Considerations for CBE Technical Architectures in Postsecondary Education

WHITE PAPER
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Globally, our approach to education and training is outdated—it’s not rooted in an understanding of what learning truly means, and it’s not serving learners or employers. That’s why the Competency-Based Education Network (C-BEN) is advancing a revolutionary approach, transforming how we design, experience, and measure learning throughout a lifetime. Learning should be measured by what you can do: the knowledge, skills, and behaviors that lay the foundation for your success. At C-BEN, we lead our network of changemakers toward a reimagined future, one where everyone, regardless of age, location, or background, can grow the competencies they need for career-readiness and lifelong learning.

While our network is driving transformation of learning systems, a key partner for success is the technology community that can enable competency-based solutions by developing technology architectures that can support the learning lifecycle using competencies rather than time.

As a part of the CompetencyXChange initiative, C-BEN has partnered with Unicon, a leading provider of education technology consulting, to chair the Ed Tech workgroup. The result of this partnership is a new issue paper outlining considerations for the field on CBE and technology. In sum, we have seen great progress made on the technology drivers that power digital, competency based programs. However, in order to scale as quickly as the demand for skilled, agile workers is growing, learning providers still lack the availability of a market of cost effective solutions that are competency-driven. The goal of the Ed Tech workgroup in producing this issue paper is to lay the groundwork for future development and partnership. We hope you will be in touch with us about the ideas and solutions you have for competency-driven technology.

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Competency-Driven Technology

Just as IT architectures and systems vary from institution to institution, the technology used to support CBE programs will differ at each school. In this paper we explore both the systems involved in CBE technology deployment as well as the common operational features of CBE programs in order to help institutions arrive at their own CBE technical architecture.
The diagram below includes the systems that are likely to be involved in the facilitation of an institution’s operational functions for CBE. Implementations will vary based on the arrangement of IT (centralized, decentralized), the specific policies and processes of the CBE program, and the institution’s operational staff. Operational considerations for CBE programs are listed in the right margin, and are explored in the next section.
Systems

Student Information System (SIS)
Manage student information across the student experience.

Learning Management System (LMS)
Administer a learning process through course structures, content, assessments, and related tooling.

Financial Aid
Enable the tracking and distribution of financial aid to learners.

Admissions and Registration
Enable administrative workflows for attracting and enrolling learners.

Customer Relationship Management (CRM)
Enable the personalized tracking and servicing of individual learners over the learner journey.

Competency Management
Manage competency definitions, groupings, mappings and related assessments.

Curriculum and Courseware
Deliver interactive course content and lightweight assessment.

Assessment
Facilitate the measurement of what students know and can do.

Communications and Conferencing Platforms
Connect learners to faculty, peers, and support networks via audio and video.

Academic Advising and Planning
Enable Advisors to provide learners individualized support and academic planning across a program.

Opportunities for Ed Tech Improvement

Most current SIS market offerings don’t provide data models and APIs that support the open-ended, self-paced courses required in CBE programs.

Financial aid systems need to be able to support mechanisms other than calendar-based triggering events to distribute student financial aid. In addition, purpose-built data infrastructure capable of watching and surfacing the CBE student actions that trigger these events, such as completing their first CBE course pre-assessment or attaining an initial competency, will improve the aid disbursement process.

Data shows a large percentage of students taking self-paced courses struggle to appropriately pace their own work. Learners in CBE programs benefit from “nudges.” Reminders such as “it has been two weeks since you completed an assignment” or “you are three days off your desired course pace” can motivate students to continue. Nudging technology is an area ripe for innovation, and will likely require integration with the LMS, CRM, and advising system, backed by data infrastructure.

Most transcript systems lack the capacity to represent the concept of competencies. Schools have had to convert competency into an alpha grade to be able to generate any sort of transcript that displays this information. Greater flexibility in the types of information that can be included on transcripts is needed to include competencies, badges, and certifications, in addition to courses, units, and grades.

With the exception of the largest institutions and most mature CBE programs, most new adopters do not have the data solutions in place to do more than basic reporting. Greater investment in this lack of simplified, aggregated data access is necessary to surface comprehensive CBE-based dashboards to students, faculty, and staff such that an accurate understanding of progress can be communicated and challenges can be identified.

Transcript
Provide an official record of credits and credentials earned at an institution.

Credential Management
Credential definition, mapping and sharing.

Data Infrastructure
Provide core data structures and schemas for integrated data handling.

Digital Wallet
Enable storage and access to portable digital credentials and/or transcripts.

