No, none do	Yes, some do	Yes, all do
Lead to a certificate, undergraduate, or graduate degree, if completed?	7%	10%	24%	60%
Require mastery learning of ALL competencies in a program?	11%	11%	17%	61%
Primarily require students to demonstrate their competency via authentic assessments?	10%	0%	36%	54%
Use "backward design," where the competencies to be mastered drive students' learning journey?	26%	10%	27%	37%

Table A–4. Can students access federal financial aid to pay for your CBE offerings?

Yes	55%
No	22%
Don't know	24%

Table A–5. For federal financial aid purposes, our institution…

Maps competencies to credit hours to award financial aid	68%
Has been approved for "direct assessment" by the US Department of Education	17%
Other	15%

Table A–6. At which award levels are your undergraduate CBE programs offered? (Check all that apply.)

Non-credit	14%
Certificate	51%
Associate's degree	38%
Bachelor's degree	53%

Table A–7. In what disciplines are your undergraduate CBE programs offered? (Check all that apply.)

Biological and Life Sciences	7%
Business Administration	40%
Computer and Information Sciences and Support Services	47%
Construction Trades	13%
Education	17%
Liberal Arts and Humanities	10%
Mechanic and Repair Technologies	12%
Nursing and Health Professions	33%
Physical Sciences (e.g., Chemistry, Engineering)	3%
Social Sciences (e.g., Psychology, Sociology, Political Science, Economics)	8%
Other	19%

Table A–8. For the most recent academic year for which you have data available, about how many undergraduate students:

	0–50	51–100	101–200	201–499	500–1000	More than 1000
Are enrolled in CBE programs that are entirely competency-based?	53%	13%	9%	11%	9%	6%
Are expected to be enrolled in your CBE programs that are entirely competency-based within 5 years?	13%	18%	20%	21%	19%	9%
Have graduated from CBE programs that are entirely competency-based?	62%	12%	7%	11%	3%	4%

Table A–9. For the most recent data you have available, which best describes the composition of undergraduate students enrolled in your certificate and degree programs that are entirely competency based?

	Percent of undergraduate students enrolled in your certificate or degree programs that are entirely competency-based			
	0–24%	25–49%	50–74%	75% or more
Percent who are white, non-Hispanic	33%	21%	40%	6%
Percent who are at least 25 years old	17%	12%	28%	44%
Percent who had college credit at the time of admission	41%	11%	11%	37%
Percent who are veterans or active duty military	96%	4%	0%	0%

Note. Fewer than 50 institutions reported data for this item.

Table A–10. At which award levels are your graduate (post-baccalaureate) CBE programs offered? (Check all that apply.)

Non-credit	0%
Certificate	43%
Master's degree	52%
Professional degree	12%
Doctoral degree	5%

Table A–11. In what disciplines are your graduate (post-baccalaureate) CBE programs offered? (Check all that apply.)

Biological and Life Sciences	0%
Business Administration	23%
Computer and Information Sciences and Support Services	21%
Construction Trades	0%
Education	28%
Liberal Arts and Humanities	2%
Mechanic and Repair Technologies	0%
Nursing and Health Professions	36%
Physical Sciences (e.g., Chemistry, Engineering)	0%
Social Sciences (e.g., Psychology, Sociology, Political Science, Economics)	2%
Other	5%

Note. Fewer than 50 institutions reported data for this item.

Table A–12. For the most recent academic year for which you have data available, about how many graduate (post-baccalaureate) students are enrolled in CBE programs that are entirely competency-based?

0–50	61%
51–100	29%
101–200	0%
201–499	0%
500–1000	2%
More than 1000	8%

Note. Fewer than 50 institutions reported data for this item.

Table A–13. Five years from now, about how many graduate (post-baccalaureate) students do you expect to be enrolled in your CBE programs that are entirely competency-based in each year?

0–50	31%
51–100	33%
101–200	18%
201–499	2%
500–1000	4%
More than 1000	11%

Note. Fewer than 50 institutions reported data for this item.

Table A–14. For the most recent data you have available, about how many graduate (post-baccalaureate) students have ever graduated from CBE programs that are entirely competency-based in total?

