



A 'Disruptive' Look at Competency-Based Education

How the Innovative Use of Technology
Will Transform the College Experience

Louis Soares

June 2012

Introduction

Mozilla's Open Badges Initiative and MITx—the Massachusetts Institute of Technology's cutting-edge initiative offering free, high-quality college courses online—have put a public spotlight on alternative ways to deliver postsecondary education that not only document whether a student has achieved a level of competence but also validate the learning that's occurred. These two innovative education models differ from traditional education by focusing strictly on the demonstration of competency regardless of how long it took a student to gain that competency. MITx, for its part, is introducing these new methods into the well-heeled community of world-class universities, while the Open Badges Initiative is at the frontier of documenting and validating learning that happens anywhere and at any time. Both initiatives point the way to a future where education can be high-quality and personalized yet so affordable that it's accessible to millions of additional learners.

The question, of course, is whether these innovative learning initiatives and others like them can truly disrupt the current model of postsecondary education—a model that relies on time-based measures to structure and fund learning experiences.

The answer to that question lies in whether or not competency-based education can be effectively taken to scale. If the answer is “yes,” then the challenge becomes identifying what type of innovations in policy and practice are necessary to accomplish that outcome. One approach to the question—which is the focus of this brief—is through the lens of “disruptive innovation,” a business theory that considers how technology can change an organization, sector, or industry.

The first section of this brief provides a short primer on competency-based education in postsecondary education. Next we introduce the four elements of disruptive innovation theory and use these elements as a guide to study education initiatives that could

promote disruptive innovation. Lastly, we outline a number of recommendations for policymakers on how to facilitate disruptive innovation to transform higher education.

Competency-based education primer

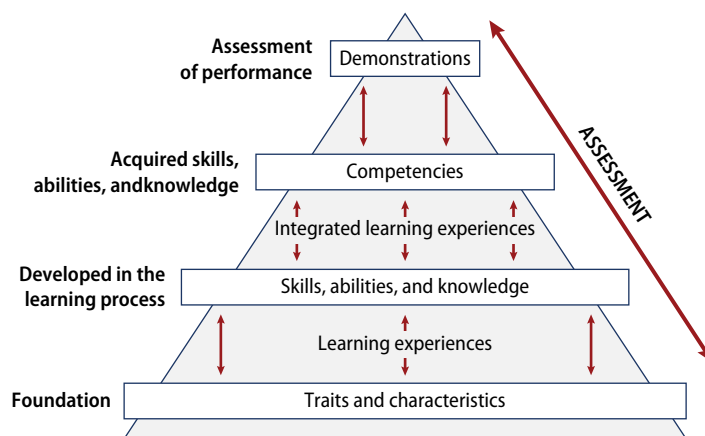
Competency-based education is an outcomes-based approach to education where the emphasis is on what comes out of postsecondary education—what graduates know and can do—rather than what goes into the curriculum. With a competency-based approach, you do not begin preparing a course syllabus by identifying content and readings. Instead, you begin by identifying competencies and then select the content, readings, and assignments to support student attainment of those competencies.

With a competency-based approach, students advance when they have demonstrated mastery of a competency, which is defined as “a combination of skills, abilities and knowledge needed to perform a task in a specific context.”¹ Mastery is the sole determinant of progress, which means that delivery options multiply and expand since any instructional method or instructional provider that can move a student toward mastery is theoretically acceptable.

In competency-based education, assessment is embedded in every step of the learning process in order to provide students with guidance and support toward mastery. This heightened level of assessment is designed to build competencies in real time. The following figure, from the National Postsecondary Education Cooperative’s report “Defining and Assessing Learning,” provides a simple yet powerful visual of the competency-based approach:

As described in the report, the first rung at the bottom of the pyramid consists of *traits and characteristics*—these are the foundation of learning and depict the innate makeup of individuals upon which further experiences can be built. The second rung consists of *skills, abilities, and knowledge* developed through learning experiences broadly defined to include formal education, work, and participation in community affairs. The third rung, *competencies*, are the outcome of integrated learning experiences, in which skills, abilities, and knowledge are focused on the performance of a task. Finally, the top rung, *demonstrations*, results from the application of competencies. Assessment is deeply embedded at all stages of this learning process.

FIGURE 1
A conceptual learning model



Source: U.S. Department of Education, 2001.