Human Resource Information Systems (HRIS)
Employer processes for recruiting, resume screening and hiring.
Competency-Driven Operational Functions

In order to design and build an appropriate technical architecture for a competency-based program, it is necessary to inventory the specific functions the program must fulfill for learners, faculty, and staff. The desired operational functions within a CBE program will often drive technology choices, including system selection, integration design, and data capture. In addition, because competency-based programs are often implemented within infrastructure and systems that were procured to handle traditional program workflows, we must also clearly delineate how the CBE functions and workflows will need to differ from the traditional ones. While the systems required to progress a student from pre-enrollment through credential or degree attainment and out into the workforce have a significant amount of overlap whether traditional or CBE, the operational functions for CBE programming are uniquely tailored to the competency and its role in the learner’s lifecycle.
When designing the technical architecture to support a competency-driven program, the following operational functions should be considered:

- **Academic Calendaring/Pacing**
  *Enable flexible academic calendars and student-led pacing.* The creation of non-traditional course calendars enable CBE programs to allow students to move through the course at the pace best aligned to their mastery of the material. These flexible calendar and pacing models also have financial impacts, where students can pay for and complete the courses outside traditional terms. Finally, the ability for data to be assembled outside the traditional course/section model is required to support student tracking and reporting. Impacted systems are likely the SIS, LMS, and data infrastructure.

- **Faculty Workload Orchestration**
  *Orchestrate assessment workload across faculty.* Flexible pacing for students can result in a variable workload for faculty with the timing of assessment submissions not strictly aligned to a fixed calendar. Incorporation of authentic assessments in CBE programs may also increase demands on faculty time. Faculty need tools to monitor the submission and review of assessments, as well as the scheduling of face-to-face authentic assessments. These tools may be provided in an institution’s LMS or a custom workload orchestration application.

- **Financial Aid Policies & Processes**
  *Customize financial aid policies and processes to enable competency-based aid events.* Financial aid system, policies, and process changes may be required to support CBE operations, such that CBE students can be billed tuition and granted aid outside of traditional academic calendar terms.

- **Competency Management**
  *Delineate and manage digital competencies.* Competency definition and alignment to curriculum and assessments is foundational to establishing and managing a CBE program. This work is supported by competency management systems and assessments and integrated with digital wallets and transcript systems. The use of a standard like 1EdTech CASE (Competencies and Academic Standards Exchange®) allows systems to exchange information about learning standards and competencies more easily.
• **Learner Lifecycle Management**

*Marketing, enrollment, advising, degree/credential pathways, and student support.* Operations of successful CBE programs require pre and post-enrollment support activities, in addition to advising services necessary to guide students during the program. Pre-enrollment CRM solutions drive marketing and integrate with SIS and Admissions/Registration systems to onboard new students. Advising and degree audit systems use an underlying CBE-aligned data infrastructure to support student navigation of the degree and credential pathways. Post-enrollment, the HRIS and CRM assist students with employment objectives.

• **Teaching, Learning & Assessment**

*Personalized curriculum and content design, delivered with authentic assessments.* The CBE teaching and learning functions require significant integrations of systems to create and deliver content, measure learning progress, establish evidence of learning and track the outcomes of those assessments and interactions. Tools for communication and collaboration between faculty, students, and student peers must also be in place to facilitate these core functions. Systems required include the SIS, LMS, assessments solutions for formative, summative, and prior-learning assessments, curriculum products, conferencing platforms, and an underlying data infrastructure. The use of the 1EdTech Learning Tools Interoperability (LTI) standard acts as a foundation for integrating many of the teaching, learning, and assessment applications.

• **Credential Management & Issuance**

*Digital, employer-readable credentials.* Students’ ability to share credentials with potential employers is a critical outcome of each CBE program; standards such as 1EdTech Comprehensive Learner Record (CLR) can be leveraged to achieve this objective. Supporting systems include credential managers, digital wallets, transcripts and in some instances integration with an employer’s HRIS.

• **Workforce Integration**

*Alignment of learner achievements to job requirements.* Integration between the digital wallet and/or transcript solution with employers’ HRIS support workforce integration in a CBE program model by transforming learner competencies, certificates, badges, and degrees into formats that can be easily matched to job requirements and responsibilities.

• **Administrative Reporting**

*Enable administrative reporting at the competency, learner, and program levels.* Data Infrastructure must be in place to support the administrative reporting needed to manage and evaluate the performance of the CBE program over time, but also to support required compliance reporting requirements.
Summary

As the adoption of competency-based programs continues to grow, an increasing number of organizations are looking to build or adapt their technical infrastructure into an ecosystem that can support CBE programs. This technical design requires an understanding of the operational functions required of the CBE program, an inventory of the systems available for use by the program, and resources (financial, human) available to fill in systems gaps and/or deploy new solutions. Armed with this information, teams can design technical architectures that support competency-based education and its specialized learner, faculty, and administrative workflows.