0–50	60%
51–100	14%
101–200	0%
201–499	14%
500–1000	7%
More than 1000	4%

Note. Fewer than 50 institutions reported data for this item.

Table A–15. For the most recent academic year for which you have data available, which best describes the composition of graduate students enrolled in your certificate and degree programs that are entirely competency based?

	Percent of graduate students enrolled in your certificate or degree programs that are entirely competency-based				
	Don't Know	0–24%	25–49%	50–74%	75% or more
Percent who are white, non-Hispanic	26%	2%	19%	47%	7%
Percent who are at least 25 years old	26%	0%	16%	21%	37%
Percent who had college credit at the time of admission	12%	23%	0%	16%	48%
Percent who are veterans or active duty military	52%	44%	4%	0%	0%

Note. Fewer than 50 institutions reported data for this item.

Table A–16. To what extent does a senior administrator lead efforts related to competency-based approaches?

Not at all	16%
A little	11%
Mostly	21%
To a great extent	44%
Don’t know	8%

Table A–17. To what extent is CBE incorporated into your institution’s strategic plan?

CBE is not in our current strategic plan and isn't likely to appear in a future one.	8%
CBE is not in our current strategic plan but is likely to play a minor role in a future one.	17%
CBE is not in our current strategic plan but is likely to play a major role in a future one.	8%
CBE is in our current strategic plan in a minor way.	40%
CBE is in our current strategic plan in a major way.	16%
Don't know	11%

Table A–18. To what extent is funding for CBE available for each of the following?

	No funding available for CBE	Some funding available for CBE	Major funding available for CBE
Departments at your institution	34%	53%	14%
Your institution	45%	41%	14%

Table A–19. How do your students access and participate in CBE offerings?

Our CBE courses are accessed entirely online.	37%
Our CBE courses are accessed in a hybrid or blended modality, combining online and face-to-face interactions.	30%
Our CBE courses are predominately face-to-face, with a few online assignments.	17%
Our CBE courses are entirely face-to-face.	16%

Table A–20. For each of the following CBE characteristics, consider the current CBE offerings which you are most familiar. How often, or to what extent, are…

	Don't know	Never	Occasionally/to some extent	Frequently/to a great extent	Always
Curricula clearly organized around measurable competencies.	0%	0%	6%	35%	59%
Competencies aligned to specific workforce opportunities.	6%	0%	15%	41%	38%
Offerings designed to be completed over variable periods of time.	7%	2%	22%	17%	52%
Students proceeding through content and assignments at a flexible pace.	6%	2%	22%	16%	54%
Students receiving real-time, personalized assessments of their learning progress.	6%	1%	11%	48%	34%
Students' pathways through courses personalized based on assessments of their learning progress.	12%	9%	23%	23%	33%

Table A–21. Generally, how does the level of effort required of faculty and support staff in CBE offerings compare to non-CBE offerings at your institution?

CBE requires much more work than non-CBE	22%
CBE requires somewhat more work than non-CBE	38%
Roughly the same level of work than non-CBE	22%
CBE requires somewhat less work than non-CBE	16%
CBE requires much less work than non-CBE	0%
Don't know	2%

Table A–22. Generally, how does each of the following differ in your institution's CBE offerings compared to non-CBE offerings?

	Too early to judge or don't know	Significantly worse in CBE than non-CBE	Slightly worse in CBE than non-CBE	Roughly the same	Slightly better in CBE than non-CBE	Significantly better in CBE than non-CBE
Faculty-student communication	38%	0%	2%	41%	16%	2%
Learning outcomes	43%	0%	0%	26%	20%	10%
Completion rates	43%	0%	6%	36%	4%	10%

Table A–23. Please identify how your institution supports CBE graduates. My institution…

Expedites the transfer of credits to and from other institutions.	12%
Matches graduates with employers based on student performance and mastery of specific competencies.	8%
Connects graduates to a broader community of CBE alumni.	10%
Identifies areas of greatest workforce needs and opportunities.	32%
Provides ongoing opportunities for graduates to continue augmenting their education through new CBE courses, certificates and degrees.	12%
Other	8%
Has no current CBE graduates.	44%
Don't know	2%

Note. Fewer than 50 institutions reported data for this item.