It is clear, given this description, that the design of the learning experience is dependent upon standardized and agreed-upon definitions for skills, abilities, and knowledge; competencies; and demonstrations. Once students, faculty, employers, and policymakers agree upon competencies that must be mastered, it opens up avenues for students to personalize their learning options by selecting among different providers. The ability to personalize learning options enables students to find the best instruction at the lowest cost. What's more, as long as students can demonstrate mastery of a subject it no longer matters where they went to school. As it happens, standardized definitions of competencies are integral to whether or not competency-based education can be scaled up and “disrupt” postsecondary education.

A very short history of competency-based education

In recent postsecondary education history the emergence of competency-based education as a topic of interest paralleled the information-technology revolution, which has allowed for different ways of delivering education and capturing data about the learning experience. As referenced earlier, the U.S. Education Department in 2002 sponsored a study by the National Postsecondary Education Cooperative that examined this very topic by analyzing the practices of eight organizations,² asserting that:

[A]ccess to learning opportunities is greater now than at any previous time. The learning paths created by advances in information technology no longer lead solely to postsecondary institutions. Organizations outside of postsecondary education have made significant inroads by providing performance-based learning opportunities built on competencies.

One of the institutions studied by the National Postsecondary Education Cooperative was Western Governors University, or WGU, a fully online college experience in which technology does the teaching and students advance based on their mastery of content as opposed to the amount of time spent in a course. It was one of the earliest models of competency-based education that has begun to be taken to scale.

Newer examples of competency-based education include the Carnegie Mellon Open Learning Initiative³ and upstart firms such as Sophia Learning,⁴ which is building a social learning, competency-based education platform. In addition, there are many other innovators across the country applying elements of a competency-based education.

It is possible that competency-based education could serve as a game changer in postsecondary education, delivering high-quality education experiences that lead to demonstrated learning and mastery at an affordable price. Over the past decade we've learned much about established organizations such as WGU but there remains a great deal to learn about the mix of technology, curriculum, and processes that could turn competency-based education into a true game changer in postsecondary education.

Let's now turn to the theory of disruptive innovation as it relates to competency-based education.

Disruptive innovation as an analytical tool

In its most fundamental form, disruptive innovation theory, an analytical tool pioneered by Harvard University business professor Clayton Christensen, is a way of thinking about how technology can change an organization, sector, or industry.

Disruptive innovation theory makes a distinction between sustaining innovation and disruptive innovation. Sustaining innovation is when technology is applied in a way that makes it easier to deploy people and processes to better serve existing customers. In contrast, disruptive innovation is when technology is applied in way that creates a simpler, more affordable product for a new group of customers who, in most cases, were not buying (or succeeding in) the traditional offering.

For disruptive innovation to be possible, it must include four interrelated elements:

- **Technology enabler:** There must be a technology that transforms a business process that once required deep training, expertise, iteration, and intuition into a rules-based process that can be performed by computer software. Often the technology enabler makes it possible to “unbundle” a product or service that was once considered to be viable but was only delivered in a vertically integrated manner.
- **Business model change:** The new process or solution must be able to fit into a business that can be profitable while delivering customers a more affordable and convenient product or service.
- **New value network:** The solution and business must be able to connect with other businesses that offer complementary services and whose revenue models are also complementary.
- **Standards:** Since the technology enabler, business model, and value network create entirely new ways of doing business and organizing resources, disruptive innovation requires a rethinking of industry standards for quality, safety, and interoperability that define how the industry operates and typically support traditional products, services, and financing.⁵

Whether or not a new offering can be disruptive depends on a mix of these elements being present. That being the case, let's examine if these elements are indeed present for competency-based education.

Can competency-based education be a disruptive innovation?

Technology

Let's begin with whether the necessary technology enablers for competency-based education exist. Specifically, this is a question of software that enables student-driven instruction, assessment, and student support. The answer to this question is “yes”—these tools do exist. Advances in cognitive science, software engineering, and human-computer interaction are all making it possible to use technology to create web-based education environments that both support the learning process at a granular level and assess student progress along the way. Often called “cognitive tutor” software, these online education environments are beginning to make it possible to validate student learning in new ways.

One of the more visible examples of the changes in measuring student learning in this way is the Carnegie Mellon Open Learning Initiative. Carnegie's open learning courses are designed by teams composed of faculty, learning scientists, human-computer interaction experts, and software engineers in order to make the best use of multidisciplinary knowledge for designing effective learning environments. Carnegie's open learning design team articulates an initial set of student-centered, measurable learning objectives and designs the instructional environment to support students in achieving them. These learning objectives become the “true north” of the competency that the student is trying to achieve.

Next the cognitive tutors take over and create a computerized learning environment whose interaction with students is like those of a human tutor—making comments when students err, answering questions about what to do next, and maintaining a low profile when students are performing well. Embedded assessments and tutors in open learning courses are designed to support students, but they also collect data on student performance that is fed back into the system. It is used to guide the student, the faculty member teaching the course, the team that will produce the next iteration of the course, and learning scientists who use the data to create and refine theories of human learning.

Western Governors University, which we mentioned earlier, is an accredited postsecondary education institution offering bachelor's degrees in four areas using the technology-enabled environments that perform the instruction, assessment, and student support.⁶

Additionally, there are other software solutions that are not necessarily as integrated, but supply pieces of the student support puzzle, including Course Signals developed at Purdue University and Course SHERPA, or Service-Oriented Higher Education Recommendation Personalization Assistant, developed at North Orange County Community College. Both student-support software tools were profiled in CAP's brief on personalized higher education, “The ‘Personalization of Higher Education: Using Technology to Enhance the College Experience.’”⁷

Clearly, the technology exists to make competency-based education a disruptive innovation, though these technologies are not yet broadly adopted in the postsecondary sector.

Business model change

Postsecondary education leaders and policymakers are often uncomfortable using terms such as “business model” to refer to how institutions of higher education function. In postsecondary education, the term business model simply refers to how leaders organize people, curriculum, instruction, facilities, and technology to deliver education in a way that keeps the enterprise financially viable. In this light, the current business model is largely a campus-based model, one in which instruction is a highly variable process guided by individual faculty and movement through the education experience is time based. Using this model, students sit in classrooms for an allotted period of time (a semester or quarter)—which also happens to be how schools are compensated for delivering their service—with individual faculty creating highly variable learning experiences through curriculum and instruction.

We are now, however, beginning to see alternative business models emerging that are using centralized curriculum development along with technology enablers to standardize instruction and assessment so that costs can be dramatically reduced within the business model while still providing a meaningful education experience. Three examples of emergent approaches to the traditional higher education business model are Western Governors University, Straighterline, and Coursera/Massive Open Online Courses, or MOOCs.

As previously noted, Western Governors University has standardized curriculum through a competency-based approach to education and uses technology to create self-directed learning for students that are accompanied with assessments designed to demonstrate mastery. This model has allowed WGU to reduce personnel, curriculum development, and student-support costs while creating a new business model to deliver accredited education.

Straighterline, a for-profit, nonaccredited company, provides yet another example of how college-level learning can be delivered through a radically low-cost business model using technology. Straighterline, while not competency-based, offers low-cost college courses online and then partners with colleges and universities to accept its learners and give them credit for coursework toward a degree. Straighterline sources its coursework from open source content available on the Internet and also pursues validation of learning through other organizations that provide this service such as the American Council on Education.

Equally as innovative is Coursera, a venture-backed, social enterprise that has grown directly out of the Massive Open Online Courses phenomenon. MOOCs are college courses offered online by star faculty at premier universities that are open to anyone for free. Coursera is an attempt to create a business model from free and open content using its unique draw: After all, what student wouldn't want to take a course from a star professor from a prestigious institution? Coursera is building an interactive platform that will allow the best schools in the world to not only offer a wide range of free course lectures online, but also a system of testing, grading, student-to-student help, and awarding certificates of completion for which students pay a \$100 fee. Coursera is starting with 40 courses online—from computing to the humanities—offered by professors from Stanford University, Princeton University, the University of Michigan, and the University of Pennsylvania.

While not strictly competency-based, these are three different technology-driven business models that are providing attractive alternatives to the traditional, campus-based postsecondary experience.

Value network

The business models just described are certainly indicative of the emergence of a value network, but one that is not well established to promote competency-based education. Western Governors University and Straighterline are sourcing curriculum and technology from different providers to support their businesses. Coursera is building a business model around credentialing learning from free and available content. Together they form an emergent value network. The problem is the absence of a common set of agreed upon standards, both educational and technological, detailing how a new cohort of educational providers would integrate their offerings.

As a consequence, the value network remains underdeveloped. Two efforts underway, however, could help the value network coalesce—the Shared Learning Collaborative and the Learning Registry.

The Shared Learning Collaborative is an alliance of states, foundation, educators, content providers, developers, and vendors who are passionate about using technology to improve education. The Shared Learning Collaborative is supported by the Bill & Melinda Gates Foundation and the Carnegie Corporation of New York and is coordinated by The Council of Chief State School Officers.