Table A–24. Which services do you outsource to an external vendor to support your institution's CBE offerings?

Learning Management System (LMS)	66%
Instructional design	2%
Client relationship management (CRM)	16%
Marketing and recruitment	2%
Enrollment management	2%
Development of assessments or competencies	0%
Development of online or blended CBE courseware	4%
Learning portfolio services	29%
Other	2%
Don't know	16%

Note. Fewer than 50 institutions reported data for this item.

Table A–25. How is CBE course content created?

Developed largely from scratch by our faculty.	90%
Bundled as part of our learning management system (LMS) or similar tool.	6%
Developed by a third-party specialist.	0%
Developed by a combination of faculty and third-party specialists.	10%
Used, adapted, or modified content from outside the university.	8%
Used, adapted, or modified content from within the university.	18%
Developed in conjunction with specific employers or industry associations.	38%
Other	4%

Note. Fewer than 50 institutions reported data for this item.

Table A–26. How are CBE competencies created?

Developed largely from scratch by our faculty.	92%
Developed by a third-party specialist.	0%
Developed by a combination of faculty and third-party specialists.	10%
Developed in conjunction with specific employers or industry associations.	31%
Other	2%

Note. Fewer than 50 institutions reported data for this item.

Table A–27. Have you used the following resources as you developed your program? (For institutions with programs or in the process of adopting)

Quality Framework published by the Competency-Based Education Network (CBEN)	28%
The Connecting Credentials Framework/Beta Credentials Framework	11%
LEAP/VALUE rubrics published by AAC&U	30%
Resources provided by the U.S. Department of Labor (O*NET, Building Blocks)	36%
Degree Qualifications Profile	22%
Employer or industry competency models	60%

Table A–28. Have you heard of any of the following resources that can be used to support CBE program development? (For institutions with interest, but no program)

Quality Framework published by the Competency-Based Education Network (CBEN)	29%
The Connecting Credentials Framework/Beta Credentials Framework	0%
LEAP/VALUE rubrics published by AAC&U	71%
Resources provided by the U.S. Department of Labor (O*NET, Building Blocks)	0%
Degree Qualifications Profile	43%
Employer or industry competency models	43%

Note. Fewer than 50 institutions reported data for this item.

Appendix B: Technical Documentation

This appendix outlines the methods of the National Survey of Postsecondary Competency-Based Education (NSPCBE), sponsored by Lumina Foundation and conducted by the American Institutes for Research (AIR). The Web-based survey was administered in the summer of 2018, from June 11 to July 27.

POPULATION AND SAMPLING

The NSPCBE was intended to be administered to administrators at all 4,291 2- and 4-year institutions of higher education in the United States. The list of institutions was drawn from the Integrated Postsecondary Education Data System (IPEDS). Because this is a census, no sampling occurred. Not all institutions were contacted for the survey, though; if the institution could not be successfully "rostered"—meaning that the research team could not obtain contact information for at least one administrator who may be knowledgeable about CBE programs—it was not contacted.

In total, 4,668 provosts, institutional research directors, and other administrators representing 3,043 institutions were sent an invitation to participate on June 12, 2018. Contact information was obtained from several sources, including directory files purchased by the research team and contact information reported in the previous Eduventures survey.

Because this was a census and not a probability sample, no estimates of sampling error will be reported.

RECRUITMENT AND SURVEY FOLLOW-UP

The surveys were administered via the Web with e-mail notifications and reminders. Prior to launch on June 11, AIR and Eduventures notified their partners by direct e-mail and announcements on various electronic mailing lists. During the field period, AIR and Eduventures contacted potential survey respondents through e-mail reminders and direct mail, supplemented by presentations and announcements about the survey through advisory board member outlets.

RESPONSE RATES

The overall response rate for this survey was 16%; 501 of the 3,043 rostered institutions responded. Priority institutions—identified based on their past interest in CBE or the size and makeup of their student population—had a response rate of 23%.