The Shared Learning Collaborative is building a set of shared services, aligned with the K-12 common core education standards, meant to connect disparate student data and learning content that currently exist in different formats and locations and don't neces-

sarily integrate with one another. The Shared Learning Collaborative technology will include the following:

- **Middleware:** Software that integrates and orchestrates activities across different state systems, components, and applications enabling them to interact
- **Data store:** A secure, cloud-based repository for structured and unstructured learning data
- **Dashboards:** Out-of-the-box dashboards to make student data more manageable and useful for educators in a customizable format
- **Learning maps:** Graphical representations of student learning data to help visualize student achievements and needs
- **Application programming interface, or API:** An open API to enable vendors and developers to create applications and content that can interface with the Shared Learning Collaborative technology

The Learning Registry is a new approach to capturing, sharing, and analyzing learning resource data to broaden the usefulness of digital content to benefit educators and learners.⁸ Learning Registry is sponsored by the U.S. Departments of Education and Defense with support from the White House and numerous federal agencies, nonprofit organizations, international organizations, and private companies.

The Learning Registry is an open source technical system designed to facilitate the exchange of data behind the scenes. It is an open community of resource creators, publishers, curators, and consumers who are collaborating to broadly share resources, as well as information about how those resources are used by educators in diverse learning environments across the Web.

This effort, begun in 2010,⁹ is creating a set of technical protocols as a platform for innovation by content authors and aggregators.¹⁰ Applications built to harness the power of harvesting and analyzing the Learning Registry data will allow educators to quickly find content specific to their unique needs. The Learning Registry will store more than traditional descriptive data (metadata)—it will also allow sharing of ratings, comments, downloads, standards alignment, and more.

Both the Shared Learning Collaborative and the Learning Registry are helping promote the development of new technology-driven learning products and services and how those services can be interoperable. Interoperability, in turn, is the key to the development of a new value network.

Standards environment

A competency-based education cannot exist without agreed upon standards for what a student needs to know and competencies that, when mastered, demonstrate that they have met the standard.

In postsecondary education there are initiatives attempting to develop these competencies. These initiatives tend to be partnerships between postsecondary education institutions and other stakeholders, especially philanthropic and industry-based groups. Let's turn now to three such initiatives—the Degree Qualifications Profile, the Manufacturing Skills Certification System, and the American National Standards Institute's Accreditation Program for Certificate Issuers.

Degree Qualifications Profile

The Degree Qualifications Profile initiative,¹¹ supported by the Lumina Foundation for Education, is a framework for illustrating what students should be expected to know and be able to do once they earn their postsecondary degrees. The initiative proposes specific learning outcomes and competencies that benchmark the associate, bachelor's, and master's degrees along five dimensions:

- **Applied learning:** used by students to demonstrate what they can do with what they know
- **Intellectual skills:** used by students to think critically and analytically about what they learn
- **Specialized knowledge:** the knowledge students demonstrate about their individual fields of study
- **Broad knowledge:** transcends the typical boundaries of students' first two years of higher education and encompasses all learning in broad areas through multiple degree levels
- **Civic learning:** enables students to respond to social, environmental, and economic challenges at local, national, and global levels

The Degree Qualifications Profile initiative is currently partnering with three states—Indiana, Minnesota, and Utah—to build out the framework in two disciplines each. The disciplines under consideration are biology, chemistry, education, history, physics, and graphic design.

Manufacturing Skills Certification System

An industry-driven initiative, the National Association of Manufacturers' Manufacturing Skills Certification System has developed a structure of stackable credentials indicating that

workers have attained competencies for increasingly sophisticated levels of work across many areas of manufacturing, from machine operator to engineer to management positions.

The essential elements of the Skills Certification System are:

- A collection of competencies that together defines a successful, high-performance manufacturing workforce
- Industry-driven certifications that align with competencies
- Best-in-class curriculum to articulate into for-credit education pathways that will ensure students achieve the competencies necessary to achieve industry credentials¹²

This initiative is already beginning to bridge the worlds of workplace competencies and postsecondary education. In 2011 the National Association of Manufacturers announced a partnership with the University of Phoenix, in which the association's competency-based curriculum and credentials will form the core of a bachelor's in management at the online university.

ANSI Accreditation of Certificate Issuers

The American National Standards Institute, or ANSI, is the nonprofit member organization that sets U.S. national standards for consumer protection and product conformity. It works with more than 1,000 businesses, associations, and government agencies to set standards for product certifiers, personnel certifiers, laboratories, and inspection bodies. In 2009 ANSI started a program to certify organizations that provide education programs yielding one-year certificates to improve quality and rigor in this sector. Until now, this sector of the education world, which offers these certificates, has lacked any type of quality control. The criteria being used to ensure quality emphasize agreed upon learning outcomes and competencies and maintain that:

- Learning outcomes are based on industry input and have market value
- The content taught is aligned with measureable learning objectives
- Assessment tools measure learning outcomes
- Infrastructure assures the continual success of the certificate program
- A process ensures the continuous improvement of the training

In its initial rounds of certification, ANSI has accredited 30 organizations, mostly professional associations, as promoting quality certificate programs. This is a first step in developing quality standards and competencies in this sector and can help better connect it to postsecondary education.

Competency-based education can start to take off once initiatives such as this build out and scale the usage of these standards and competencies. Students, faculty, employers, and policymakers must all have the same definition of what success looks like.

Conclusion and recommendations

Our analysis clearly demonstrates that competency-based education does have the potential to be a disruptive innovation in postsecondary education. Our four-element analytical lens shows that the technologies, organizational experimentation, and standards are coalescing in ways that make competency-based education a potential game changer in the delivery and affordability of postsecondary education.

It is clear from our examples that postsecondary institutions, policymakers, employers, and philanthropies are trying to build the infrastructure necessary for competency-based education to take off.

We offer the following recommendations to further catalyze this process and urge federal policymakers to:

1. Encourage experimentation in competency-based education that leverages the four elements of disruptive innovation.

The impending reauthorization of the Higher Education Act provides an opportunity to modify the statute to encourage demonstration projects and experimental sites.

We could use a clinical-trials model similar to the Food and Drug Administration, in which students would be informed that they were involved in an experimental educational offering and would thus get discounted tuition to participate.

2. Survey state-level legislation and initiatives, in particular in K-12 online initiatives, to catalogue what policy and regulatory approaches to technology-enabled, competency-based learning may be applicable to postsecondary education.

One area to look at would be how are the pilot states in the Shared Learning Collaborative aligning state purchasing requirements to allow for cooperative purchasing? And how is this process being used in postsecondary education, in particular with gateway college courses?

A clearinghouse of this type of information could be made available through one of the initiatives named above.

3. Hold a convening of business and postsecondary education leaders to discuss the value of competency-based education to all stakeholders to promote leadership and build consensus on how to move the work forward.

Competency-based education could be the key to providing quality, postsecondary education to millions of Americans at a lower cost. But this transition will require policymakers, institution leaders, and other stakeholders to manage innovation in the sector in ways that respect the strengths of traditional colleges and universities yet help build the business models and value networks necessary for scaled change.

Louis Soares is a Senior Fellow at the Center for American Progress.

Endnotes

- 1 National Center on Education Statistics, "Defining and Assessing Learning: Exploring Competency Based Initiatives, National Postsecondary Education Cooperative" (2002).
- 2 The eight organizations studied by NPEC were King's College, North West Missouri University, Sinclair Community College, Hagerstown Community College, Colorado Community Colleges, Western Governors University, Oregon PASS Program and Ford Motor Company.
- 3 "Carnegie Mellon Open Learning Initiative," available at <http://oli.web.cmu.edu/openlearning/>.
- 4 "Sophia," available at <http://www.sophia.org/>.
- 5 "Regulatory issues are often included with standards but are not covered in this brief; see Clayton M. Christensen and others, "Disrupting College: How Disruptive Innovation Can Deliver Quality and Affordability to Postsecondary Education" (Washington: Center for American Progress, 2011), available at http://www.americanprogress.org/issues/2011/02/disrupting_college.html
- 6 "Innosight Institute," available at <http://www.innosightinstitute.org/media-room/publications/education-publications/the-engine-behind-wgu/>.
- 7 Louis Soares, "The 'Personalization' of Higher Education" (Washington: Center for American Progress, 2011), available at http://www.americanprogress.org/issues/2011/10/personalized_higher_education.html.
- 8 "Learning Registry," available at <http://www.learningregistry.org/>.
- 9 Department of Education, "National Summit Brings Together Technology, Rural Ed Experts to Focus on Solutions for Overcoming Distance, Accessing Resources," Press release, July 21, 2010, available at <http://www.ed.gov/news/press-releases/national-summit-brings-together-technology-rural-ed-experts-focus-solutions-over>.
- 10 "Technical Guides," available at <http://www.learningregistry.org/documents>.
- 11 Lumina Foundation, "The Degree Qualifications Profile" (2011), available at http://www.luminafoundation.org/publications/The_Degree_Qualifications_Profile.pdf.
- 12 "About the NAM-Endorsed Manufacturing Skills Certification System," available at <http://www.themanufacturinginstitute.org/Education-Workforce/Skills-Certification-System/About/About.aspx>.