Response rates may be calculated in a variety of different ways. The American Association for Public Opinion Research (AAPOR) has standardized response rate calculations across the survey and polling industry, providing a variety of different options for researchers.[21] In this study, AAPOR's Response Rate 2 (RR2) was used to calculate response rates:

$$\text{AAPOR RR2} = (\text{Completes} + \text{Partials}) / (\text{Completes} + \text{Partials} + \text{Eligible Nonrespondents})$$

Partial responses were counted as such if the respondent completed the screener (up to question 5; see Appendix A) but did not complete the rest of the survey. If individuals logged into the survey but did not complete the screener, they were considered nonrespondents. Individuals who completed all relevant survey items were counted as completers.

[21] https://www.aapor.org/Standards-Ethics/Standard-Definitions-(1).aspx

Institution-level response rates. The research team targeted multiple individuals at each institution and, at 24 institutions, two individuals responded. Analyses included only a single respondent for each institution, based on a series of rules as follows to identify and keep the most knowledgeable respondent at the institution:

- **Completeness of data:** the respondent with the most complete data took precedence.
- **Scope of knowledge:** if both respondents had the same number of questions completed, the respondent who indicated "institutionwide" knowledge of CBE approaches in question 2 of the survey took precedence.
- **Role:** if the response to question 2 was missing or if both individuals selected that option, question 1 was used to identify the person most likely to be knowledgeable about activity across the institution. Vice provosts took precedence, followed in order by deans, provosts, institutional review directors, department chairs, presidents, and faculty.

In addition to calculating the response rate at the individual level, AIR and Eduventures also calculated the response rate at the institution level, again using AAPOR RR2. In this response rate calculation, the numerator includes institutions with *at least one* complete or partial response, per the definitions described above. The denominator was the 3,043 institutions for which valid contact information was available.

WEIGHTING

Broadly, the target population for the NSPCBE consists of institutions of higher education in the United States. For weighting purposes, the target population was defined as institutions meeting *both* of the following criteria:

- The institution is listed in IPEDS[22]; and
- The institution was successfully "rostered," meaning that the project team was able to obtain contact information for at least one administrator who may be knowledgeable about CBE programs.

This corresponds to the definition used in the calculation of response rates. Note that this definition implies that institutions that are listed in IPEDS but were not rostered are treated as ineligible for the survey. Thus, weighted estimates will be representative *only* of rostered institutions; they will not be representative of all institutions in the United States.

To calculate the weights, the universe of institutions was first partitioned into adjustment cells using a classification and regression tree (CART).[23] CART is a machine learning algorithm that automatically identifies predictors that are associated with a dependent variable of interest—in this case, IPEDS variables associated with the likelihood of being a respondent. The algorithm then successively partitions the universe into cells defined by those variables, with the aim of maximizing between-cell variability in the response rate.

For all institutions *i* assigned to a given cell *b,* the weight was calculated as:

$$(1) \quad w_i = \frac{U_b}{R_b}$$

[22] One exception was the College of Traditional Midwifery. This institution was not in IPEDS but was included because it is part of the CBEN network and is known to CBE users.
[23] The specific CART implementation was the rpart function in R, available in the rpart package. A minimum cell size of 35 and a complexity parameter of 0 were specified.

where U_b is the universe size in cell *b* and R_b is the number of contacts in cell *b.* Equation 1 is the equivalent of the inverse of the response rate within cell *b.*

The following IPEDS variables were selected by the CART analysis to define the nonresponse adjustment cells:

- STRATUM
- C15BASIC (Carnegie classification 2015)
- CCBASIC (Carnegie classification 2005/2010)
- STABBR (state)
- EFTOTLM (number of enrolled men, categorized into deciles)
- EF2MORT (number enrolled with two or more races, categorized into deciles)
- EFYASIAW (number of enrolled Asian women, categorized into deciles)

Across the 501 respondents, the final weights, by construction, sum to the universe size of 3,043 institutions. The final weight is undefined for the remaining 2,541 institutions in the universe that were not respondents.

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